

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



INDO-PACIFIC FISHERIES COUNCIL

PROCEEDINGS

10th SESSION

SEOUL

REPUBLIC OF KOREA

10–25 October, 1962

SECTION I

**IPFC Secretariat, FAO Regional Office
for Asia and the Far East
Bangkok
1963**

OFFICE BEARERS OF THE INDO-PACIFIC FISHERIES COUNCIL

1962 - 1964

EXECUTIVE COMMITTEE

Chairman: *Mr. K. Gopinatha Pillai (India)*
Vice-Chairman: *Mr. Kim, Myung Nyun (Korea)*
Member:
Secretary* : *Mr. J.A. Tubb (FAO)*

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Dr. G.L. Kesteven (Australia)
Technical Secretary:
Mr. Wm. A. Dill (Fisheries Division, FAO)

SUB-COMMITTEE ON STOCKS ASSESSMENT

Chairman (ad interim):
Dr. G.L. Kesteven (Australia)

SUB-COMMITTEE ON FISHERIES OCEANOGRAPHY

Chairman (ad interim):
Mr. J.C. Marr (U.S.A.)

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Chairman:
Mr. Tuanthai Bamrajarinpai (Thailand)
(during the session)
Mr. Lee Bong Nai (Korea)
(for the intersession period)
Technical Secretary:
Dr. G.N. Subba Rao (Asst. Regional Fisheries Officer, FAO)

SUB-COMMITTEE ON FISHING CRAFT AND GEAR

Chairman:
Mr. Tuanthai Bamrajarinpai (Thailand)

SUB-COMMITTEE ON FOOD TECHNOLOGY

Chairman:
Mr. Hee Un Chang (Korea)

SUB-COMMITTEE ON SOCIO-ECONOMICS & STATISTICS

Chairman:
Mr. Takashi Nakamura (Japan)
Technical Secretary:
Mr. Y. Miyake (Fisheries Division, FAO)

* The Office of Secretary to the Council is currently held by the FAO Regional Fisheries Officer for Asia and the Far East.

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OPENING ADDRESS

by

H.E. Chang, Kyung Soon

Minister of Agriculture and Forestry, Republic of Korea

"Mr. Chairman, Distinguished Delegates, Ladies and Gentlemen,

It is a great honour for the Government of the Republic of Korea to host the 10th Session of the Indo-Pacific Fisheries Council in our capital, Seoul, and on behalf of the Government and the people of the Republic of Korea, I take this opportunity to extend a hearty welcome to the honorable Delegates and Observers to this conference.

Our country was divided into two parts at the end of the Second World War, and even before the national wish for the re-unification could be realized, we experienced the rigor and devastation of the three-year war touched off by an unprovoked aggression from the north. Since then, our economy has recovered for the most part and is making progress, thanks to unstinted assistance and aid from the United Nations and free nations of the World. Eliminating political corruption and other old evils following the military revolution in May 1961, Korea is making great strides towards real democracy and economic reconstruction.

Korea is surrounded on three sides by the sea, and taking advantage of these geographical conditions, admirably suited to fisheries, our forefathers have since time immemorial engaged in fishing, which, today ranks among the most important of our industries, also playing an important role in earning foreign exchange.

Development of fisheries is given an important place within the framework of the Five-Year Plan for Economic Development, which was inaugurated at the beginning of this year, and various steps are being initiated in this connection.

However, these are a great number of problems and difficulties which must be

solved for the successful implementation of our fisheries development program; especially urgent are the problems of the modernization of fishing boats and of gear, the adjustment of the supply and demand of marine products to stabilize prices, and the processing of marine products. No less important are the tasks of fostering Fisheries Cooperative Associations and rationalizing the management of fisheries.

These problems are not unique to us but are commonly faced by most member nations of the Indo-Pacific Fisheries Council, and will, I believe, be taken up for discussion at the Council's plenary session.

As we are all aware, the Food & Agriculture Organization of the United Nations has made significant contributions to the development of fisheries throughout the world, and has provided invaluable assistance to the Republic of Korea.

As the world becomes smaller and narrower in time and space, the need for international cooperation is more keenly felt than ever before; and this gathering of fisheries technicians and administrators of the member nations fills the vital role of undertaking the joint study and solution of common problems on a footing of international cooperation.

Problems faced by individual member nations may vary according to their peculiar economic, geographic and social backgrounds; however, it is our universally recognized necessity to promote the development of fisheries, the intensification of the utilization of marine resources and the improvement of the living standards of fishermen through the exchange of technical information and other means of mutual cooperation through the medium of the Indo-Pacific Fisheries Council.

In the end, it is my sincere wish that you will find your sojourn in Korea both useful and agreeable, and that the Conference will be able to achieve great, constructive

results.

And with this message of hope I declare the 10th Session of the Indo-Pacific Fisheries Council open."

PRECIS OF ADDRESS

by

**Dr. D.B. Finn, representing
the Director-General F.A.O., Dr. R.B. Sen**

Dr. Finn brought a message of greeting from the FAO Director-General to this 10th Session of the IPFC and his wishes for a successful meeting. He emphasised that from the time in Baguio in the Philippines to now, a matter of 14 years, the Council had grown in stature and importance. Dr. Finn said that this is recognized by inter-governmental and international bodies over the world as well as in the field of international law. This was further attested to by the action of the Far East Regional Conference of FAO that had just finished its meeting in Kuala Lumpur, which referred many fisheries questions to the IPFC and invited its guidance in certain matters concerning fisheries development. This, it was pointed out, emphasised the responsibilities of the IPFC in recommending policies for fisheries development to Member Governments.

The role of the Council in matters of food production was stressed. This fitted in

with the Freedom from Hunger campaign, which is being conducted by FAO with the cooperation of other specialized agencies. This is, in fact, a campaign for the rededication of the ideas and ideals which gave rise to FAO in 1945. Dr. Finn said that these ideals were more important than ever since the tremendous growth in population was expected to reach a world level of 6 billion by the turn of the century. This meant that world food production would have at least to be increased more than three times if populations were to be properly fed. The sea and fisheries must play a large part in this. This once again emphasised the importance of the role of IPFC.

Dr. Finn closed by conveying to the Government of the Republic of Korea the Director-General's gratitude for the invitation which was so generously made to the IPFC enabling its meeting to be held in Seoul.

OPENING CEREMONY ADDRESS

by

**Mr. J.A. Tubb
Acting Chairman**

"Mr. Minister, Dr. Finn, Ladies and Gentlemen:

I find it a matter of very great satisfaction both from the point of view of our Council and to me, personally, that the Council was able to accept the courteous and gene-

rous invitation of the Government of the Republic of Korea to hold its 10th Session in the fine city of Seoul. I should like to take this opportunity of making reference to the splendid work which has been, and is being,

done by the Organizing Committee and by the staff assigned to assist the Council's secretariat. During the past week the work load has been extremely heavy but the staff have worked long hours and in difficult conditions without complaint. You have had some indication of the success of their efforts in the documents which have already been issued to you.

Through the period since the 9th session of the Council held in Karachi the various members of the Technical Committees and special Sub-committees have worked well and productively and you will consider, in a short while, the Reports which have been drawn up by the technical secretaries and which show in detail the result of the intersession work.

In addition you will, I am sure, be grateful to know that the response from fisheries workers in the region to requests for information and for technical papers has been most enthusiastic. As you will see from the documents tabled, 55 technical papers have

been presented for consideration at this Session of the Council.

In his address to you Dr. Finn has referred to a number of significant matters which were discussed at the recent South East Asia Regional Conference of FAO and I am sure that this Council, both in committee and in plenary session, will wish to comment on these matters and recommendations and give the subjects very serious consideration.

Finally the members of the Council will recall that it is of primary importance on an occasion such as this for the Council to give priority to consideration of the problems of the host country. We have with us a strong Delegation from the Government of Korea composed of fisheries workers who are familiar with the problems of their country and who, I am sure, will contribute greatly to the discussions and will be able to present a clear exposition of the problems of fisheries in Korea and also of the policy and programs currently in operation to resolve these problems. Thank you."

ADDRESS

by

Mr. Choong Shik Min

Assistant Vice-Minister for Operation, Ministry of Agriculture and Forestry

Chairman, IPFC 10th Session

"Dr. Finn, Mr. Tubb, Distinguished Delegates, Ladies and Gentlemen :

May I express my deep gratitude for your fine gesture of electing me Temporary Chairman of the 10th Session of the Council. I certainly deem it a great honor for my country, as well as for myself, to have an opportunity to preside over this important Conference.

I do realize the depth and weight of responsibility I now shoulder since the efficiency with which this meeting proceeds will have a great and far-reaching bearing upon the development of fisheries in these areas

and betterment of lives of so many people engaged in fisheries in one way or another.

Sharing with you the determination to make this Conference a definite success, I look forward to your unsparing cooperation and help and hope that our distinguished Delegates from so many friendly countries will conduct both stimulating and useful discussions in a most friendly atmosphere.

Only through your encouragement and help can I be of some help in bringing about notable achievements within the limited time available for us. I feel most humble in accepting this important nomination. Thank you."

CHAPTER I

COUNCIL PROCEDURE

AGENDA

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| <ol style="list-style-type: none"> 1. Business of the Session <ol style="list-style-type: none"> 1.1 Adoption of the Agenda 1.2 Report of Credentials 1.3 Nominations <ol style="list-style-type: none"> 1.31 Technical Committees 1.32 Council Administrative Correspondents 2. Statements by Delegations 3. Report of the Executive Committee <ol style="list-style-type: none"> 3.1 Membership 3.2 Relations with International and other Organizations 3.3 Council's Report of FAO 3.4 Publication and Editorial Policy 3.5 Financial and Budget Report 3.6 Implementation of Council Instructions and Recommendations 4. Amendments to the Agreement and Rules of Procedure | <ol style="list-style-type: none"> 4.1 Amendment proposed by the United Kingdom Government 5. Education 6. Extension Services for Development of Fisheries 7. Stock Assessments 8. Formulation of Research Programs 9. Management of Fisheries 10. Control of Diseases & Importation of Exotic Species 11. Relationship with Oceanographic Programs 12. Reports of Technical and Sub-Committees <ol style="list-style-type: none"> 12.1 Technical Committee I 12.2 Technical Committee II 13. Time and Place of 11th IPFC Session 14. Election of Chairman and Vice-Chairman 15. Symposium for 10th Session 16. Proposals for Symposium of 11th Session 17. Other Business. |
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The Official Opening of the 10th Session of the Indo-Pacific Fisheries Council was conducted by the Minister of Agriculture and Forestry of the Government of the Republic of Korea, Mr. Chang Kyung Soon, in the Grand Hall of the Chosun Hotel, Seoul, Korea at 10:45 on Wednesday, 10th October 1962.

In the absence of the Chairman and Vice-Chairman, the Secretary took the chair in accordance with Rule VIII of the Council's Rules of Procedure and introduced the Minister.

In a speech given in Korean and later translated into English and recorded in the introduction to these Proceedings, the Minister formally inaugurated the Tenth Session.

The Acting Chairman then introduced Dr. D.B. Finn, representing the Director Ge-

neral of FAO. Dr. B.R. Sen, and Director of Fisheries Division FAO. Dr. Finn delivered an address the precis of which is recorded in the introduction to these Proceedings.

The Acting Chairman then delivered a short address which is also recorded in the introduction to the Proceedings.

The Acting Chairman proposed that the Rules of Procedure might be suspended to permit the election of a Chairman from amongst the Delegates. The Delegate for India moved that the Rules of Procedure be suspended in accordance with the provisions of Rule XVI to permit the election of a Chairman to serve for the duration of the present Session. The motion was seconded by the Delegate for United Kingdom and supported by the Delegate for Japan.

The statutory 48 hours notice of motion having elapsed. Mr. Choong Shik Min, Delegate for Korea, was nominated by the Delegate for Ceylon, seconded by the Delegate for India as Chairman for the duration of the 10th Session.

There being no other nomination the Delegate for Korea was declared elected amid acclamation and welcomed to the chair by Dr. Finn and the Secretary.

On assuming office the Chairman delivered a short address which is recorded in the introduction to these Proceedings.

The Delegate for Australia requested the inclusion in the Council's agenda of seven additional items and the deletion of items 5.3 to 5.7 inclusive.

On a motion by the Delegate for Australia, seconded by the Delegate for Ceylon, the agenda as amended was adopted.

In accordance with a resolution of the Council's 6th Session, official statements from Delegates and Observers were tabled and not presented verbally; the salient points of the statements are given in the following paragraphs.

The Delegate for Australia stated that his country had in many ways shown much interest in the Council's work and its confidence in the value of the Council as an instrument of international cooperation and mutual assistance. His Government suggested that the Council might find it opportune to examine closely ways and means to improve the Council procedures and examine in detail such matters as the preparation and subject matter of its Agenda, the possibility of detailed discussion in Plenary Session on the procedure to be adopted in arranging the work of Technical Committees, and further to examine in what ways more effective types of collaboration between its members might be achieved both during Council Sessions and in the intersession period.

The Delegate for Ceylon said that his Government's objective was self-sufficiency

in fish production and that as production was increasing so also per caput consumption was also becoming greater. A major line of development was the introduction of mechanized fishing craft, and parallel with this was the programme for the mechanization of the traditional fishing vessels. His Government was pursuing an active programme for the construction of new and the improvement of existing harbors, the development of improved handling and marketing facilities, the provision of better roads and transport services and had set up an extensive fishermen's housing scheme. A government accident compensation scheme has been established and during 1961 and 1962 disbursed over R25,000,000. Loans for fisheries development are also available directly to individual fishermen and through cooperative societies.

Le Délégué Français dit La France n'a pas cessé de prendre grand intérêt aux travaux du Conseil et le caractère tardif de ma présence ici est en réalité une preuve du maintien de cet intérêt: le Gouvernement français n'a pu au dernier moment procéder à une autre désignation que la mienne qui n'était pas prévue au début en raison d'engagements antérieurs; cependant si, en définitive, il m'a envoyé ici et cela dans des délais très courts, c'est qu'il tenait à ce que sa représentation et sa participation à ce Conseil soit assurée à tout prix.

Depuis la dernière session, le programme de notre laboratoire de NOUMEA est resté consacré par priorité aux pêches et à l'océanographie en haute mer, en particulier dans ses rapports avec les pêches. Il est principalement relié à la biologie des Thonss. A ce titre, nous attachons une importance primordiale à la coopération internationale; il est peu de problèmes en effet dans toutes les sciences de la mer qui requièrent à ce point une action internationale: les recherches et prospections en haute mer sont "lourdes" quant au poids du matériel employé et plus encore quant à son prix et au prix de sa mise en action, elles sont difficiles et longues à conduire et peut-être plus encore à interpré-

ter et à relier aux pêches. C'est à la principale raison de notre intérêt sur le plan pratique.

The Delegate for India referred to the decline in fish production in his country during 1961 owing to the failure of the chub-mackerel fishery. He stated that a marked increase in budgetary provision had been provided under the Third Five Year Plan. New items of marine research included the tuna resources of the Arabian Sea and the Bay of Bengal and physical oceanographic studies in Indian Seas. In connection with the IIOE, the INS KRISHNA will start the first scientific cruise in October 1962. Success had been achieved in the induced spawning of the large Chinese carps. Technological research of craft, gear and processing was continuing. There was considerable expansion in the scope of and facilities for training in inland fisheries and an Institute for training officers at district level had been set up with aid from UN Special Fund. Plans for further training facilities and the expansion of the Indo-Norwegian Project were well advanced. Short supply of diesel engines had hindered the expansion of the offshore fishing fleet but agreement had recently been reached to license the manufacture of several popular makes of diesel engines in India. One factory for manufacture of nylon thread was already in operation and a second plant was expected to be set up shortly. Attention was being given to the improvement of harbour, landing, handling and marketing facilities, particularly by the provision of increased cold storage and refrigerated transport.

The Delegate for Japan noted that the world fish catch was increasing year after year, and that was also the case with Japanese fish production, due largely to the development of offshore fisheries. The low income level of Japanese coastal fishermen had influenced the Government to establish a structure Improvement Project which aimed at raising the production per man and doubling individual incomes within the next ten years. In other areas also steps were being taken to develop the status of the industry through

modernizing working conditions and the enforcement of a fish price support programme. Scientific and technological research was being intensified and expanded, and the Japanese Government would provide two research vessels for the IIOE during 1962 and 1963.

The Delegate for Korea said that Korea was pleased and honoured to be host to the 10th Session of the IPFC. Korea was richly endowed with marine resources but their proper exploitation involved a number of problems. There was great need for modernization throughout the industry and to assist in this process, the Delegate for Korea proposed that the obvious necessity for joint research in fisheries problems be a topic for discussion during the current Session. He also emphasized the need to increase the income of the fishermen and to rationalize fisheries management. Useful action toward this objective was being taken by the Korean Revolutionary Government, but many problems still awaited solution. Fisheries cooperatives needed stimulation and encouragement and there was an outstanding need to consider the problems of over-fishing and depletion of the resources.

The Delegate for the Netherlands expressed his deepest gratitude to the Government of the Republic of Korea for the cordial hospitality extended to him during the 10th Session of the Indo-Pacific Council and said that his Government availed itself of this opportunity to extend to the host Government its best wishes for the prosperity of the Republic of Korea.

The Delegate for the Philippines stated that the objectives of the five years Socio-Economic Development Program were (1) to restore immediately economic stability, (2) to alleviate the plight of the common man, and (3) to establish dynamic basis for future growth. This included the increase of fisheries production and efficiency to provide the raw materials for the expanding processing industries and for export. The fishing industries was still confronted by major problems to the solution of which the Government was

intensifying efforts to provide adequate loan funds for operatives, conduct offshore exploratory fishing and provide appropriate training facilities. Joint ventures between local and foreign firms were being encouraged and swamp-lands were being reclaimed for fish-culture. The private sector of the industry was cooperating fully and Congress had approved a Bill to expand and reorganize the Bureau of Fisheries into a Fisheries Commission. Valuable assistance was being received through Colombo Plan, AID and FAO.

The Delegate for Thailand briefly outlined progress in fisheries development in his country, referring particularly to advance in fish culture, over-all production and the acquisition of three additional research vessels during 1963. Studies in fish processing technology were continuing and there was some improvement in the marketing of fish facilities for ship-to-shore radio communication and improvement in fish transportation services were of increasing importance. Biological studies, particularly on Chub mackerel were continuing and through the ASA program methods of international cooperation in fisheries conservation activities were under study. Major obstacles were shortage of technically trained staff and the great diversification in fishing methods and equipment, together with widely decentralized fish landing system which rendered difficult the collection of the essential fishery statistics.

The Delegate for the United Kingdom expressed his Government's gratitude to the Government of Korea for inviting the 10th Session of the IPFC to be held in Seoul, and for the hospitality and facilities to ensure the success of the conference. The U.K. Government had always taken a deep interest in the work of the IPFC and would continue to support its invaluable efforts in improving the world food situation.

The Delegate for U.S.A. defined the distribution of fisheries responsibility under U.S. administration and referred particularly to the work in the Trust Territory of the Pacific Islands where the program included

training, boat-building, marketing and fishing activities. Recent advances in the research programme of the Bureau of Commercial Fisheries Hawaii Area Office included the production of an oceanographic climatic atlas of the tropical central Pacific and computer programmes for processing oceanographic data. Predictions of skipjack abundance based on the empirical relationship of these fish with the oceanography of the Central Pacific were successful and efforts were being made to refine these predictions. Knowledge of the tuna sub-populations had been advanced through the study of blood groups. A model of the migrations of the albacore had been completed. Participation in IIOE was planned and construction of a new 157' research vessel should commence soon. The U.S.A. had a great interest in the use of fish protein concentrate and efforts were being made to determine the best processing methods.

The Observer on behalf of the General Fisheries Council for the Mediterranean said his Council welcomed the opportunity of strengthening its ties with IPFC and hoped that this meeting, like those of the past, would stimulate still closer cooperation between the two bodies. Both Councils had been created by FAO to serve a similar purpose in different regions. The problems are often similar and likewise a solution valid in one region was often acceptable in the other, once local differences had been taken into consideration. The GFCM looked forward, therefore, to the results of the current deliberations with great interest.

The Observer for UNESCO briefly described the program agreed on at the UNESCO Meeting of Marine Scientists in Manila in March 1962 and referred to the need for each country to establish reference collections of marine organisms. To facilitate this UNESCO had appointed a Taxonomist as regional officer attached to the Science Cooperation Office in Djakarta. He informed the Council that a regional training course in the taxonomy of marine animals would be held in from Bangkok, 11 November to 15 December

1962. In connection with the HIOE a proposal to set up a Biological Center at Cochin, India, was receiving UNESCO support.

10th Session Arrangements

Through the courtesy of the Government of the Republic of Korea the Council received an invitation to hold its 10th Session in Seoul during the last quarter 1962.

This invitation was accepted unanimously by the Delegates attending the 9th Session of the Council and, after consultation with the Korean Government, it was decided that the session should be held from 10 to 25 October 1962.

Accordingly, invitations were sent to Member Governments and to Governments and Organizations which had from time to time expressed interest in the activities of the Council.

At the 10th Session the following Member Governments were represented by Delegations—Australia, Ceylon, France, India, Japan, Korea, Netherlands, Philippines, Thailand, U.K., and U.S.A. and an accredited observer attended on behalf of Government of Vietnam.

Observer organizations represented were GFCM, PSA, SPC, UNESCO and a number of Korean institutions and societies listed in Appendix I of these Proceedings.

Apologies for inability to be represented were received from Cambodia, North Borneo, Indonesia, Sarawak, Singapore, Canada, Laos, UNO, UNTAB, IWC, WMO, ILO. In the majority of cases those unable to attend expressed continuing interest in the work of the Council and requested complete sets of documents arising from the Session.

Steering Committee

The Steering Committee constituted to guide the conduct of the Session consisted of:

The Chairman of the Council:

Mr. Min Choong Shik

The Chairman of the Tech. Com. I:

Dr. G.L. Kesteven

The Chairman of the Tech. Com. II:

Mr. T. Bamrajarinpai

The Secretary of the Council:

Mr. J.A. Tubb

Report on Credentials

In accordance with the Rules of Procedure, a report on the credentials submitted by Delegations and Observers was prepared by the Secretary, presented to the Council and adopted.

Report of the Executive Committee

The Council adopted the Report of the Executive Committee, subject to amendments arising from discussion in Plenary Session and from the Special Committee appointed to consider the budgetary provisions. (See pp. 17-21)

The Council requested the Executive Committee to prepare future reports on a basis of two separate sections, the one being a factual statement of events and activities, the other to contain proposals, including Budget Estimates for future activities.

Amendments to the Agreement

The Delegate for the United Kingdom, referring to the proposal by his Government for certain amendments to the Council's Agreement, requested permission to defer this matter for consideration at the 11th Session of the Council.

The Special Committee appointed to consider the structure of the subsidiary bodies of the Council suggested certain amendments to the Agreement and Rules of Procedure in order to eliminate apparent inconsistencies and to define more clearly the functions of such bodies.

Relations with International and Other Organizations

In this connection, the Council adopted a motion by the Delegate for Australia, seconded by the Delegate for Ceylon that:

The Council noted the list of observer organizations to whom invitations to be represented at the 10th Session had been issued

and requested the Executive Committee to review this list in order to eliminate what might be termed unfruitful relationships and take up with the FAO the role of the Organization in assisting the Council to maintain its relationships with other international bodies.

The Council had assistance from the UNESCO Observer in its discussions and heard in particular of the programme, being developed by that Organization through its SEASCO, related to taxonomy of marine organisms. The Council considered that this programme and the UNESCO activities in the region especially those relative to IOC will contribute significantly to fishery programmes in the region and therefore recommended that Member Governments give active support to these programmes. Furthermore, the Council considered that the objective of this recommendation would be furthered if active collaboration were maintained and developed between the fisheries staff at FAO Regional Office and UNESCO's SEASCO.

Council Nominations

In accordance with Rule of Procedure X(2), the Chairman polled the Delegations to determine if they desired membership on the Technical Committees and requested them to verify that the nomination forms already received by the Secretariat truly reflected the desires of their Governments.

Delegates present indicated that the nominations were valid except that the Delegate for U.K. requested permission to verify certain nominations in consultation with his Government and the Observer on behalf of Vietnam indicated that he did not wish to comment.

The Council adopted a motion by the Delegate for Ceylon, seconded by Delegate for France, that:

RESOLUTION I/62

1. The Council agree in principal with the proposals and observations contained in WP 32.

2. The Council request the Executive Committee to investigate, in accordance with Article VIII and Rules XV and XVI, the suggested amendments to the Agreement and Rules in order that this matter may be included in the Provisional Agenda of the 11th Session of the Council.
3. The Council request the Secretary to ensure that the provisions of Rule X(2) concerning appointment of Technical Committees and Sub-Committees be observed, bearing in mind that Member Governments should be given as much prior notice as possible of Sub-Committees that might be established at each Session and recognising that Member Governments may not be able to authorise their Delegations to nominate to or accept nomination for Sub-Committees of which they have not had prior notice.
4. The Council request Technical Committees to review carefully the need for continuance of Sub-Committees related to them, keeping in mind the four principles enunciated in WP 32.
5. The Council request the Technical Committees to review carefully the need for the continuance of the Panels related to them.

Publication of Council Documents

The Council requested the Secretariat to treat the documents presented to it as follows:

- 1) Publish in the Proceedings:
Technical Papers Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 25, 28, 29, 34, 35, 37, 38, 40, 44, 45, 46, 47, 48, 51, 52, 53, 54, 55, 58.

(Note: No. 14 to be published subject to clarification, ref. IPFC/C62/M/25)

- 2) Publish in IPFC Current Affairs Bulletin:
Technical Papers Nos. 18, 22, 27, 30, 36, 39, 41, 49 (pp. 1-7 only), 57, 59.
- 3) Publish as IPFC Occasional Papers:
Technical Papers Nos. 23, 24, 26, 31, 32, 42, 43, 50, 56.
(Note: Papers 42 & 43 to be combined as "Fishery Cooperatives and Fish Marketing in Gujerat")
- 4) Include in Report of Technical Committee II:
Technical Paper No. 49, pp. 7-11.
- 5) Return to the Author(s):
Technical Paper No. 33.

Education

The Council emphasized the need for an authoritative and detailed list of training institutions and services within the region and expressed the view that until such a list was available, it was not in a position to offer detailed recommendations on the question of education in fisheries. However there was a clear need for more and better trained instructors in fisheries subjects.

Taking into consideration the fact that attempts to intensify the exploitation of fish stocks, or to conserve them are often frustrated by actions arising out of ignorance on the part of fishermen and/or of the general population of even the basic elements of modern fishery biology and methods, the Committee is of the opinion that it is very desirable that Member Governments should provide basic information on fishery principles in the natural-science courses of all secondary schools serving regions where fishing is an important occupation; and that in this matter careful note should be taken of the example of Japan. It also recommends that FAO or UNESCO should be asked to prepare a basic manual of courses suitable for secondary schools, for use as a guide and a basis by member countries who will modify it to meet local conditions.

With respect to specialist training required by fishery workers, the Committee took note of the recommendation made by the 6th FAO Regional Conference for Asia and the Far East (1962) that regional training centers should be established under EPTA especially directed toward the training of instructors and methods of instruction. From its own survey of the subject, the Committee considered that in addition to the special training required for the *Rastrelliger* programme, referred to earlier in this report, training was required also in fishery oceanography, fishery limnology, fishery statistics, and fish culture, and for extension workers. It considered that training in these fields should be on a full-time basis, rather than in brief courses such as have usually been given under EPTA. Training in certain of these fields can be obtained at existing institutions in the area, and at institutions outside the area. The Committee considered that, so far as its own discussions, and the FAO Regional Conference recommendation, refer to training at university level, no conclusion can be reached until: (a) a catalogue of training opportunities is prepared and circulated to Member Governments; (b) Member Governments form an estimate, by reference to their own plans and to the catalogue, of the training which cannot be provided by existing arrangements and for which special arrangements must be made.

The Council having considered the subject of fisheries education noted that there was an acute shortage of trained personnel in the various fisheries fields and believes that the personnel requirements fall into the following categories:

- High level Techno-Economic Administrators.
- Research personnel.
- Subordinate officers.
- Instructors, Extension Staff
- Operatives—Mechanics, etc.
- Fishermen.

While emphasising that there is acute shortage of trained personnel in the above

fields, the Council feels that the following categories require the most urgent attention:

Shipwrights and Boatbuilders.

Masterfishermen.

Engineers and Mechanics.

The shipwrights and boatbuilders should understand engine installation, boat maintenance, and have some knowledge of fishing boat design. Masterfishermen should have a good knowledge of navigation and seamanship and also correct practices of handling fish on board. Engineers should be trained in the operation of maintenance of marine engines to a standard required by government regulations. Emphasis should also be given to training extension staff in the above fields at the national level.

The Council also noted that Governments of Japan and India had offered facilities for training of fisheries personnel to other countries of the Region. Scholarships have been offered by Australian Government for training *inter alia* in fisheries.

The Council recognizing the necessity for instruction in the above fields and for national training centers, and strongly supporting the recommendation made at the 6th FAO Regional Conference requested FAO to explore the possibility of holding Regional Training Centers for instructors in boatbuilding, in training masterfishermen, and in training engineers and mechanics.

The Council also strongly urged FAO to prepare a list of fishery educational institutions available for training of various categories of personnel. Until this list is prepared, the Council is unable to suggest in what institutions suitable training may be given.

Extension Services

The Council emphasized the importance of adequate fisheries extension services as an essential part of the governmental fisheries establishment and recorded its view that there was need for development and refinement of the techniques at present being used

in many Member Countries in the process of bringing the knowledge and skills developed in the research centers to the operatives in the industry.

Stock Assessments

The Council recognized the urgent need for the establishment at national and international level of increased facilities for the development of programme leading to assessment of stocks of commercially exploitable marine resources and on this basis, established a Sub-Committee on this subject.

Formulation of Research Programmes

The Council noted with interest the Resolution 4/62 of the 6th FAO Regional Conference, Kuala Lumpur, and referred the question to its Technical Committees for study and appropriate action.

Having considered the formulation of research programs and noted that these programs have been reviewed under individual topics, the Council is of the opinion that compared with biological and technological research programs in the Region, research on economic aspects has not received as much attention as it deserves and recommends to Member Governments that as a start, a study of "Impact of introduction of mechanized fishing craft and improved fishing techniques on the socio-economic status of fishing communities", should be undertaken. In the light of discussions at the FAO 6th Regional Conference, the Council also strongly recommends that biological, technological and economic research programs should be coordinated and closely integrated.

Management of Fisheries

The Council recognized the significance of this subject, but in view of the shortage of time at its disposal deferred consideration of the matter until its 11th Session.

Control of Diseases and Importation of Exotic Species

The Council referred this question to Technical Committee I for consideration and

recommendations on the subject are given in Chapter II. Particular reference is made also in Council's Special Resolution No. II/62.

Relationship with Oceanographic Programmes

The Council referred this question to Technical Committee I and in this context adopted the recommendations listed in Chapter II as well as in the Special Resolution No. II/62 and III/62.

Inter-session Meetings of Technical Committees

The Council strongly stressed the desirability of inter-session meetings of specialists and considered that such meetings increase the effectiveness of the work of the Technical Committees. The Council proposed that an Inter-session Meeting of Specialists of the Sub-Committee of Tech. Com. II be held during the period between the 10th and 11th Session and the subject chosen for discussion was "Fishery Credit and Financing".

The Council also requested FAO to make the necessary financial allocation to meet the cost of such a meeting. It is suggested that copies of the report of such a meeting together with contributed papers be made available to Member Governments.

Reports of Technical Committees

a. Technical Committee I

The inter-session reports of Technical Committee I comprising a survey of national and international activities in its field of responsibility and a report on the response to 9th Session recommendations during the inter-session period were adopted.

The Council noted that Technical Committee I had agreed to establish two Sub-Committees and the Secretary was requested to circularize Member Governments to determine if they wished to designate representatives on these Sub-Committees during the next inter-session period.

The Sub-Committee on Stock Assessment elected Dr. G. L. Kesteven, Delegate for

Australia, as interim Chairman pending advice from Governments and the consequent increase in membership.

The Sub-Committee on Fisheries Oceanography elected Mr. J. C. Marr, Delegate for U.S.A., as interim Chairman on the same basis.

Related wholly or in part to the work of Technical Committee I are the following Council Resolutions.

RESOLUTION II/62

(Moved by the Delegate for U.K., seconded by the Delegate for Australia)

The Council, having heard a statement from the Observer for UNESCO with regard to that Organization's programme in the field of marine sciences,

Being convinced that the fishery programmes with which the Council is concerned will be benefited by UNESCO's activities, especially by those relating to the IOC,

Believing that direct benefit can be obtained from an association of the Council's work with that of UNESCO's SEASCO,

Requests the Secretary to establish close contact with the staff of SEASCO and to collaborate with that staff in

- (a) organization of training courses at the regional or national level,
- (b) assistance in the establishment and development of national reference collections of marine organisms,
- (c) assistance in the preparation and distribution of plankton identification sheets,
- (d) assistance in the preparation and distribution of national or regional bibliographies on the principal groups of marine organisms.

Recognizing the increasing importance of inland waters in the production of fish, the Council requests UNESCO to consider the setting up of a similar programme for inland

waters, and in particular to implement as soon as possible a programme of assistance in the universities and research laboratories in the study of fish diseases and parasites, including those which may be harmful to human beings and economic and domestic animals.

RESOLUTION III/62

(Moved by the Delegates for Korea, seconded by the Delegate for France)

The Council :

Being aware of Resolution No. 12 of the Intergovernmental Oceanographic Commission, having to do with the investigation of the Kuroshio and adjacent seas, and

Recognizing the importance of such studies to fishery problems,

1. urges interested Member Governments to participate actively in such investigations, and
2. directs Technical Committee I, through its Fishery Oceanography Sub-Committee, to participate in and facilitate the planning of the study, and
3. requests the IOC Secretariat to explore the possibility of convening through SEASCO, planning meetings for the Kuroshio study.

RESOLUTION IV/62

(Moved by the Delegate for Australia, seconded by the Delegate for U.S.A.)

The Council having received from Technical Committee I a report of its work during this session, resolved to adopt and approve this report.

The Council in particular approved the Committee's action in appointing Standing Sub-Committees for Fishery Oceanography and Stock Assessment and noted that the Sub-Committees for *Rastrelliger*, *Hilsa*, *Chanos*, Fish Culture in Rice Fields, and Shrimp and Prawn had not been reestablished, and that it did not propose that Panels should be set up.

RESOLUTION V/62

(Moved by the Delegate for Ceylon, seconded by the Delegate for U.K.)

The Council :

Noting the action taken by the Technical Committees to review their Sub-Committees' structure,

Noting also the proposal from the Technical Committees for inter-session work to be undertaken by Sub-Committees appointed at this Session,

Believing that the proposed work is of a kind requiring inter-session meetings of these Sub-Committees,

Requests the D.G. of FAO to explore the possibility of providing funds to cover the cost of one meeting of each Sub-Committee during the forthcoming inter-session period.

RESOLUTION VI/62

(Moved by the Delegate for U.S.A., seconded by the Delegate for France)

Being aware of the importance of adequate library facilities as a necessary tool in fishery development and investigation, and

Noting the need to increase the scope of the libraries of the Central Fisheries Experiment Station at Pusan and the Pusan Fisheries College, in view of the expanding interest in fisheries,

The Council requests Member Governments and UNESCO to assist in providing publications for these libraries. Methods which may be effective to this and include, but are not restricted to,

1. sending sets of serials issued by Governments and insuring that future numbers will be sent;
2. Sending duplicates which may be available from institutional or personal libraries;
3. inserting in appropriate journals notices of the need for publications;
4. gift subscriptions to journals.

Further, the Council recognizes the importance of the usual exchange of publications between institutions and requests the Secretariat to prepare, and distribute a list of governmental and private institutions within the IPFC region desiring to enter into the exchange of publications.

RESOLUTION VII/62

(Moved by the Delegate for U.K., seconded by the Delegate for France)

The Council recognizes that many stocks of this region are subject to intense exploitation and that there are fears that in some cases the resources are subject to excessive and indiscriminate exploitation, while in others the exploitation is insufficient and/or inefficient, and

Whereas close attention to this kind of problem is appropriate to the function of this Council and corresponds to the activities of so many fisheries Councils and Commissions throughout the world;

Whereas so much attention being paid to these matters in other fisheries Councils and Commissions underlines the significance and urgency of the problem.

Therefore, may it be resolved that:

1. The Council invite the attention of Member Governments to the urgency of introducing measures for proper management and conservation of marine resources, and
2. The Council confirm:
 - (a) its willingness to give opinion in this matter, if so requested by one or more of the Member Governments of the main countries which exploit such resources assuming that sufficient data on catch and effort statistics, biological information such as size, age and sex composition of the catch are furnished by the interested Governments.

- (b) its willingness to offer, in time and upon request, its advice on the mode of exploitation that would ensure sustained yields consistent with the policies of Member Governments.

The inter-session and session reports of Technical Committee I are included in these Proceedings as Chapter II.

b. Technical Committee II

The Council considered in detail the Inter-session Report for 1961-62 and found that it gave an accurate account of the developments that have taken place in certain member countries during the period under review. Regrettably not all countries had responded to requests for information for preparation of the report, and Council urges Member Governments to cooperate more fully in this respect so that the inter-session report may in future be made more comprehensive.

This report is an account of the developments in the member countries during the inter-session period between the 9th and 10th Sessions, in the field of fisheries technology, i.e., craft, harbors, gear, fishing enterprises, training of boatbuilders and fishermen, fish handling, processing, and distribution, technical assistance programs and documentation. In addition, the report also includes information on the action taken by Member Governments as well as by FAO on the various recommendations made by the Council at its 9th Session, held in Karachi, Pakistan, 6-23 January 1961, if such information is available. In the preparation of this report, the Secretariat depends mainly on information contributed by the members of the appropriate Panels of the Technical Committee (Technology) and also on information contributed by the Council Secretariat in regard to actions taken by FAO.

The Technical Secretaries of the Technical Committee (Technology) maintain close contact with the members of the Panels of the Committee nominated by the Governments by means of circular letters as well as

by periodical visits if and when adequate travel funds become available. Such contacts facilitate exchange of information, coordination of research and experimental techniques, and rendering of *ad hoc* technical assistance on various problems. This report also contains information gathered by the Technical Secretaries during their periodical visits to member countries. During the inter-session period, the following countries were visited: Philippines (in connection with IPFC/FAO/EPTA Fish Processing Training Center), Cambodia, Ceylon, India, East Pakistan, Burma, South Thailand, Federation of Malaya, Singapore, Sarawak, Brunei, North Borneo and Indonesia.

The Council noted that the Technical Committee II had decided to abolish the Panels A, B, and C and the Fish Marketing Sub-Committees. The Council also noted that the Committee being aware of the diversity of subjects covered by it decided to establish the three Sub-Committees as follows:

Fishing Craft and Gear Sub-Committee

Food Technology Sub-Committee
Socio-Economics and Statistics Sub-Committee

The work of the former Fish Marketing Sub-Committee will be taken by the Socio-Economics and Statistics Sub-Committee.

The Session Report of Technical Committee II was introduced and following discussion was adopted on a motion by the Delegate for India seconded by the Delegate for Philippines.

These reports are included in these Proceedings as Chapters III, IV and V.

Report of the FAO/EPTA Fish Processing Training Center

The Council reviewed the provisional report of the FAO/EPTA Training Center held in Quezon City, Philippines during March/April 1961 (CP 11) and were of the opinion that the lectures presented at the Center should also be included in the final version of the report.

Symposium for 10th Session

The Symposium for the 10th Session entitled "The mechanization of fishing fleets in the Indo-Pacific Region" was convened by Mr. Lee Bong Nae, and Mr. J.O. Traung served as Rapporteur.

The Symposium was divided into several sections and the Convener invited members of several delegations to open the discussions on the several sections.

Arising from the papers presented and discussions which followed, a report on the Symposium was drawn up for publication with the original papers in Section III of the Proceedings of the 10th Session.

Proposals for Symposia

The Council discussed the general matter of Symposia at the Council Sessions and it was agreed that Symposia on two subjects should be organized for the 11th Session but that the presentation of these Symposia should occur only if they did not interfere with Council's deliberations on host country problems.

The Technical Committee I subject was "Techniques of Stock Assessment". The subject of direct concern to Technical Committee II was "Increasing Consumption through Improved Fish Handling and Distribution".

Time and Place of 11th IPFC Session

There being no invitation offered from the Member Governments present, the Council invoked the provisions of Rule II of the Rules of Procedure placing the responsibility for selecting a site and time for the next Session on the Chairman in consultation with the Director-General and subject to approval of a majority of Member Governments.

RESOLUTION VIII/62

(Moved by the Delegate for U.S.A., seconded by the Delegate for Australia)

Desiring to increase the benefits of Council Sessions to the Member Governments, and

Recognizing the presence of numerous experts at Council Sessions, The Council requests the Executive Committee, in arranging the program of the 11th Session, to provide an appropriate period (perhaps one week) for consideration of those fishery problems of the host country which the host country may wish to bring forward. It is the sense of the Council that this period be used by the Technical Committees to explore fully, on the basis of background papers distributed in advance and oral reports submitted by the fishery staff of the host country, the specific fishery problems of the host country. It is hoped that such a review could be conducted informally, somewhat as a work-shop, and would result in (1) assistance in the solution of the problems of the host country, (2) greater understanding by the delegates of other countries of these problems, and (3) training opportunities for all participants.

Election of Office-Bearers

The Delegate for the United Kingdom nominated and the Delegate for Japan seconded Mr. K. Gopinath Pillai of the Indian Delegation as Chairman. Mr. K. Gopinath Pillai was elected with acclamation.

The Delegate for Ceylon nominated and the Delegate for the United States of America seconded Mr. Kim Myung Nyun of the Korean Delegation as Vice-Chairman. The motion was adopted with acclamation and Mr. Kim Myung Nyun was declared elected.

Formal Resolutions

The Delegate for Australia moved and the Council adopted the following Resolution:

The Council:

Having convened in Plenary Session desires to place on record its very deep appreciation of the courtesy and generosity of the Acting President and of the Government of the Republic of Korea in extending to it an invitation to hold its 10th Session in Seoul, Republic of Korea.

Further the Council wishes to record its deep gratitude to the Minister and officers of the Government of the Republic of Korea for the courteous, enthusiastic and untiring assistance rendered by them and which has made so notable a contribution to the success of the 10th Session.

The Delegate for U.S.A. moved and the Council adopted a Resolution:

That the Council express to H. E. General Choi Duck Sin, Minister for Foreign Affairs, a most sincere expression of its appreciation of the courtesies and hospitality extended to it and assures the Minister that the success of the 10th Session has been dependent to a very great extent on the enthusiasm and untiring efforts of the members of the staff of his Ministry.

The Delegate for India moved and the Council adopted a Resolution:

That the Council express to H. E. General Chang Kyung Soon, Minister of Agriculture and Forestry, its most sincere appreciation for the courtesies and hospitality extended to it, and assures His Excellency of its deep gratitude for the services provided by the officers of the 10th Session.

The Delegate for Netherlands moved and the Council adopted the following Resolution:

The Council:

Recognizing the deep interest of the people and the Government of the Republic of Korea in the development of the fishery industries, and

Being aware that the invitation to the Council to hold its 10th Session in Seoul from 10 to 25 October 1962 is a concrete example of the desire of the people and the Government of the Republic of Korea to do all in their power to aid in the development of these industries,

Places on permanent record an expression of deep appreciation for and commends

in the highest terms the devoted and untiring efforts of the Organizing Committee, Liaison Officers and Clerical Staff provided by the Government of Korea and without whose enthusiastic assistance it would not have been possible to bring to a successful conclusion the 10th Session of the Council.

The Delegate for Japan moved and the Council adopted a Resolution:

That the Council express its sincere appreciation for the courtesy and hospitality afforded to it by

- i. The Australian Charge d'affaires a.i.
- ii. The Chief, Central Fisheries Inspection Station, Pusan
- iii. The President, Korea Fishing Net Industries Association
- iv. The Director, Central Federation of Fisheries Cooperatives.

The Delegate for Philippines moved and the Council adopted the following Resolution:

The Council:

Expresses its gratitude to the Dean of Pusan Fisheries College for the hospitality offered and the facilities made available for

the Council to inspect the Pusan Fisheries College and to discuss with Members of Staff the activities of the College in connection with the development of fisheries industries of the Republic of Korea.

The Delegate for Thailand moved and the Council adopted the following Resolution:

The Council:

Records an expression of sincere appreciation for the courtesy and hospitality extended to it by the Director, Central Fisheries Experimental Station Pusan, and for the excellent arrangements made and entertainment provided during the Council's visit to Pusan.

The Delegate for U.K. moved and the Council adopted a Resolution that:

The Council:

Expresses its sincere appreciation for the courteous and generous hospitality offered to it during its visit to Pusan by

Shin Heung Refrigeration Co.
Pusan Ice Plant Co.
Dong Yang Can Co.
Pusan Shipyard Co.
Sam Hae Fishery Net Co.

APPENDIX

Statement of Expenditure and Estimates

The following Statement of Expenditure and Estimates was prepared and circulated to Member Governments together with the official invitation to be represented at the 10th Session.

The statement formed Appendix I of

the Report of the Executive Committee and with this Report, was adopted in Plenary Session, except that provision for the 34th and 35th Executive Committee Meetings has been since deleted as the proposed meetings could not be convened in connection with the 10th Session.

STATEMENT OF EXPENDITURE FOR 1961

	Expenditure US\$	Budget Allocation US\$
A. EXECUTIVE COMMITTEE TRAVEL	1,006.00	1,500.00
		(1) 400.00
		<u>1,900.00</u>
<i>31st Executive Committee Meeting, Jan. 4-5, 1961, Karachi, West Pakistan.</i>		
Chairman: Mr. Tran Van Tri (Vietnam)		
Subsistence	35.00	
Vice-Chairman: Mr. D.T.E.A. de Fonseka (Ceylon)		
Subsistence	35.00	
Chairman Technical Committee I—co-opted:		
(2) Mr. Soong Min Kong (Malaya)		
Subsistence	35.00	
<i>32nd Executive Committee Meeting, Jan. 24, 1961, Karachi, West Pakistan.</i>		
Chairman: Mr. D.T.E.A. de Fonseka (Ceylon)		
Subsistence	17.50	
Vice-Chairman: Dr. M.R. Qureshi (W. Pakistan)		
Subsistence	—	
Member: Mr. Tran Van Tri (Vietnam)		
Subsistence	35.00	
<i>33rd Executive Committee Meeting, Oct. 24-27, 1961, Bangkok, Thailand.</i>		
Chairman: Mr. D.T.E.A. de Fonseka (Ceylon)		
Fare:	268.00	
Subsistence:	122.50	
Terminal:	12.00	
	} 402.50	
Vice-Chairman: Dr. M.R. Qureshi (W. Pakistan)		
Fare:	368.00	
Subsistence:	70.00	
Terminal:	8.00	
	} 446.00	
Member: Mr. Tran Van Tri (Vietnam)		
Unable to attend	—	
B. PRINTING	2,000.00⁽³⁾	2,000.00
650 copies and reprints CAB No. 30	180.18	
650 copies and reprints CAB No. 31	115.18	
1,300 copies of IPFC Procs. 9 (I)	1,317.14	
650 copies and reprints CAB No. 32		
(paid March 1962)	126.00	
1,300 copies of IPFC Procs. 9 (III)	261.50	
Part payment April 1962		

	Expenditure US\$	Budget Allocation US\$
C. MEETING		
See note 4.	—	nil
D. MISCELLANEOUS	1,713.59	1,900.00
Postage and Telegrams	802.28	
Stationery	894.67	
Sea Freight	9.87	
Expenditure at FAO Delhi Office on behalf of IPFC (Ind. Rups. 32-24)	6.77	

Explanatory Notes:

(1) FAO Rome, on request furnished an extra US\$400, to meet expenses in this item, when it was earlier foreseen that there would be insufficient funds to meet the holding of the 33rd Executive Committee Meeting. However, due to inability of the Member, Mr. Tran Van Tri from Vietnam, to attend this Meeting, expenses were considerably reduced.

(2) Due to absence of the Member, Dr. K. Kuronuma, according to the Terms of the Agreement, Mr. Soong Min Kong, Chairman

of Technical Committee I was co-opted in his place.

(3) Provisions were made to have the unused balance funds, US\$387.50, already committed in 1961, (US\$2,000-1,612.50) carried over for use in 1962. Paid from this carry-over in March 1962 was the cost of Current Affairs Bulletin No. 32 (\$126.00) and in April, 1962 part payment for IPFC Procs. 9 (III) for \$261.50.

(4) Expenses of IPFC 9th Session, Karachi, January 1961, were met from 1960 Budget.

IPFC STATEMENT OF EXPENDITURE FOR JAN. - DEC. 1962⁽¹⁾
(Estimated)

	Expenditure	Budget Allocations
A. EXECUTIVE COMMITTEE TRAVEL	—	1,500.00
B. PRINTING ⁽²⁾	1,488.59	2,000.00
650 copies and reprints CAB No. 33 (Apr. 1962)	109.14	
650 copies and reprints CAB No. 34 (Aug. 1962)	110.00	
650 copies and reprints CAB No. 35 (Dec. 1962)	110.00	
1,300 copies IPFC Procs. 9 (III) balance payment	351.83	
1,300 copies of IPFC Procs. 9 (II)	807.62	
C. MEETING	550.00	550.00
10th Session, Seoul, Korea (excluding Interpretation Services)		

	Expenditure US\$	Budget Allocation US\$
D. MISCELLANEOUS	1,750.00	1,750.00
Postage and Telegrams	650.00	
Stationery	950.00	
Sea freight (Seoul-Bangkok)	140.00	
Expenditure at FAO Office, Delhi, on behalf of IPFC—Ind. Rup. 35.00 (est.)	10.00	

Notes:

(1) Prepared in July 1962 but figures given include estimated expenditure until December 1962.

(2) Any unused balance funds under Printing Allocation will be carried over for use in 1963.

IPFC ESTIMATES OF EXPENDITURE 1963

	US\$
A. EXECUTIVE COMMITTEE TRAVEL	
35th Executive Committee Meeting	1,500.00
B. PRINTING	3,500.00
750 copies and reprints CAB No. 36 (April 1963)	
750 copies and reprints CAB No. 37 (August 1963)	
750 copies and reprints CAB No. 38 (December 1963)	
1,500 copies IPFC Proceedings 10th Session	
250 extra copies, 10th Session Symposium	
C. MEETING	nil
D. MISCELLANEOUS	
Postage and Telegrams	850
Stationery	890
Expenditure at FAO Office, Delhi, on behalf of IPFC	10

IPFC ESTIMATES OF EXPENDITURE 1964-65*

	US\$
A. EXECUTIVE COMMITTEE TRAVEL	3,000
36th Executive Committee Meeting 1964	
37th Executive Committee Meeting (pre-session, 1964)	
38th Executive Committee Meeting (post-session, 1964)	
39th Executive Committee Meeting 1965	

* FAO Fiscal Biennium

		US\$
B. PRINTING		4,000
6 issues x 750 copies Current Affairs Bulletin		
1,500 IPFC Proceedings, 11th Session 1964		
250 extra copies, 11th Session Symposium		
C. MEETING		600
11th Session 1964		
(excluding Interpretation Services)		
D. MISCELLANEOUS		3,650
Postage and Telegrams	1,700	
Stationery	1,800	
Sea Freight (11th Session)	140	
Expenditure at FAO Office, Delhi, on behalf of IPFC	10	

CHAPTER II

RESOURCES

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INTRODUCTION

Following the recommendation made by Technical Committee I (Hydrology and Biology), IPFC, at the 10th Session of IPFC, this chapter on Resources is composed of three separate reports followed by Annexes.

Part A — Survey of national and international activities in the field of responsibility of Technical Committee I in the Indo-Pacific Region during the inter-session period, 1961-62, compiled from reports from Member Governments and FAO.

Part B — Report on the response during the inter-session period, 1961-62, to the recommendations made by the 9th Session of IPFC having reference to the work of Technical Committee I or to subjects within its field.

Part C — Session Report of Technical Committee I

Annex I — Reports of member countries, IPFC, for the inter-session period, 1961-62.

Annex II — Report of the Food and Agriculture Organization for the inter-session period, 1961-62, on activities relating to the work programme of Technical Committee I, IPFC.

Annex III — Report of the Chanos Sub-Committee to Technical Committee I, IPFC, for the inter-session period, 1961-62.

PART A

SURVEY OF NATIONAL AND INTERNATIONAL ACTIVITIES IN
THE FIELD OF RESPONSIBILITY OF TECHNICAL COMMITTEE I
IN THE INDO-PACIFIC REGION DURING THE INTER-SESSION
PERIOD, 1961-62, COMPILED FROM REPORTS
FROM MEMBER GOVERNMENTS AND FAO

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INTRODUCTION

This is a summary report or survey of the activities with respect to fishery biology, oceanography and limnology of member countries of the Indo-Pacific Fisheries Council (IPFC), and of the Food and Agriculture Organization of the United Nations (FAO) during the inter-session period of 1961-62 as compiled by Technical Committee I (Hydrology and Biology) of IPFC.

The survey has been prepared by the Committee at the 10th Session from individual "country reports", a report from FAO, and from papers presented at or contributed to the Session.

Lest the wording of the introductory paragraph above go unnoted, let it be emphasized here—as it was at the 9th Session—that most of the activities described are those of the individual countries or individual agencies; i.e., there has been little real work by the Committee, its Panels or its Sub-Committees during the inter-session period. It must be noted, however, that the Committee as a whole was not assigned any specific tasks at the 9th Session, and the only recommen-

dation of the Council which was directed to it was concerned with its *modus operandi*.

The survey merely attempts to pick out a few highlights and points out some trends where apparent.

A second section of Chapter II titled "Report on the response during the inter-session period, 1961-62, to the recommendations made by the 9th Session of IPFC having reference to the work of Technical Committee I or to subjects within its field" contains a complete list of these recommendations and describes subsequent action by the various bodies to whom they were specifically directed.

For further information on inter-session activities, reference should be made to the detailed accounts prepared by Member Governments, FAO and the Chanos Sub-Committee and presented here as Annexes.

It should be noted that most of the material used as source material for this survey was originally presented in the "Report of Technical Committee I, (Hydrology and Biology), IPFC, inter-session period 1961-

62" (IPFC/C62/WP3) following an outline adopted by the Council at its 9th Session for presentation of the Committee's inter-session activities. However, in view of the adoption by the Council at its 10th Session of a revised outline or organizational scheme for reporting inter-session activities, the newly revised outline has been used in presenting this survey of activities.

1. INFORMATION GENERALLY, BIBLIOGRAPHIES AND REFERENCE BOOKS

1.1 Information—generally:

The coordination of fisheries and oceanographic research efforts within the Region was of major interest to the Council—in itself a coordinating body. Some examples follow.

On the international level certain fishery and oceanographic research in the north eastern Pacific is coordinated through three informal annual meetings; Sardine Conference, Tuna Conference, and Eastern Pacific Oceanic Conference (EPOC). These meetings are attended in their *personal* capacities by representatives from the United States, Canada, and various countries of Central and South America.

In Australia two committees have been established to promote and coordinate research on fishery resources. Oceanographic research in Japan is coordinated through the Japan National Committee on Oceanic Research.

The Korean Oceanographic Commission, made up of representatives of government agencies and universities, includes among its functions the coordination of national programs as well as cooperating in international programs.

In addition to governmental committees in the United States, the committee on Oceanography of the National Academy of Sciences has been very active in reviewing the current status of research and facilities and making recommendations.

With respect to freshwater research, the Board of Management of the Tropical Fish Culture Research Institute, Malacca, acts, among other capacities, as a review panel for the research program of the Institute.

1.2 Bibliographies

1.21 Lists of papers published during the Inter-Session Period

Rather extensive lists of publications issued during the inter-session period have been furnished by some member countries. (See the individual "Country Reports in Annex I, for these lists)

FAO has also listed most of its publications which are related to the work of Technical Committee I. (See Annex II)

1.22 Lists of bibliographies prepared

With respect to the issue of bibliographies *sensu strictu* attention is called to those issued by the IPFC Secretariat (Bangkok) in the IPFC Occasional Paper series on the fish and fisheries of Burma, Ceylon, Indonesia, Pakistan and the Philippines. FAO issued bibliographies on tunas and crabs. Ceylon reported a bibliography on the pearl oyster in press.

1.3 Reference books

Work has continued by FAO on the preparation or revision of six manuals concerned with fisheries biology: sampling, gear selectivity, fish tagging, methods in fisheries biology, a manual on fisheries science and one on stock assessment.

The completion and issue in 1962 of a revised version of "Handbook on fish culture in the Indo-Pacific Region. Based on a manuscript by S.L. Hora and T.V.R. Pillay, prepared in cooperation with the Fisheries Division of FAO" fulfilled a need which has been reiterated at many sessions of the IPFC.

Japan listed a considerable number of reference books covering such fields as fisheries biology, marine biology and fish culture.

A guide to the freshwater fauna of Ceylon is in press.

2. DEVELOPMENT OF METHODOLOGY AND TECHNIQUES

2.1 Information storage and retrieval

As a means for the expeditious and accurate treatment of data, the use of punched card systems for recording, storing, retrieval and manipulation of all forms of data is steadily spreading. Korea and Thailand report the introduction of hand-sorted systems, while Australia, Japan and the U.S.A. have adopted mechanically operated systems for the purpose.

At Cochin, India, a data centre pertaining mainly to plankton, has been set up by UNESCO in collaboration with the Indian Government.

2.2 Equipment and methods, including standardization and intercalibration

Australia has participated in the work of SCOR (the Special Committee on Oceanographic Research) of the International Council of Scientific Unions (ICSU) in connection with standardization of methods of collecting zooplankton. In India, work on standardization has been suspended because of lack of equipment. Korea has tried several types of nets during the past 20 years, and since 1960 the 60-cm. vertical net has been substituted for the Marutoku-B net. Malaya has used North Pacific standard nets for plankton collection and a Japanese standard XXI3 net to study the abundance of cockle larvae. Thailand states that standardization has not been achieved, but that the use of the Marutoku-B net continues in Gulf of Thailand studies. The Philippines has carried out rather extensive sampling and made comparisons of the Marutoku-B net and the Hensen egg-net. The former does not differ significantly from the Hensen net in catching power and is better at catching fast-moving organisms like *Sagitta*.

The symposium on zooplankton production held by the International Council for the

Exploration of the Sea (ICES) in 1961 suggested that the ICES establish a sub-committee to study and advise on the possibility of using standardized gear for comparative sampling; and the Intergovernmental Oceanographic Commission (IOC) under UNESCO has agreed, in connection with the International Indian Ocean Expedition (IIOE), to standardize methods of zooplankton sampling and to carry out field comparisons of different methods.

The Council noted these and other moves toward standardization of equipment and techniques and that in some cases steps are being taken to ensure interchangeability of results by intercalibration of equipment. The Council hopes that steps can be taken to keep Member Governments informed of progress in this work.

2.3 Identification of aquatic organisms

Immunological techniques (blood group studies) are being developed and used in Japan to identify portions of whale populations; and both in Japan and the U.S.A. identification of tuna sub-populations.

X-ray photography has been applied to the identification of larvae, juvenile and adult black-fin tuna, *Thunnus atlanticus*.

2.4 Population studies, age determination, fish behaviour and related studies

Australia has organized an in-training course in population analysis with the co-operation of the fisheries laboratory at Lowestoft and FAO.

In Thailand a comparative study of the effects of two types of tag, the Petersen disc and the plastic dart tag, on the growth and mortality of *Rastrelliger* has been made. The dart tag gave better results. Korea has devised a method of "automatic tagging" in studies of the Yellow Sea corvina, *Pseudosciaena manchuria*. Plastic Atkins tags and hooks are attached by silk thread to the branch lines of standard long-lines.

Japan has developed methods of using radio isotopes of zinc (in the form of injections) and cobalt (as needles) for studying the predation to which stocks of river trout are subject.

The question of age determination of fishes from the tropical areas of the Region continues to be an important problem. Australia has developed new equipment and methods for treating scales for reading. Thailand reports that hard parts cannot be used for aging *Rastrelliger*, and in the Philippines the Petersen method continues to be the only one used for age determinations. India is combining studies of scales and length frequencies of marine fishes, and with respect to certain freshwater species states there is a growing conviction amongst its workers that the general belief that hard parts of the body are of no value in aging fish from tropical waters may not be true. Japan has found that vertebral counts are not reliable in inferring hatching season of anchovy over 10 cm. in body length and that scale rings are not seasonal marks. Japan has suggested a method for age determination of the pearl oyster, *Pinctada maxima*.

The use of under-water ports in the United States' research vessel "CHARLES H. GILBERT" is a striking development in the field of behaviour studies on marine fish. A method of predicting the tuna catch in Hawaii by using coastal sea surface temperatures has been evolved by the U.S.A.

3. FISHERY OCEANOGRAPHY AND FISHERY LIMNOLOGY

3.1 Fishery oceanography

A paper by D.H. Cushing (IPFC/C62/CP 16) defines the term "fisheries oceanography" and a further paper by the Biology Branch Fisheries Division, FAO (IPFC/C62/CP 18) outlines fisheries oceanographic synopses.*

* Cushing, D.H. (1962) Fisheries Oceanography. *FAO Fish. Biol. Tech. Pap.* (24): 11 p.

Biology Branch, Fisheries Division, FAO (1962) Preparation of regional fisheries oceanographic synopses. *FAO Fish. Biol. Synops.*, (5-Rev. 1): 14 p.

3.11 General

A fairly extensive oceanographic survey of the three seas off Korea has been carried out in relation to fisheries (IPFC/C62/CP 19 pp. 1-9). Japan has reported the study of various fields of oceanography in close conjunction with fisheries investigations. Intensive oceanographic studies of Manila Bay have been made in the Philippines since April 1957.

A number of Member Governments (Australia, Ceylon, France India, Indonesia, Japan, Pakistan, Thailand, the United Kingdom and the United States) have participated in the International Indian Ocean Expedition, whilst in India some fisheries officers have participated in oceanographic cruises of the R.V. VARUNA conducted by the Indo-Norwegian project.

3.12 Physical and dynamic oceanography

In the U.S.A. the results of an intensive study of oceanographic data around the Hawaiian islands has been presented in the form of a climatic atlas. Computer programmes for the processing of oceanographic station data will make it possible to examine all Pacific Ocean station data in a short time and thus study the Pacific Ocean as a whole rather than by small units. India has made observations on seasonal changes in hydrology of its inshore and offshore waters.

3.13 Chemical Oceanography

Salinity studies have been continued in Malayan waters, both with reference to *Rastrelliger* distribution and to the culture of cockles.

3.14 Biological Oceanography

A qualitative study of plankton in the Arabian Sea, Indian Ocean and the Bay of Bengal was carried out under the sponsorship of the National Committee of Oceanic Re-

search for SCOR in Pakistan. Work in Korea has shown the use of plankters as indicator species for certain oceanic currents. In Thailand oceanographic surveys were carried out in the Gulf of Thailand, in conjunction with the Hydrographic Department of the Royal Thai Navy, with particular reference to plankton and fish eggs, especially of *Rastrelliger*. Australia, France and the U.S.A. have participated in the work of SCOR in connection with the standardization of methods of measuring basic productivity, and these countries as well as India, Japan and the Philippines are using C-14 in their studies of basic productivity.

3.2 Fishery limnology

Limnological surveys of inland waters were conducted by several Member Governments of IPFC during the inter-session period. Since most of these surveys involved considerable attention to appraisals of the economically valuable aquatic resources, a number of them have been listed in section 4.2, rather than here.

4. AQUATIC RESOURCES APPRAISAL

Although progress in the appraisal of the Indo-Pacific Region's aquatic resources—a major objective of the Council—may sometimes seem disappointingly slow, reference to the inter-session reports of Member Governments will reveal the amazing number, diversity, and scope of the problems under investigation. Contrast of the present situation with that existing at the formation of the IPFC demonstrates the remarkable change that has occurred in fishery research in the Region.

In this respect, certain developments in this field appeared to be of special significance and are therefore dealt with here.

Reference is made below (in section 4.3 (i)) to: the Pacific Tuna Biology Conference (Honolulu, 1961), the symposium on Scombroid Fishes (Mandapam Camp, 1962), and the World Scientific Meeting on the Biology of Tunas and Related Species (La Jolla,

1962). These meetings produced: (1) extensive collections of papers, (2) summary records of discussions, and (3) resolutions indicating needed actions. These resolutions represent the consensus of the tuna researchers and are thus of special significance.

The resolutions of the Honolulu Conference may be broadly categorized as follows: taxonomy and nomenclature (2 resolutions); sub-population identification, especially blood group studies and tagging experiment (4 resolutions); larvae and juvenile identification and collection (1 resolution); dynamics of North Pacific albacore (2); fishery oceanography (1); estimates of world tuna resources (1); exchange of scientists (1). The resolutions of the La Jolla Meeting may be categorized as follows: taxonomy and nomenclature (2 resolutions); sub-population identification (3); world tuna resources, especially catch statistics (1); larvae and juvenile identification and collection (2); larvae survival (1) dynamics of North Pacific albacore and bluefin, especially co-operative studies (1); fishery oceanography (2); behavior research (1); gear size selectivity (1); West African Tuna Commission (1); economic effort of regulations (1); exchange of scientists (1); species synopses (1); continuing committee (1); and population dynamics (1).

Of the many problems recognized as requiring attention by the participants in these meetings, four general problems received the greatest attention. These are: (1) Sub-population identification, (2) Taxonomy and nomenclature, (3) larvae and juvenile identification and collection, and (4) fishery oceanography. Attention is drawn to the significance of those problems.

The need is emerging, in connection with certain problems, for more truly cooperative and coordinated international studies. For the present, these problems include (a) the study of tunas and (b) fishery oceanography of the high seas. From the standpoint of distance alone, these problems are so vast that their solution will require joint efforts.

4.1 Country and regional appraisals, reviews or synopses.

Appraisals or reviews of this nature have been made by a number of countries, and attention has already been drawn (section 3.1 (i) above) to the FAO paper, "Preparation of regional fisheries oceanographic synopses"

Summaries of the fisheries of each country which describe the species exploited, the fishing seasons, the areas fished and the type of gear used would be useful. The following summary of the fisheries of Korea is reproduced here as illustrative of the type of summary which is of interest to the Council.

Summary of the Korean fisheries

1. The Eastern Sea

<u>Stock</u>	<u>Season</u>	<u>Fishing Gear</u>
Alaska pollack (<i>Theragra chalcogramma</i>)	Nov. — Jan.	Gillnet, Longline Trawl
Pacific cod (<i>Gadus macrocephalus</i>)	Dec. — Jan.	Trap, Seine
Mackerel (<i>Scomber japonicus</i>)	Apr. — Oct.	Purse Seine
Spanish Mackerel (<i>Scombra niphonia</i>)	Apr. — Oct.	Longline, Purse Seine
Saury Pike (<i>Cololabis saira</i>)	Dec. — Apr.	Trap net
Yellowtail (<i>Seriola quinqueradiata</i>)	Dec. — Apr.	Set net
Horse Mackerel (<i>Trachurus japonicus</i>)	Apr. — Oct.	Purse Seine
Herring (<i>Clupea pallasii</i>)	(Fifty years ago were caught in great quantity but today are very scarce)	
Shrimp (<i>Pandalus hypsinotus</i> ; <i>P. borealis</i>)	Year — round	Trawl net
Crab (<i>Chionectes opilio</i>)	Year — round	Trawl, Gillnet
Gelidium (<i>Gelidium amansii</i>)	Apr. — Sept.	—

2. The Western Sea (The Yellow Sea)

Shrimp (<i>Peneus orientalis</i> , <i>Penaeopsis jogneri</i>)	Year — round	Trawl net
Corvina (<i>Pseudosciaena manchurica</i>)	Apr. — June	Gillnet, Trawl, Stownet
Spanish Mackerel (<i>Scombra niphonia</i>)	Apr. — Oct.	Longline, Gillnet
Horse Mackerel (<i>Trachurus japonicus</i>)	Apr. — Oct.	Purse Seine
Ray (<i>Raja kenogei</i>)	Apr. — July	Trawl

<u>Stock</u>	<u>Season</u>	<u>Fishing Gear</u>
Oyster (<i>Ostrea gigas</i>)	Year — round (Especially autumn)	—
Hard clam (<i>Meretrix lamarcki</i>)	—	—
3. The Southern Sea		
Seaweed (<i>Porphyra tenera</i> ; <i>Gelidium amansii</i>)	Nov. — Feb.	—
Oyster (<i>Ostrea gigas</i>)	Year — round	—
Anchovy (<i>Engraulis japonicus</i>)	Apr. — Oct.	Gillnet, Fixed net
Mackerel (<i>Scomber japonicus</i>)	”	Purse Seine
Hairtail (<i>Trichurus haumela</i>)	”	Trawl, Longline, Sto net
Spanish Mackerel (<i>Scomber niphonia</i>)	”	Longline
Horse Mackerel (<i>Trachurus japonicus</i>)	”	Trawl
Red sea bream (<i>Brama raii</i>)	Year — round	Trawl
Shark (<i>Scylliorhinus forazame</i> ; <i>Squalus suckleyi</i>)	”	Longline, Trawl
Sea eel (<i>Astroconger myriater</i>)	”	Longline, Trap
Ray (<i>Raja kenoei</i>)	”	Trawl
Sharp-toothed eel (<i>Muraenesox cinereus</i>)	”	Longline, Trap
Pacific cod (<i>Gadus macrocephalus</i>)	Apr. — Oct.	Trawl, Purse Seine
Yellowtail (<i>Seriola quinqueradiata</i>)	”	Trawl, Purse Seine
Mullet (<i>Mugil cephalus</i>)	Year — round	Set net, Gillnet
Hard Clam (<i>Meretrix lamarcki</i>)	”	—
Cockle (<i>Anadara granosa</i>)	”	—
Abalone (<i>Haliotis gigantea</i>)	”	—
Sea mustard (<i>Undaria pinnatifida</i>)	Apr. — June	—

4.2 Appraisals, surveys or synopses of marine areas or of river basins or individual waters.

During the inter-session period surveys of impounded waters, natural watersheds and marine areas were conducted by various member countries. Australia made a study of watersheds which included Lake Eucumbone, an artificial Lake in New South Wales, and Gippsland Lake and Western Port in Victoria.

A limnological survey of a series of reservoirs in Ceylon was carried out in 1962. A report concerning the appraisal and development of inland fisheries resources in Ceylon was published by FAO in 1962 (FAO/EPTA Report 1527).

In Japan studies were made of the populations of pond smelt (*Hypomesus olidus*) in Lake Suwa and of ayu (*Plecoglossus altivelis*) in Lake Biwa. Stock assessments were emphasized by the Japanese biologists in such surveys.

In the Federation of Malaya, 25,000 acres of mangrove swamp of the Taiping District have been surveyed for the possibility of prawn culture. Limnological work on the 90,000 ha. Laguna de Bay, has been undertaken by the Government of the Philippines. In connection with this work, an experimental station was set up at Los Banos. Limnological studies on various reservoirs of the Agno River system were also conducted.

As far as marine areas are concerned, progress has been made in the survey of the productivity of the Gulf of Thailand. Research on planktonic fish eggs in relation to the population of chub mackerel (*Rastrelliger*) is being undertaken. The Government of Malaya has also conducted an investigation with regards to the hydrology of the fishing ground of chub mackerel off Pangkor Island.

The Indian Government also conducted a survey of the chub mackerel resources in the Arabian Sea.

The Japanese Fisheries Agency has continued its oceanographic survey of the

fishing grounds with cooperation rendered by the Meteorological Agency and the Hydrographical Office. During the inter-session period, the Korean Fisheries Agency made a study of important species of plankton found in the seas off Korea.

4.3 Appraisals or inventories of fish populations and stocks, including reviews or synopses of aquatic forms of economic importance.

(0) General

Almost all reporting countries described considerable work in making inventories of their commercial fish populations, and in some cases reported use of their results in predicting the extent to which certain stocks could sustain establishment of commercial fisheries. An interesting example is that of the Japanese anchovy, for which it has proved possible to predict future catches.

Following the extended use of synopses on the biology of species of aquatic organisms at FAO's World Scientific Meeting on the Biology of Sardines and Related Species, Rome, 1959, and the issue at the 9th Session of IPFC of a synopsis on milkfish (*Chanos*) as the first FAO *Fisheries Biology Synopsis* in its present form, a decided interest has developed in the preparation and use of such synopses.

Indo-Pacific forms have received considerable attention among the species and groups selected for initial synoptic treatment, e.g. synopses have been prepared on the species of Trichiuroidei, *Sardinella* and *Sardinops*, *Clupea (Harengula) longiceps*, *Rastrelliger* and *Hilsa*. The tunas and related species of the IPFC region have also been included in synopses. A synopsis of biological data on *Mugil cephalus* has been prepared and synopses of a number of other Indo-Pacific forms are in preparation by CSIRO (Australia). These will have the same format and arrangement as the FAO series.

(i) Tunas

There was an excellent response by ten member countries of IPFC (Australia,

Ceylon, France, India, Japan, Korea, Federation of Malaya, Republic of the Philippines, U.K. and U.S.A.) to the request for reports on current and planned research to be submitted to the World Scientific Meeting on the Biology of Tunas and Related Species. The contributions were summarized and reported to the Meeting.

The increase in activity in the field of tuna research during the inter-session period was considered outstanding. Two major conferences on tunas and closely related species were held during 1961-62: (1) The Pacific Tuna Biology Conference, convened by the U.S. Fish and Wildlife Service, 14-19 August, 1961 and (2) The World Scientific Meeting on the Biology of Tunas and Related Species, convened by FAO, 2-14 July 1962, at La Jolla, California, U.S.A. Another meeting, the Symposium on Scombroid Fishes held under the auspices of the Marine Biological Association of India at Mandapam Camp, India, 12-15 January 1962 was also concerned with tunas and tuna-like fishes. (Mackerels, Spanish mackerels or seerfishes, and bill-fishes were also discussed.)

(ii) Mackerels

Ceylon, India, Malaya, the Philippines and Thailand all reported on their biological work concerned with *Rastrelliger*. Of particular interest are the tagging experiments in the Gulf of Thailand. Work was also reported on other mackerels such as *Pneumatophorus* (by Japan, Korea and the Philippines) and *Scomberomerus* (by Thailand).

A "Workshop" on *Rastrelliger*, a follow-up to the FAO *Rastrelliger* Training Center held at Bangkok in 1958, has been included by FAO in its list of proposed regional projects under the Expanded Program of Technical Assistance (EPTA) in 1964.

(iii) Sardine

With respect to *Sardinella* it may be noted that studies in India have indicated the usefulness of its scales in age determination of *S. fimbriatus*. In the Philippines, biological

work on its four species of *Sardinella* commenced only in March 1959; it has continued with emphasis on egg and maturity studies. Although of importance in the fisheries of Thailand, the life history of *Sardinella* has not yet been studied there. Japan and the U.S.A. have continued intensive research on their sardine stocks.

The attention of the Committee is called to the issue during the inter-session period (although under a date of 1960) of the "Proceedings of the World Scientific Meeting on the Biology of Sardines and Related Species held in Rome, 14-21 September 1959" by FAO. Supplement 1 to the Proceedings (1961) was also issued.

(iv) *Chanos*

The report of the *Chanos* Sub-Committee to the 10th Session (See Annex III) and reports from member countries reveal the expanding interest in the culture of *Chanos*, the milkfish, not only in countries where it has long been cultured, e.g. Indonesia and the Philippines, but also in other countries. Vietnam has reported fry along its coast and Malaya is undertaking a survey of fry resources. Culture experiments are under way in India and Ceylon. Thus there is a growing demand for fry and intensified efforts should be made to provide additional sources, not only by surveys of new areas, but also by the artificial induction of spawning in confined environment. (See also section 6.10)

(v) *Hilsa*

Hilsa is of primary interest to only three countries in the Indo-Pacific region: Burma, India and Pakistan. Reports of individual work done in the last two countries show continued activity. Tagging experiments have been carried out, but as yet there appears to be no firmly established coordination of activities.

(vi) *Mugil*

Australia is now making an assessment of the stocks of *Mugil cephalus* on its East Coast.

The synopsis on *M. cephalus* issued by CSIRO, Australia, has been mentioned under 4.3 (0).

(vii) Bottom fishes

Australia has recently made an assessment of the stock of tiger flathead off the East Coast. Some fundamental studies of the structure and management of demersal fish resources of the East China and Yellow Sea were reported by Japan. The Philippines reported on sampling from otter-board trawlers and described their studies on the biology of several groups of bottom fishes.

Such studies have continued for some years. A completely new study of bottom resources was begun in Thailand in 1961 by the Fisheries Department with the assistance of a taxonomist from the George Vanderbilt Foundation. In the same year otter-board trawl fishing was introduced into the Gulf of Thailand by German experts under the Thai-German Bilateral Agreement on Technical and Economic Cooperation. During 1962 an otter-board trawler was imported and nearly thirty boats of the locally-built paired-trawler fleet were modified for use with otter-boards. An exploratory fishing programme for the fiscal year of 1963 has been approved, to make appraisals of demersal fish stocks of the Gulf and adjacent waters as well as of the Indian Ocean. Chemical and physical data will also be obtained.

(viii) Prawns and shrimps

With respect to the investigations of member countries on prawns and shrimps, a number of new developments were noted. Ceylon is attempting to determine whether the grounds off its northeast coast will sustain a trawl fishery for prawns. India reported that important investigations are in progress on the biology of estuarine and marine prawns and that a separate prawn research unit has been established at the Central Indian Fisheries Research Institute. It has provided IPFC with a synopsis of biological data and a bibliography. Pakistan reported investiga-

tions in both its wings including those by a team of Japanese experts under the Colombo Plan.

(ix) Molluscs

Activity with respect to investigations of nacreous molluscs was reported by Ceylon which made its regular biennial survey of pearl oyster beds. In India an FAO fisheries expert assisted the Government with studies on pearl and chank beds in the Gulf of Mannaar. Japan conducted studies not only on the cultured pearl oyster but on abalone and other species. It also noted that although several pearl farms in Lake Biwa are now producing salmon-pink pearls in *Anodonta*, that development of this type of culture is hampered by lack of knowledge of this clam's life-cycle.

(x) Marine algae

Taxonomic studies of marine algae were made in Ceylon and Japan, the latter also conducted physiological and ecological studies of seaweeds.

5. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

5.1 Regulatory measures (legislative) to control fishing operations

Most, if not all, member countries have complex patterns of fishery regulations for both marine and inland waters and hence there was some difficulty in providing information on this matter. Some countries reported new developments in this field: Thailand, for example, reported the introduction of a regulation to control the season of operation of purse seiners fishing *Rastrelliger*. Korea reported having instituted more or less similar regulations to control fishing activities, mostly aimed at better management of fishery resources. Australia recently took some steps to co-ordinate Federal and State control of certain sea fisheries.

5.2 Control or alteration of the physical features of the environment

Australia, India, Japan and Thailand reported surveys to assess the effect of construction of dams and other types of river basin development which might influence aquatic stocks and their habitat.

In Japan work includes development of artificial spawning grounds for ayu and facilities to maintain stocks of this species; the Japanese work also included engineering research for fisheries to meet proposed development projects. The Thai work, which covers physical, chemical and biological aspects of the problem, is intended to lead to proper management of the resources of the Pumiphol dam.

5.3 Control or alteration of the chemical features of the environment

(i) Water pollution control

India reported on research to assess the effect of certain effluents and on the establishment of a new unit for this purpose. Japan also reported work in this field, the methods being used included bioassays. Australia and the Philippines reported recognition of the problem. The Pacific Science Association, at its 10th Congress in 1961, adopted a resolution suggesting appropriate safeguards to prevent injury to public health and to desirable plants and animals, including fish and wildlife.

(ii) Use of fertilizers

The Philippines reported an increase in the use of inorganic and organic fertilizers in pond culture, but that this increase was restricted by a lack of the inorganic fertilizers. Japan reported studies, now advanced, on the fertilization of marine algae beds.

5.4 Control or alteration of the biological features of the environment

India reported the conduct of surveys of weed-infested waters, and investigations into the ecology of weeds and described a

method of using anhydrous ammonia for aquatic weed control. The Philippines reported studies on the use of fish species for the control of weeds. FAO prepared a review of the use of manatee (*Trichechus*) to control aquatic plants.

5.5 Stocking

(i) Maintenance stocking and transplantation

Australia reported research to discover ways of promoting the reproduction, growth and survival of indigenous fish with the intention that action programmes to promote the development of stocks of these species would be initiated as a result of the research. Ceylon reported the release of fingerlings of gouramy (*Osphronemus gourami*) and common carp (*Cyprinus carpio*). Japan reported the stocking of salmon (*Oncorhynchus*), ayu, rainbow trout (*Salmo gairdnerii*), pond smelt, and common carp. Malaya reported continued work with regard to the spread and establishment of popular species in various inland areas; this work related to *Trichogaster pectoralis*, and *Puntius javanicus*. The Philippines reported work on *Chanos*, *Puntius javanicus*, *Cyprinus carpio*, *Tilapia mossambica*, *Trichogaster* and *Osphronemus gourami*. Korea reported a rather extensive programme of increased stocking of carp, mullet and salmon.

(ii) Introduction of non-indigenous species

Australia reported the establishment of two committees to advise on the control of the importation of non-indigenous species for aquaria and for food and sport purposes; this is done in order to give an opportunity to make fullest possible use of indigenous species and to protect the indigenous fauna; research is being carried out to ascertain the characteristics of the natural situations, and information is being assembled on the suitability of various non-indigenous species (whose importation might be contemplated) for acclimatization in Australian waters. Ceylon reported that no new non-indigenous species had been introduced. Japan reported that the Chinese grass carp (*Ctenopharyngodon idellus*),

introduced to the River Tone about 15 years ago are propagating successfully, and that *Tilapia mossambica* are reared on a small scale at some hot-spring resorts. Malaya described progress in studies on the use of *Catla catla*. The U.S.A. reported the introduction and establishment of threadfin shad (*Dorosoma petenensis*) in several reservoirs in Hawaii; also several species of marine fish, primarily snappers and groupers, have been introduced.

6. FISH CULTURE AND FISH DISEASE CONTROL

6.1 Fish Culture, General

Pond culture is, of course, well established in almost all member countries, and during the past biennium the production was increased. This was achieved not only by increasing the area under pond culture—note the gradual expansion of milkfish ponds in the Philippines—but also by the institution of more efficient methods. For example, the techniques evolved for induced breeding of Indian major carps, as well as the year-round breeding of common carp in India, have made it possible to augment the supply of “fish seed” and also to utilize the nursery ponds throughout the year. The change in regimen has, however, brought about other problems. Lacking this use, these ponds have hitherto lain fallow from October and July, but utilization throughout the whole year has led to reduction in natural fertility necessitating recourse to artificial fertilization and feeding. Expansion of fish culture in Malaya has been due largely to the Fisheries Division's extension service and free supplies of fish fry from Government stations and the Research Institute in Malacca. The interest of the Malay population in fish culture has been stimulated by the substitution of cattle sheds for pig sties (as in the Chinese system of culture) as a source of manure for the ponds. (Note, however, the paper IPFC/C62/Tech. 18 on the effect of organic manures in ponds). Although the general picture appears bright, it was pointed out by Japan that shortage of “fish seed”, fish food and capital, together

with a defective distribution system hampered the development of this industry beyond its present level.

Attention is called to the extremely useful reference book on fish culture for the Region issued during the inter-sessional period: the “Handbook on fish culture in the Indo-Pacific Region” issued by FAO in 1962, also to the publication “Fish Farming methods in the Philippines, Indonesia and Hong Kong” by T.G. Pillai, also issued by FAO in 1962.

6.2 Fish nutrition

Japan has reported on the use of commercial pellet food for trout feeding, and some work has been carried out in the Philippines on the food habits of marine fish. Paper IPFC/C62/Tech. 18 has reference to research on digestibility of algae by algae-feeding fish.

6.3 Pond fertilization

Studies with chemical fertilizers have been carried out in, for example, India, Japan and the Philippines. The latter reported that a lack of suitable formulations and experimental areas hampered their work. At the Tropical Fish Culture Research Institute, Malacca, Malaya, an intensive study has been carried out in ponds especially designed for experimental purposes. Reference is made to this in paper IPFC/C62/Tech. 18.

6.4 Fish breeding, including genetics

The most noteworthy development in this field was the work at the Central Inland Fisheries Research Sub-Station, Cuttack, India, where success was obtained in inducing specimens of Chinese grass carp (*Ctenopharyngodon idellus*) and silver carp (*Hypophthalmichthys molitrix*) to spawn using pituitary injections. Partial success has also been achieved in Japan using similar techniques. In Japan research has been carried out on the mass production of ayu fry in closed circulation aquaria and the induction of spawning by prolonging the length of the day artificially.

India reported on experiments with mullets in which injections of pituitary gave encouraging results in inducing the spawning of *Mugil cephalus* and *Liza troscheli*.

6.5 Aquatic weed control

See section 5.4.

6.6 Handling and transport of "fish seed"

No very new methods of fish transport were reported, but the use of oxygenated sealed plastic bags has become a common method in the Region.

6.7 Disease and parasite control

In India, *Aeromonas liquefaciens* appears to be the cause of an eye disease in *Catla catla*; a species of *Aeromonas* causes dropsy in Indian carps. FAO has issued a provisional list of workers on fish diseases and is preparing a new one.

6.8 Use of non-indigenous species

In many countries various non-indigenous fishes (*Tilapia* rather generally, and in Japan the Chinese carps) have become to be accepted as part of the cultivated and/or wild fauna, and are being studied as such. In Australia advisory committees have been set up to study the importation of exotic species, whilst in Victoria the Government is attempting to exterminate the common carp, *Cyprinus carpio*. (See also section 5.5).

6.9 Economics of fish culture

There appears to be a paucity of studies in this field, although technical paper IPFC/C62/Tech. 18 makes some reference to them. The Economics Branch, Fisheries Division FAO is preparing a handbook on the economic analysis of fish pond operations.

6.10 Special forms of aquaculture

(i) Rice-field fish culture

Thailand has reported much success in rice-field fish culture, but India reports low

yields of fish and low survival of fish fry in paddy fields. The culture of carp in rice-fields has been encouraged in Korea, with some success, and experiments in paddy field fish culture have started in the Philippines. In Japan the use of insecticides and certain herbicides has led to a decrease in the success of this formerly flourishing type of fish culture.

(ii) *Chanos* culture

Although *Chanos* is commonly cultured in a number of countries, and a start has been made in its culture in Ceylon and India, little is known of the biology and distribution of this fish. In particular, little research has been carried out on the artificial induction of spawning of *Chanos* in ponds.

(iii) Prawn and shrimp culture

The most noteworthy contribution to the study of prawn culture is the excellent work of Dr. S.W. Ling, FAO/ETAP Biologist in Malaya, in which the giant prawn (*Macrobrachium rosenbergi*) has been reared successfully from the larval state to juveniles suitable for stocking and culturing (IPFC/C62/Tech. 57). Japan has produced a very useful guide for the spawning of *Peneus japonicus* under artificial conditions (IPFC/C62/Tech. 59). In Malaya a survey of mangrove areas along the west coast has started with a view to opening up prawn ponds. The indigenous forms are *Peneus* and *Metapenaeus*. Thailand has already developed a considerable number of shrimp farms. In the Philippines, Peneid shrimps are commonly cultured together with *Chanos* although a lack of shrimp "seed" supply limits the extent of shrimp culture.

(iv) Mollusc culture

Several countries reported progress with the culture of edible molluscs. A five-year programme for the development of tidal flats, involving the transplantation of various shellfish is in progress in Korea; oyster culture is also being improved especially through the use of "raft-style" culture. In Malaya research has been carried out to improve the present practice of oyster collection

and to attempt to establish oyster culture. Study on the biology of the economically important cockle, *Anadara granosa*, is being carried on by the Federation as a prerequisite for the development of successful culture methods. In the Philippines, four demonstration oyster farms have been set up on Luzon and intensive culture has gained momentum.

(v) Miscellaneous types of fish culture

In Japan considerable financial aid has been provided for research and development on the culture of economically important marine organisms. Scientists are studying techniques for obtaining fry of yellowtail, as well as red and black sea bream, puffer and

octopus with the use of artificially or naturally fertilized eggs. Eel culture is continued in Japan. In Hawaii a *tilapia* "farm" came into operation in 1962 for the purpose of providing a supplementary live bait source for the skipjack fishing.

(vi) Algae culture

Two noteworthy studies are those of Japan with respect to the fertilization of marine algae grounds and those of the Philippines on *Caulerpa*. It has been found that this deep-water form can be propagated easily in shallow marine ponds. Korea noted that it was studying methods of cultivating seaweeds.

PART B

REPORT ON THE RESPONSE DURING THE INTER-SESSION PERIOD, 1961-1962, TO THE RECOMMENDATIONS MADE BY THE 9TH SESSION OF IPFC HAVING REFERENCES TO THE WORK OF TECHNICAL COMMITTEE I OR TO SUBJECTS WITHIN ITS FIELD

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INTRODUCTION

During its 9th Session, held in Karachi, January 1961, the Indo-Pacific Fisheries Council made a series of recommendations with respect to the work programme of Technical Committee I and the fields of activity within

its terms of reference.

There follows a list of these recommendations (grouped according to the headings of the 1961-62 work programme) and an account of subsequent action by the various bodies to whom they were specifically directed.*

* The recommendations appear in abridged form.

Cross references are made to the Chapter and pages of *Proc. Indo-Pacific Fish. Coun. 9, Section I (1961)* where the full recommendations as approved by the Council are reported.

These were called to the attention of the 10th Session of the Council for its use as one of the bases for evaluating the work accomplished during the inter-session period, 1961-62, and in determining whether additional action need be taken on the recommendations.

0. COMMITTEE PROCEDURE

(a) Work Programme

Rec. 9th Sess. (Ch. II, p. 94): A new work programme to be adopted grouping the various subjects and problems of interest to the Committee according to only a few major fields of activity—to ensure stability of the programme, promote a better grouping of allied subjects, permit addition of new subsidiary topics or deletion of old ones without disturbance to the major frame-work, and to simplify reporting.

The outline of the new work programme is given below :

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

- (a) Information—generally
- (b) Bibliographies
- (c) Reference books

2. AQUATIC RESOURCES APPRAISAL

- (a) Country and regional appraisals, reviews or synopses.
- (b) Appraisals, survey or synopses of marine areas or of river basins (inland) or individual waters (inland).
- (c) Appraisals or inventories of fish populations.
- (d) Reviews or synopses of aquatic forms of economic importance, with special reference to the following:

Tunas	<i>Mugil</i>
Mackerels	Bottom fishes
Sardines	Prawn and shrimps
<i>Chanos</i>	Molluscs
<i>Hilsa</i>	Marine algae

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES, ON CERTAIN SPECIALISED SUBJECTS RELATING TO FISHERIES

- (a) Standardization of equipment and methods of assessment of plankton populations.
- (b) Identification of aquatic organisms.
- (c) Population dynamics, age determination, fish behaviour, and related studies.
- (d) Oceanography.
- (e) Study of basic productivity.
- (f) Aquatic ecology.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

- (a) Regulatory (legislative) measures.
- (b) Control or alteration of the physical features of the environment
 - (i) River basin development
 - (ii) Others
- (c) Control or alteration of the chemical features of the environment
 - (i) Water pollution control
 - (ii) Use of fertilizers
- (d) Control or alteration of the biological features of the environment
 - (i) Aquatic weed control (See also under 5(e)).
 - (ii) Others
- (e) Stocking
 - (i) Maintenance stocking and transplantation
 - (ii) Introduction of non-indigenous species (See also under 5(h)).

5. FISH CULTURE AND FISH DISEASE CONTROL

- (a) Fish culture—general
- (b) Nutrition
- (c) Pond fertilization
- (d) Studies of fish breeding, including genetics

- (e) Aquatic weed control (See also under 4(d)).
- (f) Handling and transport of "fish seed"
- (g) Disease and parasite control
- (h) Studies of non-indigenous fishes (See also under 4(e)).
- (i) Economics of fish culture
- (j) Special forms of aquaculture; e.g. rice-field fish culture; shrimp culture; brackishwater fish culture; oyster culture, etc.

6. MISCELLANEOUS PROBLEMS, OFTEN SHORT TERM

The outline has been followed quite faithfully by all Members of Technical Committee I, the Panels and FAO in preparing the inter-session reports for 1961-62, and with but a few exceptions seem to have been easily interpreted.

(b) Reporting

Rec. 9th Sess. (Ch. II, p. 94): In order to eliminate repetition, lessen the number of reports to be submitted to the Chairman and Technical Secretary, and to clarify the method of reporting, the Council recommended the following procedure:

(i) The representative of Technical Committee I in each country is responsible for preparing the report covering *all* of the inter-session activities of his country in *all* fields associated with the Committee.

(A) He obtains material for this report by soliciting and receiving individual reports from his fellow countrymen on the Sub-Committees.

(B) He then incorporates or combines their material into a single report for his country—arranged according to the outline of the Work Programme. (Obviously his countrymen on the Sub-Committees follow the same outline).

(ii) This report is submitted to the Chairman of Technical Committee I (through the Technical Secretary).

(iii) The Chairman—using all of the country reports as working material—prepares a Summary Report for the next Session. He also sends any material relevant to the work of each Sub-Committee directly to the Chairman of the Sub-Committee concerned.

(iv) The individual "country reports", reports of the Special Sub-Committees and a report from FAO are attached as annexes.

(v) The entire report, including its annexes, is to be prepared as a working paper and examined—if possible—by Council members prior to the next Session.

(vi) A minimum amount of time of the Committee should be devoted to its revision at the Session itself, and this time should, of course, be confined to revision of the Summary Report itself.

During the 1961-62 inter-session period, a firm attempt was made to follow the outlined procedure. Requests were made on 5 July 1962 (through the Technical Secretary) to all members of Technical Committee I to obtain individual reports from their fellow countrymen on Panels A, B and the related Sub-Committees, to combine these into a single report for their country and to submit it by 15 August 1962. (Informational copies were sent to all Panel A, B and Sub-Committee members and Administrative Correspondents.) A follow-up letter was sent on 3 September 1962 to late respondents. Generally speaking, the response was good. As of 10 October 1962, five countries had submitted a single report as requested; three countries had submitted individual reports for Panel A and B; three submitted reports of rather fragmentary nature and from several sources; six countries had unfortunately submitted no reports at all by the opening of the 10th Session. (One of the latter countries submitted a report during the Session.) In most cases there appeared to be compensating circumstances.

According to the Secretary, compilation and editing of the material was simplified.

(c) Inter-Session meetings

Rec. 9th Sess. (Ch. I, p. 30): The consensus of Member Governments was in favour of inter-session meetings of Technical Committees provided the agenda was restricted to one subject.

The Technical Committees were instructed to keep this matter in view when preparing recommendations for the Council's program for the ensuing inter-session period.

During the 1961-62 period there were no inter-session meetings of Technical Committee I.

(d) Panels and Sub-Committees

Rec. 9th Sess. (Ch. I, p. 30): Panel A, Inland Fisheries; Panel B, Sea Fisheries; and the Sub-Committees on *Rastrelliger*, *Chanos*, *Hilsa* and Fish Culture in Rice Fields of Technical Committees I, should continue to function.

At the 10th Session the work of Panels and Sub-Committees be appraised in the light of programs achieved in the inter-session period and that as necessary they be re-constituted or discontinued.

The Council accepted the recommendation of Technical Committee I that Panels A and B and Special Sub-Committees on *Chanos*, *Rastrelliger*, *Hilsa* and Fish Culture in Rice Fields should not be re-constituted, that the work of these bodies be taken over directly by the Technical Committee and that two new Sub-Committees on Stock Assessment and on Fisheries Oceanography be set up.

(e) Elections of Chairman of Panels A and B and Rapporteur

Rec. 9th Sess. (Ch. II, p. 94): Consideration at the 10th Session that the Chairman of Panels A and B and the Rapporteur be elected for the Session only.

In view of the above decision, no action was taken on this question except that a Rapporteur to assist the Technical Secretary was

elected for the duration of the 10th Session only.

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS**(a) Information—generally**

Rec. 9th Sess. (Ch. II, p. 96): Governments to request institutions to forward publications to IPFC (Secretariat) who will list them in a suitable medium for distribution.

In general, member countries provided a considerable amount of information to the Secretariat throughout the biennium. The information has been transmitted to all the member countries through publications such as: the *IPFC Current Affairs Bulletin*, *IPFC Occasional Papers*, and various circulars.

Rec. 9th Sess. (Ch. II, p. 96): Governments to request appropriate institutions to furnish FAO with adequate particulars concerning their workers in the field of fisheries.

Some lists received by FAO may have originated in response to this recommendation.

Rec. 9th Sess. (Ch. II, p. 96): FAO to urge institutions and journals to standardize the form of published papers on fisheries to include institutional and current addresses of authors.

FAO has taken definite steps to implement this recommendation, as detailed below:

- (A) Effective with the issue of Volume 13, No. 1, January-March, 1962 of *World Fisheries Abstracts* (published by FAO), "Attempts are . . . made to include, wherever possible and useful, the address of the first author only in each abstract immediately following the full bibliographic reference of the article abstracted."
- (B) Periodicals which do not regularly cite the addresses of authors are circularized by FAO as a routine, suggesting that in the future they should do so.

Rec. 9th Sess. (Ch. II, p. 96): FAO to furnish on request short lists of workers in specialised subjects.

This is now a standard practice for the Biology Branch, Fisheries Division, FAO. During the period of 1961-62 lists of workers on the following subjects were issued: algae, diseases and parasites of aquatic organisms, biology of tunas and related species, pearl oysters, trochus and other nacreous molluscs, and various aspects of European inland fisheries.

(b) Reference Books

Rec. 9th Sess. (Ch. II, p. 96): FAO to give priority to Manual on Sampling Methods.

During the inter-session period, priority was given to the manual on sampling methods and a draft was completed.

2. AQUATIC RESOURCES APPRAISAL

(d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

Rec. 9th Sess. (Ch. II, p. 96): Governments to increase activities in this field and to furnish reports on current and planned research on the biology of tunas to be combined into a summary for the Indo-Pacific Region for presentation at the World Scientific Meeting on the Biology of Tunas and Related Species.

There was an excellent response to this recommendation by ten member countries of IPFC (Australia, Ceylon, France, India, Japan, Korea, Federation of Malaya, Republic of the Philippines, U.K., and U.S.A.) and their contributions were reported to the Meeting.

The increase in activity in the field of tuna research during the inter-session period was well demonstrated by the many papers presented at three major conferences on tuna and other scombroid fishes held during the 1961-62 period.

* Two countries submitted length frequency data during the Session.

(ii) Mackerels

Rec. 9th Sess. (Ch. II, p. 96): Governments to continue more vigorously or to initiate population studies of *Rastrelliger*, to follow a programme as laid down by the *Rastrelliger* Sub-Committee, and to send records of length sampling operations to the Chairman of the Sub-Committee for later reference to the Council Secretariat for publication as an IPFC Occasional Paper.

The Council also recommended that a "Workshop" on *Rastrelliger* should be held in Malaya as soon as possible under the (FAO) Technical Assistance Program (EPTA).

Ceylon, India, Malaya, the Philippines and Thailand all reported on their biological work concerned with *Rastrelliger*.

Work was also reported on other mackerels such as *Pneumatophorus* (by Japan, Korea and the Philippines) and *Scomberomorus* (by Thailand).

Arrangements were made by FAO, the IPFC Secretariat and the Chairman of the *Rastrelliger* Sub-Committee for the reproduction of *Rastrelliger* Length Frequency Distribution forms which were despatched in March 1962 to all members of the Sub-Committee. It was proposed that as a first experiment, summarized data for samples taken during the first half of the calendar of year 1962 be submitted to the IPFC Secretariat for compilation and presentation at the 10th Session of IPFC with a view to initiating a routine compilation from the beginning of 1963. However, no submission of such data had been received by the Secretariat prior to the 10th Session nor was any report by the *Rastrelliger* Sub-Committee submitted to the 10th Session.* The "Workshop" on *Rastrelliger*, a followup to the FAO *Rastrelliger* Training Center held at Bangkok in 1958, was included by FAO in its list of proposed regional projects under EPTA in 1964.

(iv) *Chanos*

Rec. 9th Sess. (Ch. II, pp. 96-97): Governments urged to report more fully at future

Sessions, and to carry out and report on investigations concerning the propagation of *Chanos* in confined waters.

Ceylon, India, Malaya, the Philippines and Thailand all reported on their work with *Chanos*. The *Chanos* Sub-Committee submitted a detailed report on the overall situation with respect to the status of the *Chanos* industry in the region and the desire of various governments for its improvement. There were no reports of investigations concerning the propagation of *Chanos* in confined waters.

(v) *Hilsa*

Rec. 9th Sess. (Ch. II, p. 97): Governments concerned to afford greater facilities for *Hilsa* research, if necessary with outside assistance, and to afford participants in the investigation greater opportunity for meeting and co-operation under the programme as laid down by the *Hilsa* Sub-Committee.

Hilsa is of primary interest to only three countries in the Indo-Pacific region: Burma, India and Pakistan. Reports of individual work done in India and Pakistan showed continued activity. However, there is as yet no firmly established coordination of activities; e.g., in tagging operations.

(vi) *Mugil*

Rec. 9th Sess. (Ch. III, p. 97): Governments asked to contribute information on *Mugil cephalus* to CSIRO, Australia, to aid in the preparation of a synopsis of biological data on this species.

Government asked to conduct experiments on the artificial breeding of *Mugil*.

A provisional version of the synopsis on *Mugil cephalus* has been issued by CSIRO. (Member Governments were unresponsive to the request to provide CSIRO with material). Only India reported on experiments on the artificial inducement of spawning in mullets. (Injections of pituitary gave encouraging results in *M. cephalus* and *Liza troscheli*.)

(vii) Bottom fishes

Rec. 9th Sess. (Ch. II, p. 97): Greater attention to be paid to bottom fishes, especially to those of commercial importance. Several countries, notably Australia, Japan and the Philippines continued their investigations on demersal stocks, and Thailand started its first detailed studies on the bottom resources of the Gulf of Thailand. These studies were accompanied by a decided expansion of its demersal fishing activities.

(viii) Prawns and Shrimps

Rec. 9th Sess. (Ch. II, p. 97): A Sub-Committee to be set up to pay special attention to the research on and culture of prawns and shrimps; Member Governments to be asked to nominate members.

An *ad hoc* Sub-Committee to be set up for the interim to prepare the work for the official Sub-Committee.

A few nominations were made by Member Governments during the inter-session period and some correspondence was exchanged with the Secretariat by members of the *ad hoc* Sub-Committee. However, it proved impossible for the group to outline a definite program, and it was decided that designation of the work on prawns and shrimps was best left to the 10th Session of the Council.

(ix) Molluscs

Rec. 9th Sess. (Ch. II, pp. 97-98): Governments to prepare reports on the present status of the pearl oyster fisheries to include the following: (a) the stock inventory on pearl oysters, (b) measures of protection of the natural beds, (c) the stage of research work, (d) the development projects, (e) steps being taken to meet with the competition of synthetic materials. Reports to be forwarded to Chairman of Technical Committee I for presentation at 10th Session which might then draft a common programme of work.

FAO to furnish a list of workers interested in pearl oysters, *Trochus* and other nautilus molluscs of commercial interest.

Governments to forward publications or lists of publications on this subject to IPFC Secretariat for distribution.

No reports on the present status of the pearl oyster fisheries giving the specific details requested by the first recommendation above were submitted by Member Governments. FAO responded to the recommendations directed to the Organization by issuing a provisional list of workers on nacreous molluscs in May 1962, and a second draft was submitted to the 10th Session.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton populations

Rec. 9th Sess. (Ch. II, p. 98): Countries to inform IPFC Secretariat of the general kinds of planktonic organisms of interest, the types and specifications of the nets employed, their pattern of use, volume of water strained and data on comparative tows of various types of nets.

At the 8th Session, 1958, the Council recommended that Member Governments conduct experiments with the Marutoku-B type plankton net during the inter-session period with a view towards standardizing the type of net for use by all member countries. Following a review of such trials at the 9th Session, 1961, it was decided that it was impractical to recommend a particular net or pattern of use exclusive of all others.

Consequently the Council dropped immediate efforts towards standardization and made the recommendation stated (in abridged form) above. The reports of a number of member countries described the type of equipment used, gave some information on the techniques of collection and indicated some of the planktoners in which they had a major interest. However, no really detailed studies answering to the terms of the recommendation of

the 9th Session were submitted to the Secretariat.

(b) Identification of Aquatic Organisms

Rec. 9th Sess. (Ch. II, p. 98): Governments to supply Biology Branch, Fisheries Division, FAO, with new and revised checklists of aquatic organisms, taxonomic publications and bibliographies.

FAO to compile comprehensive lists of scientific and common names of major species of aquatic organisms of economic importance.

Many member countries responded to the first recommendation but it is obvious that many reprints—especially from journals which do not deal exclusively with aquatic organisms or with fisheries—are not sent to FAO where they might be listed in its compilation, *Current Bibliography for Aquatic Sciences and Fisheries*.

A comprehensive list of genera of aquatic organisms issued by FAO in 1961 as *FAO Fish. Biol. Tech. Pap.*, (12)—used in conjunction with the taxonomic codes in the *Current Bibliography*—and enabling one to link genera with families and orders is part of a continuing plan to fulfill the second recommendation listed above.

(d) Oceanography

Rec. 9th Sess. (Ch. II, p. 99): In recognition of the importance of oceanographic studies to fisheries, the attention of Governments is drawn to the work of the International Indian Ocean Expedition (IIOE) and requested to take advantage of the opportunities afforded.

Most of the Member Governments reported participation in the International Indian Expedition: Australia, Ceylon, France, India, Indonesia, Japan, Pakistan, Thailand, the United Kingdom and the United States.

(e) Study of basic productivity

Rec. 9th Sess. (Ch. II, p. 99): Attention of Governments drawn to the Symposium on this subject at 10th Pacific Science Congress.

There was participation in this Symposium by scientists from a number of member countries.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(b) Control or alteration of the physical features of the environment

(i) River basin development (Ch. II, p. 99): Emphasized the need for a thorough fisheries survey as an integral part of the overall plan for the Lower Mekong Basin Development Project; development of fisheries resources to be accorded a proper place in the development plan.

Present knowledge indicates that while studies on the Tonle Sap Project continue, no really thorough fisheries survey has ever been made of the entire Mekong system.

(c) Control or alteration of the chemical features of the environment

(i) Water pollution control

Rec. 9th Sess. (Ch. II, p. 99): Draw attention of Governments to Conference on Water Pollution Problems in Europe, Geneva, 1961, and urged study of its pertinent literature.

Following the Conference on Water Pollution Problems in Europe, convened by the Economic Commission for Europe (ECE) and co-sponsored by FAO, the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO), requests from the fisheries departments of several member countries for copies of the Conference documents were filed by FAO. The Organization also made a distribution of the published papers to all members of Panel A, calling attention to the universal value of many of the papers in dealing with principles of pollution control, the establishment of control bodies, and the administrative, legal and economic aspects of the subject with respect to both national and international waters.

(d) Control or alteration of the biological features of the environment

(i) Aquatic weed control

Rec. 9th Sess. (Ch. II, p. 99): Governments to submit all information on use of fish for the control of aquatic weeds to FAO for distribution.

The only reference to the use of fish to control aquatic weeds in the reports from Member Governments was made by the Philippines.

(e) Stocking

Rec. 9th Sess. (Ch. II, p. 99): Attention of Governments drawn to danger inherent in indiscriminate introduction of non-indigenous species of fish; requested to evaluate consequences of such introductions and to submit reports at 10th Session.

None of the reporting countries provided a detailed evaluation of the consequences of introducing exotic species. The only country indicating dissatisfaction with past importations was Australia; in Victoria steps have been taken to eradicate the common carp, *Cyprinus carpio*.

5. FISH CULTURE AND FISH DISEASE CONTROL

(b) Nutrition

Rec. 9th Sess. (Ch. II, p. 99): Governments to initiate and develop studies on pond fish nutrition and forward material to IPFC Secretariat for dissemination.

Relatively little information on this subject was transmitted to the Secretariat. In April 1962 the Secretary (Bangkok) sent members of Panel A a preliminary bibliography on fish nutrition (IPFC/Circ. 62/8) asking for additions to be used in a final document to be submitted to the 10th Session. The response was negligible.

(d) Studies of fish breeding, including genetics

Rec. 9th Sess. (Ch. II, p. 99): Requested results of research on spawning of Chinese

carps and urged similar work on Indian and other carps of commercial importance. Recommended work on selection and improvement of pond fish.

The results of successful experiments on the artificial induction of spawning in Chinese carps through the administration of pituitary gland hormones were communicated to the Council by India; a partial success in this field was achieved in Japan.

(f) Handling and transport of "fish seed"

Rec. 9th Sess. (Ch. II, p. 99): FAO to compile information on the use of anaesthetic and tranquillizers for handling and transport of fish; governments to send FAO such information.

Although FAO has begun such a compilation, time has not permitted its completion. Meanwhile attention was called to an excellent review:

McFarland, W.N. (1960). The use of anaesthetics for the handling and transport of fishes. *Calif. Fish and Game* 46 (4): 407-31.

It may also be noted that none of the Member Governments sent FAO any informa-

tion on this subject in specific response to the recommendation.

(g) Disease and Parasite Control

Rec. 9th Sess. (Ch. II, pp. 99-100): Governments and FAO furnish all relevant information to the 10th Session.

Various information on the subject was included in the reports from the countries and from FAO. FAO has issued a provisional list of workers on fish diseases and is preparing a new one.

(j) Special forms of aquiculture

(i) Rice-field fish culture

Rec. 9th Sess. (Ch. II, p. 100): Fish Culture in Rice Fields Sub-Committee to obtain certain specific information from member countries (See reference above); governments to seek closer co-operation between agencies concerned with rice production and fish propagation and culture.

The Fish Culture in Rice Fields Sub-Committee has not submitted a report.

The reports from the member countries have not reported on what cooperation has been achieved by the relevant agencies.

PART C

SESSIONAL REPORT OF TECHNICAL COMMITTEE I

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INTRODUCTION

The Committee had extensive discussions of its methods of work, of its responsibilities and its past achievements. It noted that at the 9th Session of the Council, 1961, an observation had been made that the Committee's report was not of Committee activities, as such, but rather of activities of individual member countries; much the same kind of observation might be made with regard to the inter-session reports at this (10th) Session. For example, only one of the Committee's Sub-Committees presented a report at this Session. The Committee therefore looked for ways in which its work might be made more effective, and noted that certain indispensable conditions have to be met if it is to be able to be useful to Member Governments, within its terms of reference; these are that there should be:—

- (a) requests from Member Governments for advice on particular matters;
- (b) general information on fisheries in the region and on Governmental programmes;
- (c) sets of data relating to be particular problems on which advice is sought;
- (d) attendance at Council Sessions of research workers engaged on the problems on which advice is sought.

The Committee noted with respect to these conditions that:—

- (a) no requests for advice had been addressed to the Committee;
- (b) although (as noted below in section 1.1) the submission of information with regard to the inter-session period has improved, it is still somewhat "industries", which would provide a general statement, say on "status of the industries", which would provide a general context in which to view particular problems;
- (c) sets of data on which the Committee could work were available for only a few situations;

- (d) certain matters on which Technical Papers and reports were submitted could not be discussed because the countries concerned were not represented on the Committee during this Session.

The Committee is obliged to observe that in this situation its meetings are likely to prove ineffectual. In the Committee's view an important step for it to take is to set priorities among the different matters that might receive its attention and then to make detailed arrangements for effective work on a limited number of principal items at each Session. It proposes two courses of action to serve this purpose.

A. The Committee establishes a Sub-Committee for Stock Assessment which shall, before the 11th Session.

- (a) Compile from information from Member Governments through their normal publications and by special communications, a report on the status of the industries of the region up to the end of the year preceding the year in which the Council Session takes place. This would enable the Technical Committees to obtain an overall view of the situation and to determine the relative importance of different problems, stocks and fisheries, and would provide the basis of setting priorities. Further grouping could be effected by applying the criterion of common interest in particular stocks or problems.

- (b) Select some particular stock, or set of stocks, with respect to which it should at the next Session attempt an assessment. The interested Governments should be invited to furnish detailed sets of data with respect to their exploitation of these stocks, and their research into these stocks,

for examination by the Committee.

- B. The Committee should participate actively in the host country study proposed by the Delegate from the U.S., presented in the report of Plenary Session.

In addition to the foregoing major proposals, the Committee presents various minor suggestions in the body of this report for further increasing the effectiveness of its work.

1. MATTERS RELATING TO CONDUCT OF COMMITTEE AFFAIRS

1.1 Outline for country Inter-Session reports

The Committee noted that the effectiveness of the work that can be done in Technical Committees during each Session of the Council is primarily dependent upon the information made available to the Committees by Member Governments. The Committee noted that the outline for "country reports" developed at the 9th Session has served to bring to the current Session a wider range of information from member countries and that the material was more uniform; the Committee decided to maintain its use of this outline but, from experience gained from working with the material before it, decided to make some changes in the outline. The modified outline is given below; the changes from the original outline are:

- (a) The section on methodology and techniques has been brought forward to second place in the outline;
- (b) A new section, relating to programmes in fishery oceanography and fishery limnology has been introduced;
- (c) Explanations have been given of what the Committee wishes to receive under each heading of the outline.

In addition to the above changes in detail a major change has been made in that the Committee intends that reports made according to the outline below should relate to national activities regardless of whether any such activity might fall within the scope or intention of any proposal made by the Committee. The Committee intends that a separate document should be prepared to report the progress of matters initiated by it; at this Session the Committee has therefore submitted two reports; one describes the response to recommendations made at the 9th Session, the other summarises the reports by Member Governments of their activities, on matters within the Committee's terms of reference, during the inter-session period.

OUTLINE FOR COUNTRY REPORTS ON WORK PROGRAMME TO TECHNICAL COMMITTEE I, IPFC

1. Information Generally, Bibliographies and References Books
 - 1.1 Information—generally
(Report of new institutions, programmes, publications etc., initiated in the period.)
 - 1.2 Bibliographies
 - 1.21 Lists of papers published in the period
 - 1.22 List of bibliographies prepared
 - 1.3 Reference Books
(Compendia of methods (with background theory), manuals, major taxonomic works, etc.)
2. Development of Methodology and Techniques
(This section is for reports on research into theory and method, and of advances made; it is not to be used for reports of the application of these techniques. Naturally, many advances in techniques will emerge from action programmes.)
 - 2.1 Information storage and retrieval
(Reports of arrangements made for storage and retrieval of information, and developments of these techniques.)

- 2.2 Equipment and methods, including standardization and intercalibration
- 2.3 Identification of aquatic organisms
- 2.4 Population studies, age-determination, fish behaviour and related studies
- 2.5 Fishery oceanography and fisheries limnology
- 2.6 Basic production
- 2.7 Other
- 3. Fishery Oceanography and Fishery limnology
(This section is for reports on programmes in these two fields, indicating area being investigated, objects (e.g. current system, plankton, etc.), methods being used, equipment and staff employed, results.)
 - 3.1 Fishery oceanography
 - 3.11 General
 - 3.12 Physical and Dynamical
 - 3.13 Biological
 - 3.2 Fishery limnology
- 4. Aquatic Resources Appraisal
(This section is for reports, on programmes in this field, similar to those for section 3.)
 - 4.1 Country and regional appraisals, reviews or synopses
(Announcement of any completed reports, reviews or synopses is especially desired in addition to reports of projects in progress.)
 - 4.2 Appraisals and surveys of marine areas or of river basins or individual waters, and synopses of such work
(As for 4.1)
 - 4.3 Appraisals or inventories of fish populations and stocks, including reviews or synopses of aquatic forms of economic importance
(As for 4.1)
- 5. Management of Fishery Resources in Natural Water (Including Reservoirs)
 - 5.1 Regulatory measures (legislative) to control fishing operations
(Reports of research carried out with a view to or resulting in the introduction of regulatory measures (e.g. measurement of selectivity, assessment of the effects of regulations), and notification of regulatory measures adopted in the period.)
 - 5.2 Control or alteration of the physical features of the environment
(Reports of research to ascertain the nature and intensity of effects on aquatic resources produced or likely to be produced by human or major natural modifications of the environment, and to devise measures to combat or take advantage of such changes; and reports of measures adopted.)
 - 5.3 Control or alteration of the chemical features of the environment
(Reports as for 5.2)
 - 5.31 Water pollution control
 - 5.32 Use of fertilizers
 - 5.4 Control or alteration of biological features of the environment
(Reports as for 5.2)
 - 5.5 Stocking
(Reports of research with respect to species being or to be stocked and to the habitat into which stocking is to be made, and of programmes of stocking especially to give an idea of the success of the operations.)
 - 5.51 Maintenance stocking and transplantation
 - 5.52 Introduction of non-indigenous species
- 6. Fish Culture and Fish Disease Control
 - 6.1 Fish culture, general: (A general report to convey some idea of the current status of fish culture operations.)
 - 6.2 Fish nutrition
 - 6.3 Pond fertilization
 - 6.4 Fish breeding, including genetics
 - 6.5 Aquatic weed control
 - 6.6 Handling and transport of "fish seed"
 - 6.7 Disease and parasite control
 - 6.8 Use of non-indigenous species
 - 6.9 Economics of fish-culture
 - 6.10 Special forms of aquaculture
- 7. Miscellaneous Activities, often short term

1.2 Arrangements for the Committee's Inter-Session work

It is agreed that the summary report on inter-session work (based upon the individual country reports submitted to the Technical Secretary by Member Governments) will be prepared by the Technical Secretary prior to the Session and submitted in draft to the Committee. The report may, of course, be modified (in the form of additions or deletions) by the Committee, but, should not be revised in an editorial sense by the Committee as a whole. (Should editorial review be necessary, it should be accomplished by a small *ad hoc* group working directly with the Technical Secretary in order to save the time of the Committee).

The energies of the Committee as a whole, with respect to the inter-session report, should be devoted to an assessment of the significance of the work reported and their conclusions should be incorporated into the inter-session report.

2. WORK PROGRAMME

In this section to Committee reports the results of its discussions with respect to matters within in its terms of reference. The discussions were based upon:—

- (a) recommendations made at the 9th Session of the Council and reports of action taken by Member Governments of FAO in implementation of those recommendations. (see Part B, pp. 36-44)
- (b) information on Member Government activities in these fields as contained in their inter-session reports; this information is summarized in Part A (pp. 23-36), and the Government's detailed reports appear as Annex I, pp. 57-131.
- (c) Technical and Contributed papers presented at the Session;
- (d) various incidental documents, including a statement made by the

UNESCO Observer (IPFC/C62/WP 29), copies of resolutions adopted by the Intergovernmental Oceanographic Commission (IOC) at its meeting in Paris, September 1962, and the resolutions of the FAO World Scientific Meeting on the Biology of Tunas and Related Species, La Jolla, 1962.

2.1 Information generally, bibliographies and reference books

The Committee noted with satisfaction that FAO had prepared lists of workers in specialist fields and, especially, that the manuscript of the Manual on Sampling had been completed and forwarded to FAO Headquarters for reproduction. The Committee also learned with interest that the Manual "Introduction to Fisheries Science", of which a draft had been circulated after the 9th Session, is now being revised and attached importance to its completions at the earliest opportunity.

The Committee requested individuals and institutions who prepare specialist bibliographies to communicate these to FAO for dissemination as prepared or for incorporation in larger bibliographies.

The special request was made that FAO prepare bibliographies on the genetics of fish and the induction of spawning in fish.

Attention was drawn, by several members of the Committee, to some deficiencies in the arrangements for distribution of technical documents from FAO and the IPFC Secretariat. The Committee requested FAO to examine the possibility of improving the situation so that institutions in the area might receive documents directly and with minimum delay.

2.2 Development of methodology and techniques

2.21 Information storage and retrieval

The Committee noted that FAO continued to develop the "Current Bibliography for Aquatic Sciences and Fisheries", and

especially that the bibliography has been made the basis of some extensive indexing work at the Aquatic Sciences Retrieval Center, University of Rhode Island. The Committee recommended that Member Countries should assist the CBASF programme by ensuring the attention of its annotators was drawn to all fishery papers published in their countries.

The Committee also requested FAO to enquire of the Aquatic Sciences Retrieval Center whether it would be able to prepare, for use of the Committee, a biennial list (with detailed indexes) of literature relating to the Indo-Pacific region, within the subject fields with which the Committee is concerned.

2.22 Equipment and Methods, including standardization (and intercalibration)

The importance of this matter, as a means of ensuring the interchangeability of research results, was recognized by the Committee. The Committee learned of the steps being taken, as part of the International Indian Ocean Expedition (IIOE) to use a standard Indian ocean zooplankton net with which other zooplankton nets might be calibrated. A paper describing the "ICES Mesh Gauge"—adopted for research purposes by the International Council for the Exploration of the Sea (ICES) and the International Commission for Northwest Atlantic Fisheries (ICNAF)—was received and the attention of Member Governments were drawn to the value of this instrument.

A Korean method of automatic tagging of fish was described. Drift cards used by the U.S. Bureau of Commercial Fisheries, Honolulu Biological Laboratory, were described and an example was displayed; the practice of sending those who return tags a chart showing the presumptive path taken by the card was noted with approval.

2.23 Identification of aquatic organisms

The Committee learned with satisfaction of the steps already taken for the establishment, by the Government of India and

UNESCO, of the Biological Centre at Cochin as part of the IIOE. The Observer from an account UNESCO gave of the programmes with regard to taxonomy of aquatic organisms being developed in this region by the SEASCO; this programme will include a training Centre, at Bangkok in November 1962 (chiefly to identify problems in this field of work), assistance to national institutions in the establishment of national collections and in mutual use of such collections, and various publications; the Committee expressed interest in this programme, especially in the plan to promote the preparation and publication of a series of plankton identification sheets.

Note was taken by the Committee of Resolution 2 of the World Scientific Meeting on the Biology of Tunas and Related Species, 1962, relating to identification of tuna populations by blood-typing techniques. The Delegate from the United States pointed out that opportunities for training in these techniques could be provided at the Honolulu Biological Laboratory.

2.24 Population studies

Considerable advances have been made in recent years in methods of studying and assessing fish populations; as a result it is now possible to obtain preliminary estimates of population characteristics (e. g. fishing mortality rate) with relatively few data and such estimates at least serve to guide the conduct of more detailed research; these estimates can also serve as a preliminary guide for management action. The Committee considered that it should draw the attention of Member Governments to these developments and to the advantages to be gained from use of these methods.

The Committee noted the continuation of the work on tuna behaviour being carried out with FRV CHARLESH. GILBERT which is now provided with underwater ports. Since a deeper analysis of fish behaviour is likely to be quite critical to development of certain

types of fishing and fishery management, the continuation of such research is considered by the Committee to be important.

2.3 Fishery oceanography and Fishery limnology

2.31 Fishery oceanography

The Committee noted that fishery oceanography is concerned with three aspects of fishery research: the containment of fish stocks in the oceanic current structure, the migration of fish in the ocean and the analysis of marine populations. This statement does not mean that fishery oceanography includes those studies of fish population normally recognized as constituting fishery biology; it means that fishery oceanography provides oceanographic data required for such studies.

Marine fishes live in the ocean (and not in a vacuum) and certain features of the ocean have important effects on the abundance and distribution of these fishes. Since the abundance and distribution of commercially important fishes are of basic importance to the fisheries, it follows that fishery workers are interested in the ocean. In this context, two questions may be considered: (1) Are there practical examples of the application of oceanographic studies to fisheries? (2) If oceanographic studies are important to fisheries, how can such studies best be encouraged so that the results are readily available in useful form to the fishery workers?

Two examples of the application of oceanographic studies to fisheries may be cited from work in the Central Pacific. The skipjack fishery in the Hawaiian Islands is seasonal, with the bulk of the catch being made in the summer months. The annual landings have varied by a factor of about 2.5. The variations in landings are such that they could not seasonably be attributed to the effects of the fishery. Studies of the oceanography of the region have shown the existence, as might be expected, of an annual cycle in this ocean climate. The climatic cycle varies from year to year, just as it does on land. The entrance of the skipjack into

the area is related to variations in the annual cycle of ocean climate. On the basis of this knowledge, it has been possible to predict the general magnitude of the catch at least three months in advance of the season. This information has been useful to the fishing industry in planning operations.

In the Equatorial region, oceanographic surveys have been used in an exploratory sense, to describe the current systems, particularly with respect to the location of areas of enrichment. As a result of the oceanographic studies, it has been possible to plan more intelligently exploratory fishing cruises leading to the discovery of tuna fishing grounds. Numerous other examples could be cited.

Given, then, the importance of oceanographic studies to fishery work, how can this best be encouraged? The answer to this problem lies in providing a working situation such that communication between the oceanographer and the fishery biologist is facilitated. Communications, in this sense, include not only the simple exchange of data, but also sympathetic understanding of each others needs and interests and the opportunity for mutual intellectual stimulation. There is no one magic formula for achieving this desired state, and examples of several different approaches received attention from the Committee. For example, CSIRO (Australia) has appointed an officer, primarily with oceanographic training, whose task it is to act as a link or co-ordinator between oceanography and fishery biology. The Honolulu Laboratory (ex-POFI) of the United States has used a different approach in which fishery problems are conceived as broad ecological problems which are attacked by fishery biologists and oceanographers working together on a single, broad problem.

There are undoubtedly other approaches. The important task is to achieve the desired co-operation, without too much concern for the particular method employed or the terms used.

In the light of the above discussion, and in view of information relating to IOC and its Indian Ocean project, submitted to the Committee by various members of the Committee, the Director of the FAO Fisheries Division, and the Observer for UNESCO, the Committee decided that it should make arrangements for active work, in the field of fishery oceanography, and that this work would be of a kind and magnitude to require the establishment of a Sub-Committee.

Technical Committee I therefore resolved that:

Being aware of the importance of fishery oceanography in the study of fishery problems and,

Recognizing the relative lack of fishery oceanography in the IPFC region, and

Further realizing the importance of closer communication between fishery workers and those engaged in general oceanographic studies,

There shall be appointed a Sub-Committee on Fishery Oceanography which shall function as follows:*

(A) The Sub-Committee shall facilitate the growth of fishery oceanography in the IPFC region by:

- (a) pointing out to Member Governments the assistance in the solution of fishery problems that has resulted from studies in fishery oceanography;
- (b) encouraging the participation of Member Governments in oceanographic expeditions;
- (c) soliciting information from, and making suggestions to Member Governments concerning particular oceanographic observations which would be of value to the fishery programmes of the Member Governments; and

(d) facilitating the exchange of oceanographic information between Member Governments.

(B) The Sub-Committee shall advise the Council in its relations with FAO, IOC and/or any other international, national, or private institution, in order that:

- (a) Member Governments are kept informed in detail of oceanographic expeditions in the IPFC region which are of interest to fishery biologists;
- (b) fishery biologists are afforded opportunities of participating in the planning of oceanographic expeditions so that maximum benefits will be achieved in relation to fishery problems; and
- (c) fishery biologists are afforded opportunities to participate in such expeditions, so that ancillary observations of fishery significance may be made.

(C) The Sub-Committee, through the Executive Committee, shall facilitate the training of fishery oceanographers, particularly with respect to:

- (a) arranging their participation in oceanographic expeditions for the purpose of gaining experience in field methods; and
- (b) arranging their participation in the analysis of data for the purpose of gaining experience in analytical and interpretative methods;
- (c) informing Member Governments of training courses, seminars and symposia in marine sciences, which may be held in the IPFC Region.

* Formal Communications from the IPFC, its Technical Committees and Sub-Committees to Member Governments and U.N. Specialized Agencies are effected by the Secretary of the Council on the instructions of the Executive Committee. *Sec.*

(D) The Sub-Committee shall keep the Secretary fully informed so that he may facilitate the availability of oceanographic data to Member Governments by:

- (a) acquainting Member Governments with the facilities of existing data centres; and
- (b) encouraging Member Governments to deposit copies of their oceanographic data in the data centres.

The Committee considered that this Sub-Committee should be composed of representatives from Australia, France, India, Japan, Korea, the Philippines and the U.S.A., and requested the Secretary to communicate with the Governments of those countries, asking them to agree to representation on the Sub-Committee and to nominate a research worker; the Secretary was also requested to inform other Member Governments of the establishment of this Sub-Committee to which they could nominate representatives if they wished.

The Committee noted that proposals for research on the Kuroshio set out in the IOC Resolution No. 12 and, in deciding to give support to these proposals, agreed to submit a resolution on the matter for special consideration by the Council in Plenary Meeting.

2.32 Fishery limnology

Inland waters, both natural and artificial, contribute an important part to the fish production of several member countries of the IPFC, and are likely to become an increasingly important source of fish in the future. It is recognized that the production of fish from inland waters could be greatly increased, but is often hampered by a lack of knowledge of the basic limnological problems in the waters concerned. The Committee would therefore urge Member Governments to give greater recognition to the importance of limnological research to inland fisheries

and fish pond culture; in particular it would urge governments to give full support to those institutions carrying out research in limnology.

Further, in many countries the number of dams for irrigation, the production of hydroelectric power and other purposes is increasing, and the creation of such dams and their impoundments may bring about various fishery problems. The Committee stressed the importance of conducting detailed fishery limnological surveys of inland waters well in advance of such projected construction so as to provide the information required to achieve the maximum protection and development of the living aquatic resources.

2.4 Aquatic resources appraisal

The Committee noted that its work with respect to problems under this heading could be of considerable interest to Member Governments, most of whom maintain programmes to evaluate resources for the purposes of planning development, or to assess resources with a view to determining whether management measures should be adopted or existing measures modified.

2.41 Country and regional appraisals, reviews or synopses

The Delegate from the US made a proposal with regard to a special study, during each Council Session, of the problems of the host country; such a study would include some appraisal of the resources. The Committee agreed that this proposal, whose adoption would affect the work of both Technical Committees, should be submitted to the Council in Plenary Meeting.

2.42 Appraisals and surveys of marine areas or of river basins or individual waters, and synopses of such work

The Delegate from Korea drew attention to the special problems of the resources of coastal waters. These resources are subject to intense exploitation as a consequence

of concentration of populations in coastal areas, and as a result they are liable to excessive fishing. The Committee agreed to draw the attention of Member Governments to this matter and to recommend that more intensive research be carried out on these resources.

2.43 Appraisals or inventories of fish populations and stocks

(i) *Rastrelliger*: The Committee took note of the extensive work carried out with respect to this group in previous years and of the fact that as a result an FAO Training Centre had been conducted in Thailand in 1958 and certain lines of co-operative work had been initiated. From the information received at this Session the Committee considered that the conduct of a second training centre could have a marked effect in promoting continued development of work on this group and recommended that active steps be taken to give effect to the decision to hold the Centre. The Committee's view was that the training would be most effective if it were concentrated on the techniques of collecting, compiling and using catch and effort statistics. The Committee received one set of length measurement data (from Malaya) and learned that sets had been sent from Thailand and Ceylon; it urged member countries to continue this programme, and requested the Secretary to compile the submitted sets of data for distribution.

(ii) *Chanos*: The Committee took note of the resolution relating to research on *Chanos* adopted at the 10th Pacific Science Congress, Honolulu, 1961, and supported by the Fisheries Technical Committee of the South Pacific Commission at its meeting in Noumea in February 1962.

Questions concerning *Chanos* have been before the Council since its inception, and indeed one of the Council's Special Publications is devoted to a description of *Chanos* culture; thus, the Committee is aware of the importance of the *Chanos* industry in this

region and of problems besetting the industry, notably that of procuring sufficient fry.

Moreover the Committee recognizes that some economy of research effort and some acceleration of results could be obtained by an international approach to this problem. The Pacific Science Congress has recommended research on *Chanos* in its marine environment and the Committee could not deny that there might be long-range benefits to be obtained from the proposed study of *Chanos* in its marine environment.

However, the Committee drew attention to the fact that there might be several other ways in which the same end-point—namely increasing the quantity of fry available and ensuring a more constant supply—might be attained.

For example, the necessity of increasing the supply of fry for stocking might be offset considerably by reducing fry mortality through greater care in and development of new techniques in the collection, handling, transportation, stocking and early care of fry in the ponds. The Committee also drew particular attention to the importance of research on *Chanos* in confined waters especially with a view to the artificial induction of spawning; the Committee held the view that the latter type of research was more important than the former, and likely to lead more speedily to practical results, probably of greater economic value, than the former. Moreover, research of the latter kind could probably be arranged by special grants to research workers at existing institutions rather than by setting up a special group. The Committee could not endorse the Pacific Science Congress resolution but requested the Secretary to consult Member Governments as to their views on the desirability of endeavoring to bring about establishment of the proposed research group, and on the relative importance to be attached to research on *Chanos* in the marine environment and research on the species in confined

waters. The Committee requested the Secretary to render assistance to Member Governments in any action that might be called for as a result of this consultation.

(iii) **Shrimps and prawns:** The Committee had before it a useful Technical Paper summarising biological and other information relating to prawns in India. It was informed of a suggestion that the third of the FAO World Meetings on groups of aquatic organisms might be devoted to shrimps and prawns, and it recalled that the Council had held a prawn symposium in 1955. The Committee recognised that the importance of shrimp fisheries had greatly increased in recent years and was continuing to grow; the problems concerning these fisheries include appraisal of various unexploited or partially exploited stocks, a need for experimental work on mid-water stocks, and a need to develop the culture of prawns. The Committee therefore concluded that conduct of a symposium on prawns and shrimps within the next few years would be useful, that the symposium should be held during the 1964-65 period or, better still, in 1966; that the symposium should deal with both wild stocks and the culture of prawns and shrimps; that it would be appropriate to hold the symposium in the Indo-Pacific area but that it should not be held in association with any other major meeting, such as those of the Pacific Science Congress of the IPFC.

The Committee drew attention to the importance of other economically valuable crustacea, such as marine crayfish, lobsters and crabs, but recommended against including these in the symposium on shrimps and prawns.

(iv) **Molluscs:** The Committee drew attention to the suggestion made at the 9th Session that Member Governments should furnish information on the present status of pearl oyster fisheries.

(v) **Tunas:** The Committee took note of the resolutions adopted at the FAO World Scientific Meeting on the Biology of Tunas

and Related Species, La Jolla, 1962, and recorded its endorsement of these resolutions, more especially those of relevance to the Indo-Pacific region: Nos. 2, 3, 5, 6, 10, 11, 12, 17, and 19.

(vi) **Reef fisheries:** Attention was drawn to the discussion at the meeting in February 1962 of the Fisheries Technical Committee of the South Pacific Commission, on the importance of reef fisheries; the SPC Committee had recommended establishment of a special institute to carry out research into the biology and exploitation of stocks of reef organisms of economic importance. The Committee endorsed this resolution. This support was given not only because of the general distribution and their importance of these resources to local populations, but because of their susceptibility to exploitation.

(vii) **Demersal stock:** The Committee had before it, as a Contributed Publication by K. Tiews, an account of investigations of demersal stocks in the Gulf of Thailand (IPFC/C62/CP12). The Committee was impressed with the quality of the work done, the practical approach displayed, and the importance of this report, because of the demonstration it gives of the results to be got from this kind of research, and of the possible relevance of its methods and results to many similar areas throughout the region. The Committee recalled similar prospecting work on tropical demersal stocks out in the seas off India, Ceylon, Malaya, Indonesia, and the Philippines, and that some general review of such work had been presented in earlier papers published by the Council. The Committee noted that two aspects required consideration; first, that of prospection and management appraisal; second, that of assessment and management. The Committee recommended that contact be maintained between workers engaged in this field and that the Secretary take steps to promote active collaboration between Governments in the exchange of information and, in some cases the preparation of fishery maps. In addition, the Committee drew attention to

the importance of collecting catch and effort statistics from fishing operations bearing on these stocks and pointed out that such statistics were of very great value when drawn from a situation in which there is a significant change in the level of fishing; this is the case of the Thai fishery and the Committee recommended to the Thai Government that every effort be made to obtain these statistics since they would enable the Thai workers to refine and carry further the estimates made by Dr. Tiews of the potential productivity of these grounds.

2.5 Management of fishery resources in natural waters (including reservoirs)

The Committee noted that the furnishing of advice to Member Governments as to regulatory measures, to the control of physical, chemical and biological features of the environment, and to stocking of natural waters, is a major responsibility of various fishery councils and commissions throughout the world. However, for the Committee to be effective in this field it must have before it both requests from Governments for advice (while not being limited to dealing with such requests) and detailed information. (At this Session the Committee had to consider only the question of importation of non-indigenous species and their release into natural waters.)

In the discussion of how the Committee would operate in the event a specific problem were to be referred by a Member Government, the following was suggested: Two general types of problems (along with the data necessary to the examination of the problem) might be presented. The first of these is the case where the yield of a fishery has declined. The data in this case would be examined (1) to determine if the decline could be attributed to the fishery and, if so, what recommendation could be made as to measures to achieve the desired goal (such as maximum sustained yield), or (2) to determine if the decline could be attributed to natural causes and, if so, how these natural causes might be accommodated. These two

approaches might be undertaken consecutively or concurrently. The second general case is that in which the yield of a fishery is increasing and advice is requested concerning the level at which the maximum sustained yield (or other desired goal) would be reached.

Introduction of non-indigenous species: The Committee had a protracted discussion of this problem, which can be seen as having two principal aspects: first, the problem of deciding whether introduction of a non-indigenous species will lead to benefits or damage; second, the problem of whether control of importations should be exercised. The Committee recognized that introduction of non-indigenous species had been harmful to indigenous fauna in some cases and that it sometimes led to neglect of experimental work to make use of indigenous species. On the other hand, in some cases the importation of tried species led to immediate increase of production, and such increase could not be forgone in the hope that work on indigenous species could be used for the same purpose. In balance, the Committee concluded that the situation was one requiring that action should be taken to help Member Governments reach a decision on particular cases brought to their attention. The Committee therefore endorsed the resolution adopted by the Fisheries Technical Committee of the South Pacific Commission (1962) requesting FAO to compile a register of information on importations made and the consequences of them. In addition the Committee noted that research workers engaged in fish breeding and the study of fish genetics would be assisted if they could obtain information on the origin and genetic status of stocks of imported species. It therefore requested FAO to examine the possibility of establishing a "genetic register" of stocks of at least a selected range of important species imported into various countries.

2.6 Fish culture and fish disease control

2.61 Disease and parasite control

The Committee took note of the resolu-

tion on this matter adopted at the 6th FAO Regional Conference for Asia and the Far East, 1962, and expressed its appreciation of the proposal to secure the co-operation of UNESCO in the conduct of research into fish diseases and parasites. The Committee recommended to Member Governments that they report occurrences of these diseases and parasites to FAO (through the Council Secretary) for transmission to those who engage in this research, and, while supporting the Regional Conference resolution, would urge that such studies of fish diseases and parasites as shall be carried out should be directed not only to those diseases and parasites which are harmful to the fish themselves, but also to those diseases and parasites of which fish are vectors and which might be transmitted to and be harmful to human beings and animals of economic or domestic importance.

2.62 Fish culture in rice fields

This matter has received considerable attention from the Council in the past and was the subject of a symposium at the 7th Session 1957. The Committee was aware that opinions differ as to the economic value of this practice and was unable to reach a conclusion whether further research into it was

required. In the Committee's view the situation required a careful review of the literature on the subject and a field examination of current practices. The Committee therefore recommended to the Director-General of FAO that he appoint a consultant full-time (probably for one year) to make a thorough review of literature on this subject and to visit the countries, where this practice is followed, in order to make first hand assessment of the value of the practice and to identify the problems relating to it. The enquiries of the consultant should seek to obtain, from Member Governments, reliable information on the proportion of rice cultivated areas on which fish also is cultivated, as well as on the economics of this practice. The Committee recommends that the Consultant should prepare a detailed report of his studies and that this report be distributed at the earliest opportunity. If the Director-General should find himself unable to act on this suggestion during 1963, the Committee requests the Secretary to request Member Governments to furnish, through completion of a suitable questionnaire, information of the kind that would have been sought by a consultant, and to compile and distribute the information supplied.

ANNEX I

REPORTS OF MEMBER COUNTRIES, IPFC, FOR THE INTER-SESSION
PERIOD, 1961-62

Australia
Ceylon
India
Japan
Federation of Malaya
Pakistan

Republic of the Philippines
Thailand
United Kingdom (Sarawak)
United States of America
Vietnam

The numbering system for the major groupings adheres to that in the standard outline adopted at the 9th Session, 1961, of IPFC, for reporting on the work programme and major fields of activity of Technical Committee I.

Any omissions from the outline represent fields for which no major activity was reported.

AUSTRALIA

1. INFORMATIONAL SERVICES,
BIBLIOGRAPHIES, REFERENCE BOOKS

(b) Bibliographies

- (i) Australia collaborates with FAO in preparing the Current Bibliography for Aquatic Sciences and Fisheries.
- (ii) The following publications are listed by C.S.I.R.O. Division of Fisheries and Oceanography in their Annual Reports.

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(c) Reference Books

A "Fishery Field Officers' Handbook", dealing largely with the techniques to be employed by field officers in field work for resources research, has been published. The "Manual of Fisheries Science", circulated in draft form after the 9th Session of the Council, is being revised for publication by FAO. A "Manual of Fisheries Biology" is in course of preparation.

2. AQUATIC RESOURCES APPRAISAL

(a) Country and regional appraisals, reviews or synopses

Two committees have been established to promote and co-ordinate research on the fishery resources of marine areas around Australia; one is responsible for the pelagic resources in the south-east corner of Australia, the other for those of the south-west corner.

(b) Appraisals, surveys or synopses of individual waters (inland)

Studies are being made of particular bodies of inland water in Victoria and New South Wales; these include Lake Eucumbene, a recently established artificial lake in NSW., and Gippsland Lakes and Western Port in Victoria.

(c) Appraisals or inventories of fish populations

Work is proceeding at present on the stocks of: Southern Bluefin tuna, Australian salmon, humpback whale, southern crayfish, western crayfish, prawns in Shrak Bay Area, yellow-eye mullet, King George whiting, black bream, river perch, snapper, golden perch, scallops, and oysters. A detailed study of trout populations in Tasmania has been terminated and the final results are being written up.

(d) Reviews or synopses of aquatic forms of economic importance

A synopsis for *Mugil cephalus* has been drafted (copy will be tabled) and is now being revised preparatory to publication in the format established for this series by FAO; a synopsis has been prepared for sperm whales and is being submitted to the Biology Branch of the Fisheries Division of FAO. Rough drafts have been made of synopses for other species, and synopses for other species will be prepared as part of other programmes. Australia will participate actively as a member of the Synopsis Association proposed by the Biology Branch.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton populations

Australia has participated in the work of SCOR in connection with standardization of methods of measuring primary production and of collecting zooplankton.

(b) Identification of aquatic organisms

A "Handbook of New Guinea Fishes" is now near completion in MS form. It will go to publication within the immediate future.

(c) Population dynamics, age determination, fish behaviour, and related studies

A study group has been receiving training in population research methods: a special two-week course on population research methods under the direction of Mr. J.A. Gulland of Lowestoft, will take place at Cronulla from October 29 to November 9, 1962. New equipment has been developed for treating scales for reading. Arrangements are being planned and set in operation for intensive sampling of commercial catches and sampling natural populations of Southern bluefin tuna, Australian salmon, Southern crayfish, and Western crayfish.

(d) Oceanography

The Australian programme in oceanography has continued and, with the availability of two naval frigates, has been extended into the Indian and Pacific Oceans. A fisheries oceanographer has been appointed and has concentrated his attention on the problems of the tuna fishery.

(e) Study of basic productivity

Studies have continued.*

(f) Aquatic ecology

Studies of benthos and marine fouling have continued.*

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(b) Control or alteration of the physical features of the environment

River basin development. A large scheme for impoundment of natural waters in the Snowy Mountains region is in progress; se-

veral large bodies have already been established.

(c) Control or alteration of the chemical features of the environment

A water pollution control committee has been set up in NSW; other States maintain a watch over this problem.

Some work has been done with respect to the use of fertilizers to increase fish production.

(e) Stocking**(i) Maintenance stocking and transplantation**

A broadly based programme of research on indigenous species of fish has been initiated at the Research Station, Narrandera, to discovering the general biology of these species, with special reference to reproduction so that if this work should indicate ways in which the reproduction and recruitment of the stocks of these species could be enhanced, programmes would be initiated along the indicated lines. Similarly, if the research programme should indicate ways in which growth could be improved, or natural mortality reduced, action programmes along the indicated lines would be initiated.

(ii) Introduction of non-indigenous species

An advisory committee has been appointed to review importations of aquarium species into Australia and to advise on the species whose importation should be permitted. The Committee has prepared a list which classifies species according to whether their importation should be permitted or not. This Committee will continue to review species nominated for importation. A second committee has been appointed to perform the same task with regard to sport and food fish, but has made little progress. The Victorian Government has taken strong powers to control the release of food and sport fish into inland waters of Victoria; these powers in-

* For further detail see Annual Reports of C.S.I.R.O. Division of Fisheries and Oceanography.

clude a power to take steps to eradicate any undesirable species which may have been introduced and this power has been applied against the common carp, *Cyprinus carpio*.

5. FISH CULTURE AND FISH DISEASE CONTROL

The intensive programme with respect

to indigenous species, discussed above under 4 (e) i, will also deal with the use of these species in small impounded bodies of water, such as farm ponds.

Much work on the culture of trout is carried out at Snob's Creek in Victoria. Salmon is imported as ova into Victoria.

CEYLON

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

(b) Bibliographies

A "Bibliography of the Pearl Oyster" compiled by Mr. S. Sivalingam is now in press.

(c) Reference books

A "Guide to the Fresh-water Fauna of Ceylon" by Mr. S. Mendis and Dr. C.H. Fernando is now in press. This illustrated guide includes descriptions, records of occurrence, ecological notes and keys.

2. AQUATIC RESOURCES APPRAISAL

(b) Appraisals, surveys or synopses of marine areas or of river basin (inland) or individual waters (inland)

(i) A fisheries and limnological survey of a score of irrigation reservoirs in Ceylon was carried out early in 1962. Results are now being prepared for publication.

(ii) Ceylon's coastal waters were surveyed for lobsters.

(c) Appraisals or inventories of fish populations

(i) In the course of the lobster survey mentioned above a study was made of the effect of continuous fishing on the lobster population of a restricted area off the South-west Coast.

Results (embodied in a paper entitled "Spiny Lobsters of Ceylon" now in press) indicate that a lobster fishery could be maintained successfully.

(ii) The regular biennial surveys of Ceylon pearl oyster beds continued. They indicated that a fishery could be held in 1961 but did not indicate any likelihood of another fishery in the near future. (A fishery was indeed held in 1961, but it was not profitable mainly as a result of the artificial depression of the market by buyers).

(iii) Work is now under way to determine whether prawn grounds off the North-east Coast of the island will sustain a commercial trawl fishery.

(d) Reviews or synopses of aquatic forms of economic importance

(i) Mackerels

Studies of the taxonomy, length, sex, maturity, stomach contents, and parasites of the Indian mackerel, *Rastrelliger*, in beach-seine catches continued.

(ii) Prawns and Shrimps

See section 2(c) (iii) above.

(iii) Mollusks

See section 1 (b), and 2 (c) (ii) above.

(iv) Marine algae

See section 3 (b) (ii) below.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECT RELATING TO FISHERIES

(b) Identification of aquatic organisms

(i) The species of spiny lobster (*Panulirus*) found in our coastal waters have been identified, the work being included in the

paper "Spiny Lobster of Ceylon" already referred to in section 2 (c).

(ii) Taxonomic studies on polychaete worms and on seaweeds have also been carried out (..... Seaweeds of Ceylon by Dr. Durairatnam, 1961; T.G. Pillai, 1961.

(e) Study of basic productivity

(f) Aquatic ecology

During the survey of 21 reservoirs referred to in section 2(b) an attempt was made to collect data for an assessment of the planktonic, benthic and fish productivity of these waters.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(e) Stocking

(i) Fingerlings of the gouramy, *Ospornemus gourami*, (13,200) and common carp, *Cyprinus carpio*, (36,900) bred in the hatcheries of the Fisheries Department were stocked, mainly in the major irrigation reservoirs.

(ii) No new non-indigenous species have been introduced during the inter-session period, 1961-62.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish culture—general

(i) Freshwater fish culture continues to be carried out in the Fisheries Department's

ponds for the production of gouramy and carp for stocking purposes.

Attempts were made to make the Department's brackishwater fish farm a going concern; much alteration in the structure of the ponds was undertaken.

(ii) The following paper by the Superintendent of Brackishwater Fisheries, written as a result of his studies under an FAO fellowship was issued as:

Pillai, T. Gottfried (1962)

Fish farming methods in the Philippines, Indonesia and Hong Kong. *FAO Fish, Biol, Tech, Pap.*, (18): 68 p.

(h) Studies of non-indigenous fishes (See also under section 4 (e))

A stock of *Catla catla*, an Indian river carp, is being reared in the Department's hatchery for an attempt at induced breeding.

(i) Economics of fish culture

Experiments are now under way to assess the economics of the production carp fingerlings in the Fisheries Department's hatcheries at Polernaruwa.

(j) Special forms of aquaculture

Preliminary experiments on the culture of *Chanos chanos* in brackishwater ponds with green and blue-green algae as food have proved successful. It is expected that a first harvest of fish will be gathered from one of the ponds in the Fisheries Department's experimental Fish Farm in September 1962. The pond area is now being extended.

INDIA

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS (Covered in other sections)

2. AQUATIC RESOURCES APPRAISAL (Sections (a)-(c) covered in other sections)

(d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

Studies on various aspects of the biology of and fishery for *Euthynnus affinis affinis*, *Auxis thazard*, *Kishinoella tonggol*, *Katsuwonus*

pelamis and *Neothunnus macropterus* in the Indian seas, are being conducted by the Central Marine Fisheries Research Institute. Particular emphasis is laid on studies on fecundity, food habits, size composition in the commercial catches and fluctuations in abundance. Observations on the bionomics of various species of fish used as live bait for tuna are also in progress at the Institute. Detailed catch statistics pertaining to all the tunas mentioned are also being collected regularly.

(ii) Mackerels

Detailed investigations on the fishery biology of *Rastrelliger canagurta* from the Indian seas are being conducted at the Central Marine Fisheries Research Institute. Collection of catch statistics and biological data pertaining to the species was continued. Observations on the relation between fluctuations in the availability of the mackerel in the fishery and changes in the environment were made. Studies on the food habits and breeding biology of the species were continued. A considerable decline in availability of mackerel at all fishery centres was observed during the period. Results of a cruise in the Arabian sea off Mangalore—Calicut area showed that traces of mackerel shoals were available only up to a depth of 20 meters.

(iii) Sardines

Biological investigations on *Sardinella fimbriata* and observations on the fluctuations in its abundance in the commercial fishery have been kept in progress. The studies included observations on food habits, sex ratio of the spawners, their fecundity and stock movement in the inshore areas. Echo surveys indicated that sardine shoals are available only up to a depth of 25 meters. Detailed information on the exploitation of the fish and size composition in the fishery was also collected. Studies on the age and growth of the sardine which are in progress have indicated the usefulness of scales in aging of the fish.

(iv) *Hilsa*

General Account

Important investigations on various aspects of the fishery and biology of the species were in progress at the Central Inland Fisheries Research Institute. Collection of statistics with a view to estimate total landings, catch per unit of effort and size structure of the catches in various important river systems of the country was continued.

A late monsoon and sporadic winter fishery characterised the *Hilsa* fishery in the Ganga—Padma—Hooghly river system during the period. The winter fishery for the species, in the coastal waters, yielded large catches off the Hooghly estuarine mouth although the fishery in the estuary was comparatively poor. The bulk of the commercial catches of *Hilsa* in the Hooghly monsoon fishery and Padma fishery was comprised of III and IV year groups. The monsoon fishery in the Godavari was comprised of IV and V age groups whereas the winter fishery in the same river depended mainly on the III year group.

Studies on the food habits indicated that the fish feeds mainly on plant matter and crustaceans. Studies on the fecundity of the fish from various river systems are in progress.

Spawning: Investigation in the Hooghly estuary indicated that there are two main spawning grounds of the species, both in the freshwater zone of (i) the main Hooghly and (ii) the Rupnarain. The spawning season in both these areas extends from June to November every year with peaks during August and October. In the Godavari river, fish in advanced stages of maturity were observed during the months July to December, indicating that the fish spawns during that period. In the Narmada and the Tapti rivers also, *Hilsa* has been observed to breed in the freshwater zones of the estuary during the monsoons (July-September). In the main Ganga observations indicate that *Hilsa* spawns

in the entire stretch of the river between Rajmahal and Lalgola during monsoon. Further observations in the stretch of the river Ganga above Rajmahal are in progress.

Tagging: Tagging experiments were conducted mainly in the Ganga, in the neighbourhood of the Farakka Barrage site, during the period. So far 4.1 percent of the total number tagged have been recovered, all of them from points downstream from their point of release.

Recoveries of fish, tagged in the Ganga, from the Padma estuary in East Pakistan indicate that the Ganga stock returns to the sea (after spawning) through that estuary. Barring one instance no fish released in the Ganga was captured in the Hooghly estuary (another estuary of Ganga). None of the 3,720 fish tagged and released in the Hooghly has been recaptured in the Ganga, indicating probably, that there is very little intermingling of the Hooghly and Padma—Ganga Hilsa.

Special Report (for Hilsa Sub-Committee) on Hilsa Fisheries Investigations in India during the Period 1961-62

Catch statistics

The collection of catch statistics of *Hilsa* was continued in selected areas during the period under report, but it has not yet been possible to achieve all-India coverage in this respect. The analysis of data collected showed that there was a slight revival in the fishery in most areas during the year, even though increased landings were mostly localised. In the Ganga the catches showed considerable reduction. The available comparative data are given below:

Source	Catches in metric tons	
	1960-61	1961-62
River Hooghly	634.16	1,028.70
River Padma	685.20	1,185.33
River Ganga	200.10	70.00
River Godavari	635.30	—

Catch-per-unit effort data for selected areas have been collected and attempts are being made to standardise the fishing effort for purpose of comparison.

Hilsa investigations in relation to Farakka Barrage

Investigations were conducted during the period to assess the probable effect of the construction of the Farakka Barrage on Hilsa fisheries. Tagging experiments conducted in the area above and below the Barrage site have shown that at least part of

the Hilsa stocks in the Padma and the lower portion of the Ganga find their way to the foreshore areas through the estuaries that lie in East Pakistan. It has also been found that there is very little indication of intermingling of the stock of *Hilsa* in the Hooghly with that of the Padma or the Ganga.

Hilsa, with fully mature and partially spent gonads, were obtained in considerable numbers in the catches in the entire stretch of the rivers Ganga and Padma from Rajmahal to Lalgola. Larvae and post-larvae were also collected from Rajmahal and Lalgola showing that *Hilsa* may be breeding in this entire stretch of the river.

Hilsa fishery of the Godavari

The data collected on the biology and fishery of *Hilsa* in the Godavari were analysed during the period. Evidence has been adduced to show that Hilsa breeds in a stretch of about 40 miles below the lower-most anicut in the river and during high floods they ascend upstream and breed in the upper stretches also. There appears to be only a monsoon spawning run in the river; all the fish caught during the winter months were immature. The sex ratio of females to males was found to be higher in the catches in the months of November and December but thereafter males predominated in the catches.

Studies on the food and feeding habits seem to show that the fish migrating for breeding *do not stop feeding entirely as generally believed*. Young as well as adult *Hilsa* seem to feed at the bottom as well as the surface in the river. An examination of the possible causes for the reduction in catches of *Hilsa* from the river, indicates that silting of the river and the increasing fishery for young *Hilsa* may have an adverse effect on the size of the population in the river.

Spawning grounds of *Hilsa* in Narbada River

Detailed investigations were carried out in the freshwater regions of the Narbada River to demarcate the extent of the spawning grounds of *Hilsa* in the river. On the basis of collections of eggs and larvae it was found that the fish spawns in the freshwater area also, between Poicha and Indravarna, a stretch of 18-20 miles, besides the tidal zone of the river that has already been established as the spawning grounds of the fish. The comparison of length frequency data from the tidal and freshwater zones of the river shows that probably younger *Hilsa* breed in the tidal regions and the older ones in the upper freshwater stretches. It has also been found that *Hilsa* of the river attain first maturity at a length of 265 mm. in males and 295 mm. in females.

Tagging experiments

To date 5,875 *Hilsa* have been tagged and released in the Hooghly, the Ganga and the stretch of the Padma that lies in India, of which 7.83 percent have been recovered. The analysis of data collected through tagging experiments, showed that 80 percent of the recoveries of tagged fish in the rivers Hooghly, Padma and Ganga were made within a month after tagging. The longest time interval between tagging and recovery was 762 days. The recoveries indicate that the same fish comes up the river Hooghly for spawning more than once in its life history. The *Hilsa* of the winter run have been observed to come up the river during the following or the subsequent monsoon seasons and *vice versa*. This

supports the view that the *Hilsa* of winter and monsoon runs in the Hooghly do not form separate stocks.

The movements of *Hilsa* migrating for spawning do not appear to be always upstream. However, there is evidence of greater downstream migration during the latter half of the monsoon season. The speed of migration appears very variable. There seems to be no movement of *Hilsa* from the Hooghly to the Padma or the Ganga, and very little intermingling of the populations of Hooghly, Padma and the upper Ganga. At least a part, if not all, of the *Hilsa* of the Padma and the lower Ganga find their way to the lower estuaries that lie in East Pakistan.

Racial Investigations

The final analysis of data relating to the racial composition of *Hilsa* populations has shown that the fisheries of River Ganga bear on at least two populations (one represented by samples studied from Allahabad and the other represented by samples from Buxar) and that they are distinct from the population of the river Padma. The tagging experiments have also lent support to this inference.

(v) Mugil

Investigations on the fishery biology, and collection of catch statistics pertaining to the mullets *Mugil parsia*, *M. cephalus*, *M. cun-nasius*, *M. tade* and *Liza troscheli* are in progress at the Central and State Fisheries Research Institute in the country. Tagging experiments were conducted in the Chilka lake to ascertain the routes of migration and growth rates of mullets. Data collected are under analysis.

(vi) Prawns and Shrimps

Important investigations were conducted at the Central Inland Fisheries Research Institute on the fishery biology of the following species of prawns from the Hooghly estuary: *Metapenaeus brevicornis*, *Parapenaeopsis sculptilis*, *Palaemon mirabilis*, *P. carcinus*, *P. malcolmsonii*, *Leander styliferus* and *L. tenuipes*.

Studies were made of age and growth determination, sex, maturity and spawning, sex ratio and size composition in the commercial catches, length-weight relationship and condition, larval development, migration and the fishery.

A separate prawn research unit has been established at the Central Inland Fisheries Research Institute as one of the projects under the third five-year plan. This programme envisages comprehensive investigations on the fishery biology and culture aspects of various commercially important species of prawns from the brackishwater areas along the east coast.

The Central Marine Fisheries Research Institute is conducting important investigations on several species of commercially important prawns from the Indian seas. Detailed catch statistics with regard to these species are also being collected.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton population

The Marutoku-B type of plankton net has not been received at this Institute. Due to restrictions on import of certain types of material (bolting silk and flow-meters), and their non-availability locally, work on standardization was suspended temporarily.

(b) Identification of aquatic organisms

A considerable volume of published work already exists and descriptions and keys to the identification of most of the species of Indian fish are available. Work on the systematics and identification of all organisms, including aquatic organisms, is in progress at the Zoological Survey of India.

(c) Population dynamics, age determination fish behaviour, and related studies

Population dynamics: Studies on the dynamics of commercially important fish populations from the inland waters (rivers, reservoirs and estuaries) and the sea are in progress at the Central Inland Fisheries Research Institute and the Central Marine Fisheries Research Institute respectively.

Detailed statistics are being collected with a view to estimate total catches, total efforts and catches per unit effort, relative efficiencies of gears as well as age structure of the catches. Experiments on selectivity of bag nets with respect to some important species of fish and prawns were conducted at the Central Inland Fisheries Research Institute. Growth parameters for a monomolecular type of growth curve estimated for several species of fishes. Similar studies on other species of fish are in progress.

Age determination: Important work has been carried out at the Central Inland Fisheries Research Institute on the determination of age and growth of several species of inland fishes. Of the hard parts used for aging, spines (*M. gulio*, *P. pangasius* and *O. niloticus*) otoliths (*Sillago panijus*, *S. sihama* and *Anguilla nebulosa nebulosa* and scales (*Catla catla* and *Cirrhina mrigala*) were found to provide reliable indices of age. As a result of these studies there is a growing conviction among the workers in this country that the general belief that hard parts of the body are of no value in aging fish from tropical waters may not be true. Accounts embodying the results of the above studies have been published.

Improved methods using length frequency distributions for aging fish which are being tried at the Central Inland Fisheries Research Institute have shown considerable promise. A publication embodying these results is under preparation. Some work on aging mullets by tagging has also been done by the Central Inland Fisheries Research Institute and the Orissa State Fisheries Department.

At the Central Marine Fisheries Research Institute work on age and growth of some marine fishes by the use of scales and length frequency distributions has been done.

(d) Oceanography

Observations on the seasonal changes in the hydrological features of the inshore and offshore waters have been in progress at the Central Marine Fisheries Research Institute. Some officers of the Institute participated actively in oceanographic cruises conducted by the Indo-Norwegian Project, on board the vessel R.V. VARUNA.

(e) Study of basic productivity

Preliminary investigations using the C_{14} technique have been made at Central Marine Fisheries Research Institute; the results will be published shortly.

(f) Aquatic ecology

Observations on the fluctuations in environmental factors and their relation to plankton production in the Hooghly estuary were made at the Central Inland Fisheries Research Institute. Studies on soil composition in ponds in relation to plankton and fish production have been in progress at the pond culture unit of the Institute.

**4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS
(Including Reservoirs)**

(b) Control or alteration of the physical features of the environment

Investigations and surveys were conducted, by the Central Inland Fisheries Research Institute, to assess the probable effects on fisheries of the proposed barrages at Farakka and Gandak. It was concluded that the proposed barrage at Bhaisalotan on the Gandak river is not likely to affect the fisheries of the river adversely. Investigations with regard to Farakka barrage are in progress.

(c) Control or alteration of the chemical features of the environment

Water pollution: Investigations were conducted by the Central Inland Fisheries Research Institute on the probable effects of textile, tannery and distillery wastes on the fisheries of the River Ganga at Kanpur. The results of the study have been published. Studies on the effects of various types of industrial effluents on the fisheries of the River Hooghly were initiated. Detailed information regarding the nature and quantity of *effluents discharged into the river was collected*. Laboratory experiments to evolve suitable methods of rendering the pollutants innocuous have indicated that treatment with the coagulant aluminum sulphate in doses ranging from 0.5 to 2.0 percent reduces the values of B.O.D., odour and colour of the effluents from paper mills. Investigations to ascertain the suitability of other coagulants such as lime, ferrous sulphate and ferric chloride as possible curatives of noxious effect of pollutants are in progress.

A new unit, to study the possible effects of mining and metallurgical wastes on the fisheries of the D.V.C. reservoirs and connected rivers, is also being established by the Central Inland Fisheries Research Institute as one of the projects under the third five-year plan.

(d) Control or alteration of the biological features of the environment

Aquatic weed control: Investigations on the autecology of weeds, viability of seeds and turions of weeds and on the relative efficacy of various chemical and mechanical methods of weed control have been in progress at the Central Inland Fisheries Research Institute. As reported earlier, free ammonia was found to be effective in controlling submerged as well as emergent weeds. A new multipoint applicatory has been devised for rapid and effective delivery of ammonia gas in weed-infested ponds. A survey has also been initiated to assess the extent of weed-infested cultivable waters in various parts to the country.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish culture—general

Investigations on optimum stocking rates for fry and fingerlings in rearing and stocking ponds and observations on the desirable combinations of different species for stocking have been in progress at the Central Inland Fisheries Research Institute. With the techniques evolved for induced breeding of Indian major carps and year-round breeding of common carp under Indian conditions, it has been possible to augment substantially the supply of quality "fish seed" for culture purposes, as also to utilize nursery ponds throughout the year, which would otherwise have remained fallow from October to July. The year-round utilization of nurseries has resulted in marked depletion of their natural fertility and necessitated recourse to artificial fertilization and feeding.

(c) Pond fertilization

The following studies were conducted at the Central Inland Fisheries Research Institute. Studies on the response of alkaline soils with different levels of available phosphorous to treatment with a single phosphatic fertiliser indicated that soil reaction continued to be slightly alkaline and available nitrogen, however, was more marked after the treatment. Studies on the response of low nutrient acid soils to treatment with increasing doses of the mixed fertilizer 6-8-4 N-P-K have also been in progress.

(d) Studies on fish breeding, including genetics

Experiments to evolve the optimum dosage of pituitary extract required for successful inducement of spawning were continued at the Central Inland Fisheries Research Institute. It was found that 7.11 mg. of homoplastic pituitary gland administered per kg. of body weight of females and 2.3 mg. per kg. of body weight of males successfully induces spawning. Experiments on the artificial inducement of spawning of mullets,

Mugil cephalus and *Liza troscheli* by the administration of pituitary injections yielded encouraging results.

Chinese silver carp, grass carp and bighead carp, reared to maturity in ponds, were induced to breed by the administration of injections of pituitary hormones.

A mutant albino strain of *Catla catla* developed as a result of artificial breeding experiments has been induced to inter-breed successfully. Preliminary observations showed that the mutant strain breeds true, all the young being albinos.

(e) Aquatic weed control

See section 4(d).

(g) Disease and parasite control

Investigations on an eye disease of catla and on fish dropsy, which cause considerable mortality to fish and consequent financial loss to fish farmers, were taken up by the Central Inland Fisheries Research Institute. The etiological agent of the eye disease has been found to be probably a variant of *Aeromonas liquefaciens*. There have been no indications to show that any virus is associated with the disease. The early symptoms of the disease, via vascularisation of the cornea and opacity of the tissue are likely to be due to avitaminosis. The etiological agent was isolated in pure cultures. The bacterium shows considerable variation in form and colonies grow well in temperatures 18°-24°C. The organisms is gram-negative in staining reaction, mobile and flagellated.

The etiological agent of dropsy of Indian carps has also been recognised as a bacterium and has been tentatively identified as *Aeromonas* sp. Cultures prepared from affected tissues of artificially infected fish showed the presence of bacteria identical to the inoculated ones.

Dip treatment of one minute's duration in a 1:2,000 copper sulphate solution was found to control effectively a type of ulcer disease common in fish farms in Bengal.

(j) Rice-field fish culture

Experiments conducted at the Central Inland Fisheries Research Institute have indicated that generally the survival of fish

fry, as well as yield of fish is very low in paddy fields. Fingerlings stocked at the rate of 1,200 per acre have yielded on average 37.2 kg. after 4 months of rearing.

JAPAN**PANEL A—INLAND FISHERIES****1. INFORMATIONAL SERVICES,
BIBLIOGRAPHIES AND
REFERENCE BOOKS****(a) Information—generally**

A number of Japanese periodicals are relevant to the works of this Panel; these include: The Aquiculture, Bulletin of Freshwater Fisheries Research Laboratory, Journals of Limnology and Ecology as well as the reports of various universities, prefectural fisheries experimental stations, etc.

Among the outstanding activities is the research on induction of spawning by use of hormones conducted since 1961 on grass and silver carp by the Freshwater Fisheries Research Laboratory in collaboration with the Saitama Fisheries Experimental Station. This research constitutes a part of an overall project of the Ministry aiming at the increased production of "seed" for fisheries.

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2. AQUATIC RESOURCES APPRAISAL

(a) Country and regional appraisals, reviews or synopses

The total catch in Japan by freshwater fisheries in 1960 amounted to 74,063 metric tons, of which 40,532 tons were harvested from lakes. (Annual Report of Catch Statistics on Fishery and Aquaculture, 1961. Ministry of Agriculture and Forestry).

Breakdowns of the total catch are as follows (unit: metric ton): Amount of fish landed was 43,916 metric tons, the river catch (23,528) being slightly over the lake harvest (20,387).

By species, crucian carp (7,870 tons) comes first, followed by ayu (6,860 tons),

pond-smelt (4,761 tons), eel (2,871 tons), roach (2,822 tons) and salmon (2,605 tons). Geographically, pond-smelt, salmon, and roach predominated over other species in northern Japan; ayu and eel in southern Japan.

(b) Appraisals, surveys or synopses of river basins (inland) or individual waters (inland)

Estimations of the stock of pond-smelt and ayu are relatively easy to make, since these species are annual fish. Population dynamics of pond-smelt in Lake Suwa were studied by Shiraishi (1961). The same author also made estimations of ayu stock in Lake Biwa with the aid of a fish-finder; the results are now being prepared. There is also a report on the survival of rainbow trout stocked in a small mountain creek (Onodera, 1961).

(c) Appraisals or inventories of fish populations

See (b) above.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(b) Identification of aquatic organisms

There are reports on the taxonomy of Japanese freshwater shrimp (Kamita, 1961) and on speciation of Japanese *Hypomesus* with reference to their ecological features (Hamada, 1961).

(c) Population dynamics, age determination, fish behaviour and related studies

As noted in 2(b), there are two reports on population dynamics: Shiraishi (1961) and Onodera (1961).

With regard to fish behaviour, the following reports are available: life history of Gobioid fish (Mizuno, 1961 and Kodama, 1961), spawning migration of land-locked sockeye salmon (Tokui, 1961), and an ecological study of this salmon (Kurohagi, and Sasaki, 1961). Other reports in this field include studies on the spawning behaviour of minnows in a reservoir (Matsushima, 1961), on the natural food of silver carp (Hashimoto, 1961) and on shoot carp (Nakamura and Kasahara, 1961).

(e) Study of basic productivity

No noteworthy reports were published during 1960 and 1961 with regard to the productivity of fresh water.

However, there are a number of reports with some connection with this line of research, for example: Mizuno (1961), Ohya and Kato (1961), Satomi (1961a, 1961b and 1961c), Suzuki, S. (1961), Suzuki, S. and H. Nimura (1961), Watanabe (1961a, 1961b), Kato (1961), Mitsui *et al* (1962), Sugawara (1961), Ueno *et al* (1961).

(f) Aquatic ecology

Reports on rearing of *Artemia* (Tera-moto and Kinoshita, 1961) and *Chironomus* (Nose, 1962), both of which are important food organisms of fry, are available.

(g) Other research

There is one report on an electronic apparatus which gives notice of a drop in dissolved oxygen in water. (Koyama, 1961).

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(a) Regulatory (Legislative) Measures

Most of the fisheries are regulated by various legislative measures restricting fishing time and place, gear and boats, size of fish, etc.

(b) Control or alteration of physical features of the environment

River basin development: Studies are being made by various workers to determine effective measures to protect aquatic resources in the face of ever-increasing industrial utilization of water resources.

They include those on the development of artificial spawning grounds for ayu (Ishida, 1961a, 1961b, and 1962) and of facilities to maintain Ayu stock in Lake Biwa where a lowering of water level is being planned to meet the industrial demand. (Furukawa, U., 1961).

There is also a report of a survey of anadromous fish in the River Tone (Kasebayashi, T., 1961). This survey was designed in relation to proposed dam construction near the river mouth.

Besides these more or less biological works, there is a move on the part of the Fisheries Agency to initiate engineering reserve work for fisheries to meet proposed developmental projects for river basins.

(c) Control or alteration of the chemical features of the environment**(i) Water pollution control**

Bioassays of industrial effluents are being extensively made, by a number of workers in the effort to overcome ever-increasing damage to fishery resources. (Gose, 1961; Onodera, H., 1962; Satomi, Y., 1961; Seno, 1961; Suzuki, S. *et al*, 1961).

Reports of damage by various insecticides and weedicides are also increasing. (Mizunuma and Muranaga, 1961). Of special concern is P.C.P., a new powerful weedicide which has been causing grave loss to freshwater fishery resources. Counter-measures are being studied by the staff of the Seikai Regional Fisheries Research Laboratory.

(ii) Use of fertilizers

(See 5(c)).

(d) Control or alteration of the biological features of the environment**Aquatic weed control**

This question is not of particular concern for Japan because it has no large still-water ponds.

(e) Stocking**(i) Maintenance stocking and transportation**

Chum and pink salmon, ayu, pond-smelt and common carp are being released annually. A few hundred million hatchery salmon fry leave the rivers of northern Japan each year, while ayu, mostly of Lake Biwa origin and partly of sea origin, are liberated in the upstream areas of rivers where the passage of wild ayu is blocked. The value of stocking

common carp fry in rivers is viewed with doubt, although it is still popular among common people.

(ii) Introduction of non-indigenous species

Chinese carp, introduced to the River Tone about 15 years ago, are propagating flourishingly. *Tilapia mossambica* are reared on a small scale at some hot-spring resorts.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish Culture—general

The total output in 1960 was 15,940 metric tons. About 95 percent of this output was composed of the following species: eel (6,136 tons), carp (4,629 tons), rainbow trout (2,670 tons) and crucian carp (1,624 tons).

Shortages of "fish seed", feed, and capital together with defective distribution hamper the development of this industry beyond the present level.

(b) Nutrition

Studies on trout feeding is in progress. Commercial pellet feed has come to be widely used. The question of measuring the digestion rate of rainbow trout was discussed by Nose, Ta (1961) and Inaba *et al* (1962). With regard to carp feeding there are the following lines of research: study on new food substitutes for silkworm pupae. (Koyama and Miyajima, 1961, and Koyama, H. *et al*, 1961) and on the effect of different foods upon survival and growth of carp fry. Chiba, 1961.

(c) Pond fertilization

Chemical fertilization of small farm ponds was conducted in 1961 by the staff of the Freshwater Fisheries Research Laboratory in collaboration with that of Nagano Prefectural Fisheries Experimental Station. Silver carp and Gengoro-Buna (a phytoplankton-feeding race of crucian carp) were used

in this experiment. The results will be published soon. This question was also approached by Yamada (1961) from the chemical angle.

Fertilization of Gengoro-Buna-culture ponds with human and chicken manure has long been conducted in certain localities of Osaka district, but not elsewhere.

(d) Studies of fish breeding, including genetics

Experiments on hormone injection have been made with various marine and freshwater fishes, including eel (Sato *et al*, 1962) and grass carp. There are also reports on a histological study of the endocrine glands of Ayu (Honma, 1961), and on morphological change in the gonads of rainbow trout (Nomura, 1962). In the field of genetics, one report is available, which deals with sex and sterility of intergenetic hybrids of bitterling (Suzuki, R., 1961).

(e) Aquatic weed control

No report has been published since that of Nakamura on the weeding effect of grass carp. (Nakamura, K., 1957, IPFC Procs. 7th (II and III)).

(f) Handling and transport of "fish seed"

The following reports are available: domestic transport of *Leuciscus* eggs (Koyama and Nakamura, 1961; Nakamura, H., 1961), and oversea and domestic transport of grass and silver carp (Saitama Prefectural Fisheries Experimental Station 1960). The latter, titled "Studies on artificial spawning of grass carp", is included in the report of said station: No. 31, pp. 16-25, 1960.

(g) Disease and parasite control

No report is available on the control of parasites.

There are a number of reports on fish diseases: nutritional disease of rainbow trout (Kawatsu, 1961); nutritional disease of snapping turtles (Fukuda and Kumura, 1961);

control of the swim bladder disease of gold fish (Kawamoto, 1961); fungus disease of fish eggs (Nakamura, K., 1961).

(h) Studies of non-indigenous fishes

(i) Grass and silver carp

The natural propagation of grass and silver carp in Japan was first recognized in the River Tone in 1948. Since then an extensive survey has been conducted by Saitama Prefectural Fisheries Experimental Station; the results have been published in a number of reports.

Furthermore, success has been achieved in obtaining large quantities of "seed" of these species by hatching eggs collected from this river and feeding the fry thus obtained with egg yolk and rice bran by use of sprayers.

A knowledge of the ecology of these carps is being brought to light very rapidly by the staff of the Freshwater Fisheries Research Laboratory and Ibaragi Prefectural Fisheries Experimental Station.

(ii) *Tilapia*

This species is being reared in hot-spring water at certain resort areas. A report on wintering in well water (18°C constant) is also available (Maruyama, T., 1960, *Bull. Freshwater Res. Lab.*, 10 (2): 53-61, 2 pls.).

(j) Special forms of aquiculture

(i) Eel culture

In 1960, 795 culture farms produced some 6,000 metric tons of eel from their 1,071 ponds. Fry for culture are collected in the river mouths.

Many publications are available for this century-old business. (e.g., Inaba, D. *et al.*, 1962).

(ii) Rice field fish culture

With the use of powerful insecticides

and weedicides on the rice crop, this type of culture has lost its past prosperity, and is being practised only in the Saku district of Nagano Prefecture and other areas in remote valleys. No recent publication is available, except Kuronuma, K. (1954), *Carp culture in rice-fields as a side work of Japanese farmers*. Ministry of Agriculture and Forestry, p. 1-27. In English.

(iii) Shrimp culture

There are no freshwater shrimp farms in Japan. Two reports were published during 1960 and 1961: One deals with the behaviour of shrimp in farm ponds (Okubo, 1961), the other with their development and growth. (Mizue and Iwamoto, 1961).

(iv) Freshwater pearl-shell culture

Several pearl farms are operating pearl-shell culture in Lake Biwa, producing salmon-pink pearls using *Anodonta*. However, the development of this culture is seriously hampered by the impossibility of obtaining *Anodonta* fry because of lack of knowledge of their life cycle.

One report was published by Shiga Fisheries Experimental Station in 1959 which dealt with the growth of *Anodonta* shell. (Mizumoto, S. and K. Kobayashi, 1959).

(v) Others

Experiments have been conducted with anchored floating nylon net enclosures for the past few years in order to culture fish in lakes and other open waters. No report, however, has been published.

Besides this, there are the following lines of research worthy of note: mass production of fry in a closed circulation aquarium (Saeki, 1961), and induction of spawning of ayu by exposure to artificial light after dark. (Shiraishi and Takeda, 1961).

PANEL B—SEA FISHERIES

1. INFORMATIONAL SERVICES,
BIBLIOGRAPHIES, REFERENCE BOOKS

(a) Information—generally

Recently innumerable works have been reported every year on the Japanese fisheries, aquatic organisms, and environmental conditions. They are published in various periodicals inclusive of: Bulletin of the Japanese Society of Scientific Fisheries, Japanese Journal of Ichthyology, Journal of the Oceanographical Society of Japan, publications of universities concerning fisheries, Bulletins or Reports of the regional fisheries research laboratories and other institutions of the Fisheries Agency, and publications of prefectural fisheries experimental stations and private organizations. In addition, a number of scientific articles on Japanese fisheries are accepted in different forms of publication issued in Japan, foreign lands and international organizations. This report attempts to review some of the representative works pertinent to Technical Committee I, Panel B, IPFC.

Scientists of regional laboratories engaging in investigations of the neritic-pelagic fisheries resources have cooperated through a conference (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher., Japan 1961*) in their researches into fisheries for sardine, anchovy, mackerels, yellowtail and common squid. Since 1960, the Organizing Committee (Chairman: Dr. Z. Nakai of the Tokai Regional Fisheries Research Laboratory) has been working for expanding activities of the Conference, in addition to those species enumerated above, they include major species of salmon, tunas, skipjack, Pacific saury, demersal fishes and king crab (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher., Japan, ms.*). The first meeting of the extensive conference will be held in October 1962 at Tokyo.

In April 1962, the Japanese Society of Fisheries Oceanography (Representative Member: Dr. M. Uda of the Tokyo University of Fisheries) was established with the head

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2. AQUATIC RESOURCES APPRAISAL

(a) Country and regional appraisals, reviews or synopses

Through nation-wide investigations that have been conducted continuously since 1949, information was obtained on the present and future status of the neritic-pelagic fisheries and their resources in the waters around Japan (*Ex. Com. Conf. Invest. Neritic-Pelagic Fisher. Japan*, 1961, 1962, MS.). Information has been also obtained for the herring, salmon, Pacific saury, tunas, skipjack, demersal fishes and king crab. Some of the results are reviewed in section 2(b) below.

For fisheries on the Seto Inland Sea along Yamaguchi Prefecture, a recent study covers extensive fields such as topography, meteorology, oceanography, reclamation of

shallow waters, pollution, ecology of important marine organisms, techniques and economics of fishermen, regulation and management, and propagation and culture (Maekawa 1961).

(b) Appraisals, surveys or synopses of marine areas

As a part of the investigations on fish populations referred to in section 2(a), oceanographic surveys have been conducted on the sea areas comprising fishing grounds or spawning and nursery grounds, or both, for the respective species. In addition large scale surveys of sea conditions have been carried out by the fisheries institutions in cooperation with the Meteorological Agency and the Hydrographic Office.

(c) Appraisals or inventories of fish populations

As mentioned in section 2(a), large scale biological surveys have covered the sardine, anchovy, mackerels, salmon, Pacific saury, tunas, skipjack, demersal fishes, king crab and other economically important species.

(d) Reviews or synopses of aquatic forms of economic importance

(i) **Salmon:** Information has been obtained on the salmon in the northern North Pacific chiefly by the Hokkaido Regional Fisheries Research Laboratory (e. g., Takagi, 1961), and National and Prefectural Hatcheries (e. g., Nagasawa and Sano, 1961, Terao and Hayashinaka 1961), and presented for the International Conferences between U.S.S.R. and Japan (Governments of Japan and U.S.S.R. 1962), and between Canada, U.S.A. and Japan (Ishida *et al.*, 1961).

(ii) **Tunas:** The Nankai Regional Fisheries Research Laboratory has played the major role in advancing the fishery biology of the tunas (Fujii *et al.*, 1962; Suda, 1962). The results were presented to the World Scientific Meeting on the Biology of Tunas and Related Species held by FAO at La Jolla, July 1962.

Skipjack: The Tohoku Regional Fisheries Research Laboratory is responsible for the investigations of this species. The feeding habits of this fish were recently published (Hotta, 1960).

(iii) **Mackerels:** These fishes have been investigated in the Cooperative Investigations on Important Neritic-Pelagic Fisheries Resources since 1955. During 1957 through 1961 the total landings of the Japanese and spotted mackerels, *Scomber japonicus* and *S. tapeinocephalus*, have been continuously maintained at a high level. However, the regional catch is dwindling in the East China Sea and the Japan Sea with a noticeable decrease in recruitment. On the other hand, the catch increased in the Pacific waters along Honshu, and the high level of catch will continue at least of some more years (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher. Japan, 1961, 1962, ms*).

As to the jack mackerel, *Trachurus japonicus*, a high level of landings is predicted to continue at least for several more years. But there is a symptom that the recruitment of this species began to decrease in the East China Sea (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher. Japan, 1961, 1962, MS.*).

(iv) **Sardines:** The amount of sardine catch has decreased especially in the East China Sea and the Japan Sea. The spawning activities also have been on the decrease in these seas. The phenomena are attributed to the lowered survival rates at the early stages of life of the recent year classes. In the Pacific waters along Honshu, however, the catch suddenly increased in 1961 with evidently brisk activity in spawning. Immigration of the parents from the Japan Sea and favorable environments at the early stages are assumed to be the major factors increasing the stock sizes of recent year classes. Prediction has been made for the stocks in the northern Japan Sea and in the Pacific waters off eastern Honshu (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher. Japan, 1961, 1962 MS.*).

Two major recent papers cover the life history and population dynamics of this species (Nakai MS., Ito, 1961).

(v) **Anchovy:** The anchovy is one of the most prospering species in Japan. In almost all areas, the fisheries do not over exploit this fish (*Ex. Com., Conf. Invest. Neritic-Pelagic Fisher. Japan, 1961, 1962, MS.*).

The most productive areas for the anchovy are the Pacific waters along Honshu. An intensive study based on structure of stocks therein, growth and life span, and egg abundance revealed no evidence of over-exploitation of the local stocks, and that the sizes of stocks are predictable to some degree of accuracy for six months to two years in advance (Hayashi 1961).

(vi) **Pacific saury:** The Tohoku Regional Fisheries Research Laboratory has been advancing the fishery biology of saury. The major stock that moves southward in the autumn along the northeastern Honshu is found spawning chiefly in the northern side of the Kuroshio Front during November and December (Kimura *et al*, 1961).

(vii) **Bottom fishes:** There are two groups of fisheries for demersal species. One is operated with the use of large-sized trawlers on the East China Sea, Yellow Sea and the other high seas; the other, with medium and small sized boats, on the coastal waters.

As to the resources in the East China Sea and the Yellow Sea, methods were established to determine the optimum amount of effort (Kibesaki 1960). Extensive studies were published for ecology, management and prediction of the yellow sea bream, *Taius tumifrons* (Shindo, 1960).

The demersal resources in the waters adjacent to Japan were mainly investigated by five regional laboratories inclusive of Hokkaido, Tohoku, Nankai, Japan Sea and Naikai. Staffs of those laboratories published papers on various aspects of the resources (e.g., Ogata, 1960; Yusa, 1961).

(viii) **Prawns and shrimps:** A study on the bottom fish in the East China Sea and the Yellow Sea covers population dynamics of three species of prawns (Kibesaki, 1960).

(ix) **Molluscs:** Practical methods for rearing larvae of the abalone and other important molluscs have been advanced with the use of *Chaetoceros* (Umebayashi, 1961). Physiological and ecological studies were conducted on the oyster and *akazara*, *Chlamys farreri nipponensis*, in the coastal waters along the northeastern Honshu (Tanita and Kikuchi, 1961; Kanno and Tanita, 1961). Overall investigations were completed on improved techniques of oyster culture with the use of hardened seeds (Ogasawara *et al.*, 1962).

Other ecological studies covered spawning of the abalone (Ino and Harada, 1961) and structure of the shell fish community in particular areas (Okutani, 1962). The cultured pearl oyster was investigated from various aspects (e.g., Ota and Shimizu, 1961; Wada 1961).

(x) **Marine algae:** A comprehensive research covers the taxonomy and ecology of *Porphyra* in Japan (Kurogi, 1961). A number of physiological studies on these species appeared recently. For instance, it has been known that photoperiodism affects maturation of *P. tenera* in thallic and conchocelis phases under rearing conditions (Iwasaki, 1961).

Recent ecological studies dealt with such important species as the agar, *Gelidium* (Osuga and Yamasaki, 1960).

Studies are now advanced on the culture of various sea weeds and fertilization of the fishing grounds.

3. RESEARCH INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton populations

A basic paper was published on the structure and handling of major apparatus for

collecting plankton and other organisms for the Cooperative Neritic-Pelagic Fisheries Resources Investigations (Nakai, 1962). Among them the most common type; *Maru Toku*, was used at stations exceeding 9,637 in 1960 for collecting eggs and larvae of fishes, and other plankton in the co-operative investigations.

(b) Identification of aquatic organisms

In order to identify fishes found in stomachs, studies were conducted to prepare keys and illustrations of skeletal structures (Hotta, 1961; Takahashi 1962). Immunological and marking techniques were advanced for identifying fractions of whale populations (Fujino, 1960).

Japanese animals excluding insects are illustrated and described in a four-volume encyclopaedia (Okada, Uchida and Uchida, 1957-60).

(c) Population dynamics, age determination, fish behaviour and related studies

Mathematical treatments of population dynamics were reviewed and systematized (Tanaka, 1960). The availability of fishes, especially sardines, were analyzed statistically (Yamanaka, 1961). A statistical account was published on the fluctuation in catch of the yellowtail (Kurita 1961). Relationships between different fish populations in common environments were examined on the basis of catch data (Doi, 1961).

Work based on biological information has been advanced to make it possible for the administration to take action on management and prediction of the important fishes including sardine (Nakai, MS.; Ito 1961), anchovy (Hayashi, 1961), albacore (Suda, 1962) and yellowtail (Mitani, 1960) in the waters adjacent to Japan, and the demersal fishes in the East China Sea and the Yellow Sea (Kibesaki, 1960; Shindo, 1960), as well as the fur-seal in the northern North Pacific (Nagasaki, 1961).

Among many works on the age determination of various fishes, a comprehensive report dealt with the scale of the chum salmon (Kobayashi, 1961). The technique is advanced for the pearl oyster in the Arafura Sea (Sagara and Takemura, 1960).

Species whose behaviour was clarified are the sardine (Nakai, MS.; Ito 1961), anchovy (Hayashi, 1961), Pacific saury (Kimura *et al.*, 1961; Hotta and Aizawa, 1961), albacore (Suda, 1962), yellowtail (Mitani, 1960) in the waters adjacent to Japan, the demersal fishes in the East China Sea and the Yellow Sea (Kibesaki, 1960; Shindo, 1960).

(d) Oceanography

One of three major systems for oceanographic surveys is represented by the regional fisheries research laboratories of the Fisheries Agency in cooperation with experimental stations of prefectural governments. Another is the work by the Meteorological Agency, and another, by the Hydrographic Office of the Marine Safety Board. For investigations of general properties of oceanographic conditions such as fluctuations in the Kuroshio Current and the Oyashio Current, these three groups of scientific institutions have been cooperating and co-ordinating, since 1947, through a periodic conference.

In addition to the general investigations, the regional fisheries research laboratories, prefectural fisheries experimental stations and universities interested in fisheries have conducted "fisheries oceanographic investigations" as part of fisheries biology, fishing technology, aquicultural technology, and studies on industrial water pollution and radioactive contamination.

Raw data obtained by all the surveys enumerated above are published in various forms by the respective agencies. Studies on basic or general oceanography, especially physical and chemical studies, are reported through the Journal of the Oceanographic Society of Japan. Of course, those studies

contribute indirectly to the advance of fisheries science, but seldom describe topics of so-called fisheries oceanography.

Results of fisheries oceanographic studies conducted by fisheries institutions are usually related with various fields listed in sections (2) and (3). However, some of these studies are more closely related to physical oceanography proper than to other fields of fisheries science, while their major interests are still directed to the fisheries. These works deal with such subjects as the structure of water masses and currents of fishing grounds for particular species; e.g., the skipjack in the northeastern waters off Honshu (Kawai and Sasaki, 1961), and the salmon in the subarctic ocean of the Pacific (Hirano, 1961).

(e) Study of basic productivity

A recent paper that deals mainly with chlorophyll concentration describes various aspects of primary productivity in the northwestern Pacific (Aruga and Monsi, 1962).

(f) Aquatic ecology

Studies reviewed in Sections 2(d) and 3(c) include various aspects of the ecology of marine organisms. In addition, researches were advanced on mechanisms underlying the disastrous mortality at the early stages of the herring, sardine, anchovy and other marine fishes (Mikami *et al.*, 1961; Yokota *et al.*, 1961; Nakai *et al.*, 1962), and the food web of the fish community inhabiting the Seto Inland Sea (Hayashi and Yamaguchi, 1960).

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(a) Regulatory (legislative) measures

On the bases of studies listed in sections 2 and 3(c), steps are recommended on the management and prediction of the neritic-pelagic fishes, tunas, demersal fishes, and others. Regulation has been practiced on many coastal fishing grounds.

(b) Control or alteration of the physical features of the environment

Investigations have been initiated by the Fisheries Agency and other institutions to improve grounds for aquaculture in shallow coastal waters.

(c) Control or alteration of the chemical features of the environment

Water pollution control: Co-operative studies on sea water pollution will be completed in 1962. The major projects are dispersion of the polluted water mass, and its effects on the marine communities and fisheries productions. As a part of the studies, an extensive work was published on the physiological, ecological and chemical properties of water pollution caused by pulp mill wastes. On the basis of that study recommendations were made to eliminate the effects of this kind of pollution (Fujiya, 1962).

Investigations were conducted in regard to effects of fresh water brought by construction of power dams on coastal fisheries. On the basis of the study, a standard was obtained on a permissible amount of the fresh water to be discharged from streams (Owashiwan Dam Hosui Chosadan, 1960).

Large scale investigations have been conducted on the level of radio-activity in the sea water and marine organisms, and on the mechanisms of organisms accumulating the radio-active materials (e.g. Fukai and Yamagata, 1961; Miyake *et al.*, 1961; Nakai *et al.*, 1961).

(d) Control or alteration of the biological features of the environment

Aquatic weed control is practiced for beds of various useful sea weeds in many areas of Japan.

(e) Stocking

In October 1959, about 100,000 eggs of the chinook salmon (*Oncorhynchus tshawytscha*)

were transplanted from Washington, U.S.A., to hatcheries in Hokkaido to be released in the rivers of that area in 1961 (Hikita, 1960).

5. FISH CULTURE AND FISH DISEASE CONTROL

Recently the Japanese fisheries scientists and administrations on national and prefectural levels as well as industrial agencies have been interested in studies relevant to the culture of profitable marine organisms under a catch phrase, "From exploiting fisheries to creating fisheries". The government has delivered substantial financial aid for promoting those studies.

As listed in section (2) and (4), much knowledge has been secured from recent studies on the culture of sea weeds such as *Porphyra*, and shell fishes including pearl and edible oysters and abalone. The cultural techniques for the common prawn, *Penaeus japonicus*, have been advanced and made it possible to rear the prawn throughout its life cycle on a commercial scale in some localities. Development of rearing techniques for yearling yellowtail, *hamachi*, gave sudden rise to a new enterprise in various parts of Japan. As the enterprise needs a huge amount of juveniles, *mojako*, there has arisen a new problem on how to keep an optimal abundance of the population. Scientists are now working to establish practical techniques for obtaining fry of the yellowtail as well as red and black sea bream, puffer and octopus from artificially or naturally fertilized eggs. Generally speaking, one of the most difficult aspects of rearing marine organisms is to find suitable food for early postlarvae and to secure a sufficient and continuous supply—a problem that bears a very important association with a subject of fisheries biology where food condition at early stages of life affects year class strength of organisms under consideration. Although those studies on aquaculture are at a primary stage, promising results will appear in the near future in rapid succession.

FEDERATION OF MALAYA

2. AQUATIC RESOURCES APPRAISAL

(d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

A total of 1,900 tons, consisting mainly of *Euthynnus alleteratus affinis* Cantor, were recorded as having been landed by local fishermen in 1961. Of these, 1,400 tons were landed on the East Coast mainly by troll lines and 500 tons on the West Coast mainly by purse-seine and drift-nets.

During the years 1960-1962 the joint Japanese Malayan Company known as the Malayan Marine Industries Limited landed the following quantities of frozen tuna and other fish caught by Japanese tuna longline boats operating in the Indian Ocean:

1960— 8,720 tons	} roughly 20 percent consisted of marlins and sharks
1961—10,702.82 tons	
1962— 2,383.17 tons (up to July)	

The greater portion of the tuna were canned for export to European markets.

The freezing plant and storage facilities of this Company is being extended, and since January of this year the company has gone into the transshipment trade for frozen tuna between Penang and the United States and also between Penang and Japan. Two refrigerated ships are at present being operated as collecting depots in the harbour of Penang pending the completion of enlarged shore-based freezing and cold storage facilities.

The main species landed were, as reported at the 10th Session of IPFC, October 1962, the following:—

Thunnus alalunga
Thunnus thynnus
Parathunnus obesus
Neothunnus macropterus

No research has as yet been done on tunas in this country.

(ii) Mackerels

A paper entitles "A Note on the Scombroid Fishery in Malaya" by D. Pathansali was submitted to the Seminar on Scombroid Fishes held by the Marine Biological Association of India at Mandapam, India, in early 1962.

A two-year study on the hydrology and plankton productivity of the fishing ground for *Rastrelliger* off Pangkor Island has now been completed. Samples for salinity, oxygen, hydrogen-ion concentration and temperature determinations were taken from bottom to surface at five-fathom intervals of depth. Zoo- and phytoplankton were sampled separately in vertical, bottom to surface, hauls with two North Pacific Standard Nets, of Japanese standard GG 54 and XX13 respectively, fitted with flow-meters. The data are now being examined to see if hydrological and plankton productivity changes have any influence on the movements and fluctuations in numbers of *Rastrelliger* in the fishing ground. First indications from catch statistics are that increased landings were obtained during the period of the South-West monsoon, i.e. from March to July. This is a period of highest salinity and coincided with the period of high zooplankton but lower phytoplankton counts.

Biological investigations reported at the 9th Session of IPFC (IPFC/C61/Tech 28) were continued. Observations on gonad development confirm the observation of previous years, Stage IV, mature ovaries, appearing during the period October to May. There are indications that *Rastrelliger* spawns twice a year, and that spawning is not strictly simultaneous in all fish, there being differences between smaller and larger sized fish and between fish of the same size group (perhaps from different schools). Further observations are planned. Fecundity studies were limited due to the very small numbers of Stage IV ovaries available for study. Samples for length-frequency measurements were limited

by the poor landings of *Rastrelliger* during the latter and early parts of 1960 and 1961 respectively.

(iii) *Chanos*

Samples of *Chanos* fry and juveniles have been received through the kind offices of the Indonesian Government for distribution to field staff to assist them in surveys for *Chanos* fry resources. The Federation is very interested in *Chanos* culture but is handicapped by lack of knowledge of fry resources on our coasts.

(iv) Prawns and shrimps

Prawn-pond operation, which has been well developed and is being rapidly expanded in Singapore, has not as yet been practised in Malaya. As a necessary step towards its successful introduction to the Federation a general survey of the mangrove areas along the West Coast has been initiated, to find out the kinds of prawns present and also to select a suitable site for the establishment of an experimental-cum-demonstration station.

Over 25,000 acres of mangrove lowlands of Taiping District have been surveyed. The species of prawns present include all the important species found in the prawn-ponds of Singapore. The common species have been identified as follows :—

Penaeus indicus var. *longirostris*
P. merguensis
P. monodon
Metapenaeus monoceros
M. affinis
M. brevicornis
Penaeopsis ensis
P. stylifera, and
Parapenaeopsis sculptilis

Species of *Mysis* and *Acetes* shrimps are also present in considerable quantities.

Two sites have been selected tentatively as possible locations for the establishment of the experimental station. Expert advice and assistance from Singapore are being requested for finalising the selection. Work on the construction of the station is expected to be started in the early part of 1963.

Experiments on the rearing and culturing of the giant prawn, *Macrobrachium rosenbergii*

Since the Spring of 1961 the following progress has been achieved (a technical report on this project has been prepared by Dr. S.W. Ling, FAO/EPTA Inland Fisheries Biologist, for presentation at the 10th Session of IPFC).

1. Success in rearing larval stages to juveniles under controlled conditions has been accomplished. Work on the development of a technique for practical application (large scale production of juveniles) has made encouraging progress.

2. With good food and suitable water conditions prawn larvae reared in the laboratory start transforming into juveniles when they are about 40 days old and have completed 12 moults.

3. Living nauplii of *Artemia*, *Cyclops*, *Daphnia* and other small Crustacea, small pieces of fish, prawn, meat, cooked hens' eggs and small fish eggs have been found to be suitable material for food for the various larval stages.

4. As soon as the last larval moulting is completed the newly emerged juveniles lose the larval pelagic habits and become active crawlers. Juveniles can be easily acclimatized to live in fresh water.

5. Juveniles grow rapidly and may attain an average length of two inches when they are two to three months old.

6. Two-inch juveniles are suitable for stocking and culturing purposes.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton populations

North Pacific Standard nets were used in plankton studies (in relation to the *Rastrelliger* fishery off Pangkor Island) which were

terminated in June, 1961, after a period of two years. Concurrent samples for salinity, oxygen, hydrogen-ion concentration determination and temperature recordings, were taken. The data are now being analysed.

Weekly samples with a fine plankton net (Japanese Standard XX13) were taken since March 1961 to determine the abundance of cockle larvae and to study the plankton cycle in the channel between Penang Island and the mainland. Daily salinity and surface temperature records were also taken.

(f) Aquatic ecology

Ecological studies, with particular reference to soil composition and salinity variation, on both natural and cultured cockle beds, were conducted. Laboratory investigations on the effect of salinity variation were conducted to determine the range of salinity tolerated by cockles. These studies have assisted us in advising cockle culturers on the selection of suitable beds for culture.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(e) Stocking

Stocking of inland waters has been continued during the past year in two different aspects: (i) to spread and establish local popular species in various inland areas, and (ii) to introduce non-indigenous species into local inland waters.

(i) *Trichogaster pectoralis* introduced into the paddy areas in the coastal belts and swamps of North-West and Central Malaya, has established itself so well that it now forms a most important and welcome additional crop from the paddy fields. This is due to the presence of irrigation canals and ditches which contain water throughout the year and provide the necessary breeding stocks for the paddy fields when these become flooded. With the increase of irrigation schemes in the country similar conditions are becoming increasingly available in the other paddy

areas. This has made it possible to transplant breeding stocks from the North-West region to these potential fish-producing areas, especially those areas in North-East Malaya which for the first time are producing *Trichogaster pectoralis*.

The irrigation canals also form a suitable habitat for *Puntius javanicus* introduced originally from Indonesia. Rough release of fingerlings of this species has been carried out over the past years in Province Wellesley. *Puntius* being essentially a vegetarian will thrive on the algae and other aquatic microphytes in the canals and will thus help to control weeds in these areas to a certain extent. There have already been reports of catches of this species from irrigation canals in at least one area in Malaya.

Puntius javanicus in combination with the common carp and *Tilapia mossambica* have also been used for stocking of disused mining pools. These pools which result from tin mining operations range from 1 to 10 acres in size and the older ones invariably contain a stock of trash fish. Being small enough to manage they are usually treated with a piscicide (endrin in the form of Shell Endrex) to remove the existing stock before fingerlings of the above types are introduced.

(ii) Ever since its first introduction into Malaya in 1953, *Catla catla*, one of the Indian major carps, has been shown to be a fast grower and capable of growing well under local conditions. In certain fertilised maining pools a growth of one lb. per month has been obtained. Specimens kept in ponds over a period of six years had fully developed ovaries but these regressed in time since conditions were unfavourable for spawning.

It is known that the *Catla* in India spawns in inundated areas in rivers during the flood season and it has been possible there to induce spawning by simulating such conditions. It is therefore felt that similar conditions may exist in our lakes, especially lake Chendroh, when the shores become inundated during the flood season and that the *Catla* may in time respond.

Some 900 fingerlings of Catla were therefore stocked in two lakes in 1961. These were obtained as fry from India and grown to fingerling size in ponds before stocking.

A second stocking with imported fry from India will be undertaken soon. These fry which were obtained through the help of Director of Fisheries, West Bengal and Dr. Bhimachar, Director of the Central Inland Fisheries Research Institute, Barrackpore, India, this year are now being kept in ponds to bring them to fingerling size before release. They are fed with coconut cake and rice bran.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish Culture—general

Fish culture is becoming more popular in Malaya and although originally confined to the Chinese, with their traditional carp ponds adjacent to pig sties, the practice is rapidly spreading among the Malaya section of the population—without of course the pigsties. This has been made possible through the extension service of the Government's Fisheries Division.

In order to provide a sure start for beginners the Division maintains three fry-producing stations mainly for the production of "fish seed" for free supply to fish farmers. Fry produced at these stations consist of *Puntius javanicus*, *Cyprinus carpio*, *Tilapia mossambica* and *Osphronemus goramy*. During the years 1960 and 1961, 269,340 and 509,790 fry respectively, of the various types were produced mainly for distribution to farmers. During 1962 (i.e., up to June) the number supplied was 225,170. In addition to free supply of fry of the above species which are transported again free of charge to the pond areas, the Government also undertakes the following:

- (a) The institution of training course for existing fish farmers and also for would-be farmers.

- (b) Technical help is given for clearing of disused mining pools and ponds of predatory fish. A free supply of endrin is given and the work is usually supervised by a member of the field staff.

Whereas the Chinese traditionally maintain a stock of Chinese grass carp, silver carp, bighead carp and common carp in combination with pig farming, the practice among the Malays has to be somewhat different in that pig-rearing is out of the question. Cattle sheds have been constructed close to the fish ponds for a supply of manure in some cases.

Chinese carp fingerlings are somewhat expensive in Malaya and farmers especially beginners are not advised to purchase them for culture. Instead they have been encouraged to culture the locally available types in the following combination: *Puntius javanicus*, common carp, *Tilapia mossambica*, *Osphronemus goramy*. The stocking rate has been in the region of 1,800 fingerlings of the four types per acre usually in the following ratio:

<i>Puntius javanicus</i>	50%
<i>Cyprinus carpio</i>	25%
<i>Tilapia</i>	20%
<i>Goramy</i>	5%

The stocking rate has been largely influenced by the popularity of the various types of fish. *Puntius javanicus* has gained much popularity ever since its introduction as a pond fish from Indonesia into Malaya and farmers have been insisting that they be supplied with more of this species for culture. However with the above rate of stocking it has been possible to get a production of between 1,300 and 2,000 lbs. per acre for a period of 10-12 months. The *Tilapia* will of course breed in the pond and the production of 1,300-2,000 lbs/acre is the weight of the sum total of all the fish including the small *Tilapia*. As a matter of fact in such ponds there is a regular cropping of the bigger *Tilapia* all the time, although the ponds normally drained out once a year.

The number of fish ponds in the country has been steadily increasing over the past years. In 1959 there were 1,407 ponds covering 857.61 acres, and in 1960 the number was 1,850 (1,178.14 acres). By the end of 1961 the number rose to 2,556 (1,452.42 acres) and up to June 1962 the total under record is 2,909 covering 1,637.28 acres.

In addition to the above there were 98 disused mining pools covering 276.61 acres in 1961 which have been stocked with fingerlings for the benefit of the general public.

(f) Handling and transport of "fish seed"

Large numbers of fish seed are handled by the staff of the Fry Stations annually in supplying fish farmers with a free supply of "seed" and in stocking of inland waters.

It was originally thought that owing to the usually limited distances involved in the transport of "seed", it would be possible to transport them in open 8-gallon containers. However since the requirement of farmers vary considerably it was found more convenient to pack each individual's requirements in separate containers at the fry stations so as to eliminate the necessity of recounting at the destination. This of course would mean the use of far too many containers and would result in waste of space. It was therefore decided to use smaller containers and to pack the fry under oxygen, so that containers could be stacked in the vehicle.

The containers presently being used are 4-gallon kerosene tins with a polyethylene bag within. Each tin contains one gallon of water and is topped with oxygen. Insulating materials are not used either within or outside the containers except where the tins have to be placed close to the engine of the vehicle in which case a wooden platform is used to support the tins off the heated van floor.

The quantity of fry per tin varies according to the size of fry and the distance

to be transported. For fingerlings of 1½-2 inches in size, 500 per tin can be transported for up to 10 hours without any appreciable mortality. Where the journey exceeds 10 hours the number is reduced to 400. For larger fingerlings, especially those of the giant goramy which are distributed usually at a 3-inch size, 30 per tin will withstand a journey of up to 20 hours whereas for journeys of less than 10 hours, the number is increased up to 50.

In all cases the fry are conditioned for about 24 hours in concrete tanks with flowing water before transporting them.

(g) Disease and parasite control

The recent step-up in pond culture in this country has brought into focus once again the importance of disease control in pond-fish. Wherever Chinese carp is intensively cultured, there are reports of outbreaks of disease. Since so little is known of fish diseases among cultured fish in this country, the visit of Professor Adams of the University of British Columbia to Malaya for six months' work on fish parasites is most welcome. He is being supplied with specimens of sick fish and has also visited fish ponds around Kuala Lumpur. So far there is as yet no clue to the disease which so often attacks Chinese carp of 1-2 lbs each in this country. There are no external parasites on the sick fish and no internal parasites either. It may be a bacterial disease.

(j) Special forms of aquiculture

(i) Oyster culture

Oysters are found abundantly in the inshore waters attached to rocks and wharf pilings and other hard structures. The common rock oyster (*Ostrea cucullata*) is collected by chipping, wherever they occur particularly at low water of spring tides, schucked and sold to the local markets. A second species (unidentified) found in the Muar River, near its mouth, grows to a good size and is of good quality. Collection is by diving as the

oysters are found only on the river bed. The number of oysters collected is small and serves the local markets.

To improve on the present practice of oyster collection and, if possible, to establish oyster culture in this country, the services of a Japanese expert on oyster culture was obtained under the Columbo Plan, 1961.

Some results of his investigations carried out to date are as follows:

1. Areas for spat collection are limited by the silted conditions of our inshore waters, and the abundance of barnacles and mussels which attach themselves to the collectors and thereby prevent the attachment of oysters, and where oysters have attached themselves, to smother them.

2. Areas for culture of the collected spat are also limited for the reasons given above.

3. It has been necessary to collect spat at one area and to transfer the collectors (with spat) to another area for culture. This has been done successfully but the method obviously imposes economic considerations which will be difficult to overcome, if oyster culture is to be established as an industry in Malaya. However, it is hoped by transferring spat from the present natural beds to build up a breeding stock in the Straits of Johore which has been found up till now to be a most suitable area for fattening of oysters.

4. The oysters now being cultured are of two species, both of which are suitable for culture.

The results achieved so far are encouraging even though the practice of oyster culture would have to be limited to a few suitable areas only.

(ii) Cockle Culture

From a study of the biology and ecology of the economically important cockle, *Anadara granosa* L., the following observations are made:

1. **Breeding:** The main breeding season of the cockle is from July to October at Penang Island, although there is some spawning in other months of the year. Spatfalls from these spawnings are limited and not provide spat to stock culture beds.

Observations on spatfall of cockles in Perak indicate that spawning takes place later than in Penang, mainly during October and November. The almost uniform size of spat shows that spawning is restricted to a shorter time period in Perak than in Penang where the duration of spatfall is longer, July to November, and a greater size range in spat has been observed.

2. **Growth:** Spat sown on three culture beds at a mean size of 5 mm and ranging from 2-12 mm, attained the legal marketable size of 1 inch (about 26 mm) the mean size of the population in 6 months.

Growth rates of cockles taken from various levels of the beach do not differ, but there are indications that density does affect the growth rate.

The cockle appears to feed on organic detritus and on phytoplankton as observed by examination of faecal pellets. The stomachs taken for examination were invariably empty.

3. **Sub-stratum:** The cockle is known to colonise only fine soft estuarine or brackish muds. An analysis of soil particle size of soils from natural beds show that about 95 percent by weight is composed of soil particles less than 0.125 mm in size and of this figure more than 60 percent by weight is silt.

Only a few other pelecypods share the habitat of the cockle. Amongst these, *Pitar acuminata* Sowerby is important because its ecological requirements appear to be similar to that of the cockle and as such could be used as indicator species in selecting suitable sites for cockle culture.

4. **Toleration to salinity variation:** The cockle was not affected by a sudden change

in salinity from 100 to 80 percent sea-water—as determined by filter feeding rates. A change to 60 percent sea-water greatly reduced the filter feeding rate and a change to 40 percent resulted in the closure of the valves of the cockle.*

It was observed that if the cockle is subjected for prolonged periods to water of low salinity, 60 and 40 percent sea-water, it

gradually becomes acclimatized, and its activity (gape of valves and extrusion of foot) particularly in 60 percent sea-water, is improved. This is confirmed by the increased filter feeding rate shown by cockles subjected to 60 percent sea-water for about 16 hours. These observations indicate that the cockle, like other estuarine or brackish water inhabitants, is able to tolerate wide changes in salinity.

PAKISTAN

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

A large number of papers on fish and fisheries have recently been published by the Directorate of Fisheries, West Pakistan. In addition, special articles are written by the officers of the Directorate for discussion at the Annual Fishery Officers Conference, and are published in the form of Proceedings of the Fishery Officers Conference. The Directorate also publishes the Annual Reports as well as pamphlets in English and local languages. Annual Report for the year ending June 1961 has already been published; the one for the last year is under preparation. Similarly Proceedings for the Annual Conferences held in 1960 and 1961 have been published.

2. AQUATIC RESOURCES APPRAISAL

(b) Appraisals, surveys or synopses of river basins (inland) or individual waters (inland)

In West Pakistan regular surveys of inland waters have been undertaken for the last two years. Preliminary surveys of the type conducted are essential to find out the location of water areas, their extent and their condition in order to plan their management. Two booklets containing accounts of the surveys have been published, and it is planned to publish every year whatever additional information is collected.

(d) Reviews or synopses of aquatic forms of economic importance

(i) *Hilsa*

(a) The Indo-Pacific Fisheries Council at its 3rd Session held in 1951 at Madras suggested a co-ordinated research program on *Hilsa* fisheries. A special Sub-committee consisting of representatives of India, Burma, Pakistan and the Secretary of the Council met at Calcutta, during September 1952. The Sub-committee recommended a co-operative research program, and for its implementation, work is now in hand both in East and West Pakistan under two separate schemes. The details of the work follow.

(b) Races and stocks

Racial studies have been carried out. A detailed study of both meristic and non-meristic characters show that there is only one species of *Hilsa*, namely *Hilsa ilisha* (Ham.), in the rivers of both East and West Pakistan.

(c) Migrations

There are two runs of *Hilsa* in East Pakistan. The summer run occurs from mid-July to October and the winter run from about mid-December to mid-February. In West

* (100, 80, 60 and 40 percent sea-water correspond to salinities of 29, 23, 18 and 12 parts per thousand respectively).

Pakistan, there is only one run of *Hilsa*. *Hilsa* used to ascend the river Indus in the middle of January before the construction of Ghulam Mohammad Barrage which has now been extended by about a month. It completes its return journey to the sea after spawning by the mid-

dle of October. During the rest of the year *Hilsa* is not found in the river or in the fore-shore areas.

(d) Recovery of tagged fish

In East Pakistan, three tagged fish of West Bengal were caught as detailed below:

Date of capture Day. Month. Year	Place of capture	Serial No. of the tag	Total length of the fish (inches)
2. 8. 60	Kola fishing centre in the river of Atai Khulua	P-363	14 $\frac{1}{2}$
18. 1. 61	Belgachi fishing centre of river Padma	P-785	12 $\frac{1}{4}$
28. 11. 61	Bara Megharchar (near Hizla)	P-472	13 $\frac{3}{4}$

(e) Production and fluctuation in crop

Data on the gear, craft and manpower employed in the *Hilsa* fishery have been recorded. Data on production of *Hilsa* for East Pakistan has been collected and is about 95,300 tons. Statistics on *Hilsa* collected from West Pakistan are as follows:—

Year	Catch in Million Pounds
1955	4.2
1956	4.4
1957	5.1
1958	6.0
1959	3.2
1960	4.6
1961	4.3 (2150 metric tons)

From the above, it appears that 1958 was a year of bumper crop followed by a lean crop in 1959. There may be two reasons for this:

- (1)—A five-year biological cycle resulting in a bumper crop followed by a lean crop in 1959.
- (2)—Construction of Ghulam Mohammad Barrage, whose initial effect was felt in 1959. This barrage on the River Indus is 150 miles upstream from the sea. The effect of a five-year cycle is to be evaluated by continued collection of data for two more of such expected cycles. As regards the effect of the Barrage, it is probable that the fish could not adapt itself to the changed environment after the operation of the Barrage in 1955. The failure of *Hilsa* to breed in an abruptly changed environment resulted in a small return of young breeders in 1959. They have slowly adapted, with the result that there is, in some

way or the other, a limited breeding of *Hilsa* either in the estuarine area near the mouth of the River Indus or in the 150-mile stretch of river below the Barrage. Were it not so, *Hilsa* stocks would have been—as pointed out by Mr. G.B. Talbot—reduced by 1959-61 to one-third of the 1955 stocks. Whether the crop fluctuation referred to above, has resulted from a five-year cycle or from the construction of the G.M. Barrage and its after-effects will be confirmed after further statistics are recorded.

(f) Fish passes

A number of experiments were made to check the utility of pool-type fish passes constructed at the barrage on the River Indus, but it has been found that the present fish passes are not negotiated by *Hilsa*. The Government has therefore, moved that in the future fish-ladders should be designed during the planning stages in consultation with fish-ladder experts.

(g) *Hilsa* culture

No artificial breeding of *Hilsa* has been attempted.

(h) Endemicity of cholera as related to *Hilsa*

There is no indication in Pakistan to support this hypothesis.

(ii) Mugil

Taxonomic work on mullets has been performed. The following species have been recorded from Karachi-Sind Coast:—

Mugil speigleri, *M. waigiensis*, *M. cephalus*, *M. tade* and *M. dussumeri*.

Mugil waigiensis is available throughout the year in the aforesaid area, but *Mugil cephalus* occurs only in winter.

(iii) Prawas and Shrimps

The Government has sanctioned two investigation schemes both in East and West Pakistan during this period and the work on their life-history and distribution is being undertaken.

In addition, the Government has arranged a team of Japanese experts under the Colombo Plan, who are continuing shrimp investigations in East Pakistan (Khulna area).

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(d) Oceanography

International Indian Ocean Expedition, 1961-62: The cruise was sponsored by the National Committee of Oceanic Research for SCOR in Pakistan.

The cruise started by P.N.S. ZULFI-QUAR on 5 December 1961 and continued to 18 April 1962. It started from Karachi, proceeded off the West Coast of India, West, South and East Coast of Ceylon and then to Chittagong along the International Shipping route. From Chittagong an extensive sampling programme was undertaken in the Bay of Bengal along the coast of East Pakistan.

The objective of the cruise was the qualitative study of plankton populations in the Arabian Sea, Indian Ocean and the Bay of Bengal. Samples were taken from 6 fathoms to 100 fathoms at available depths at about 135 stations. These are now being analysed jointly by Karachi University and the Marine Fisheries Department, Karachi. During the cruise, samples of sea-weed and mollusks were also obtained in the Sunderbans and the Passur River mouth area.

In the Dubla Islands near the Passur River mouth, Lat. 21°44'N, Long 89°35'E (East Pakistan), shells of dead oysters were found. It is presumed that a oyster bed might be situated somewhere near the island. Extensive search for the bed could not be made for want of facilities and time.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

Mancher Lake is the biggest lake in Pakistan. Some parts of the lake are covered with submerged and emergent vegetation, others are free. The lake came under the management of the Directorate of Fisheries, West Pakistan, a few years ago. As the result of proper conservational measures and scientific management the production and income has increased about four times. Arrangements are being made to take up more lakes for improvement as the experience gained has clearly shown that these are capable of giving much better income and production by proper management.

A number of dams are under construction and a few of them have already been completed. The Karanafully dam in East Pakistan and Baran dam, Warsak dam and Rawal dam in West Pakistan have already been stocked with fish, and more fish are being introduced. If environmental conditions are found favourable and suitable fish in sufficient number are introduced, it should be possible to make these waters highly productive.

4. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish culture—general

People living in the interior prefer freshwater fish to marine fish and it has become a problem to feed the flourishing towns with large populations. Arrangements are being made to run extensive fish farms near such towns in order to augment the normal imports from surplus districts.

Sufficient fallow areas exist which after embanking can be converted into good fish farms. Necessary projects have been prepared which will be implemented shortly.

(d) Studies of fish breeding, including genetics

Attempts were made to induce fish to spawn as the result of injection of pituitary

extract but without much success. Supply of pure seeds in the right proportion is very essential for stepping up fish production in impoundments.

(f) Handling and transport of "fish seed"

In East Pakistan the fertilized eggs of major carps, viz., *Catla catla*, *Labeo rohita* and *Cirrhina mrigala*, are collected from the river Halda in the Chittagong district, and tiny fry from other streams of the Province. The ova are hatched in improvised hatcheries prepared annually for the purpose. When the fry are four days old, they are transported in earthenware containers to places where these are required for nursing and rearing before introduction into the stocking ponds. The fry collected from the streams are transported as soon as collected.

In West Pakistan, fingerlings used to be collected and transported by fish carriers made of galvanised sheets fitted into a specially designed truck or by jeeps and pickups. From last year, in place of young fish, fry are collected as soon as these can be gathered and carried long distances by any available means. The change has given much better results and very large number of fry have been transported at nominal cost. Up to last year there was a single special fry transport truck but this year the number has increased to five and in the course of the current year it will rise to 14. Special attention is now being paid to the collection of fry beginning from the earliest stage, their transport when quite small and their nursing in the neighbourhood of the stocking ponds. In this way it is expected that in course of time it will be possible to stock most of the village ponds, lakes, abandoned canals, dams and other perennial water areas.

In East Pakistan the introduction of polythene bags in lieu of the conventional earthenware utensils appears to bear promise of good returns to the fish fry trade. Experiments have shown that young fish up to even the fingerling stage stand very well

journeys lasting over 72 hours without oxygen. Experiments are being conducted to find out whether narcotised fish will withstand transport successfully.

(g) Disease and parasite control

The major carps are sometimes attacked by *Argulus*, but such cases are rare in West Pakistan. Recently an epidemic broke out in an impoundment of 12 acres known as Hiran Minar Fish Farm and the major carps began to die. A good number of fish were netted and given chemical baths but the

results were not very satisfactory. When other attempts failed, all healthy marketable sized fish were caught by seines and disposed of, but carp-minnows and other small sized fish could not be netted by nets of legal-sized mesh. In order to eliminate the undesirable fish as well as the fish enemies, the water was treated with 0.008 parts of Endrin per million parts of water. Results were excellent and all undesirable animals perished. The water was stocked later with major carps which have since registered very good growth.

REPUBLIC OF THE PHILIPPINES

2. AQUATIC RESOURCES APPRAISAL

(b) Appraisals, surveys or synopses of individual waters (inland)

(i) A program for the continuing study of the limnology of Laguna de Bay, the largest lake in the Philippines (90,000 hectares), has been launched with the establishment of the Freshwater Fisheries Investigations Unit Laboratory at Los Banos, Laguna. This laboratory is partly supported by FAO of the U.N. and the Philippines Bureau of Fisheries. Data on the physical, chemical and biological characteristics of the lake in correlation with fisheries and related industries such as duck raising have been collected since November 1961. It is envisioned to have this work continued as a pilot project and training center for workers who will go into inland fisheries work.

The organizational set up and recruitment and training of personnel is being completed under a United Nations FAO Expert.

(ii) The development of the Agno River System in north Central Luzon, Philippines by the construction of a series of reservoirs for hydroelectric power, water conservation and irrigation is being followed closely by fish stocking. Two reservoirs, Ambuklao and Binga, have been built and three more are planned. It has been observ-

ed in these reservoirs that the black bass-bluegill combination has been established successfully, although selective exploitation has lately hampered the balance of the fish populations toward an overabundance of forage species.

(d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

Data collected from the three longline cruises of the M/V MALASUGUI in 1960 together with the data collected by the research vessels S.F. BAIRD, T.N. GILL and D.S. JORDAN of the Philippines Fishing Program of the U.S. Fish and Wildlife Service from 1947 to 1949 were analyzed, partly treated statistically, interpreted and finally consolidated into a paper entitled "A contribution to the Biology of Philippines Tunas". This paper was submitted to the World Scientific Meeting on the Biology of Tunas and Related Species, La Jolla, July 2-14, 1962.

Some of its important findings follow:

1. The tuna catches of the M/V MALASUGUI were mostly of yellowfins, bigeye, a few albacore, several species of spearfishes and sharks.

2. For the three exploratory cruises of the MALASUGUI, yellowfin tuna predominated in the catch and males outnumbered the females by not less than 2 to 1 in the majority of the operations.

3. The range in size of the yellowfin tuna appears to indicate schooling by year classes.

4. The wide range in size of the bigeye appears to indicate that fish of several classes are taken at the same time.

5. The hook rates for the yellowfin, bigeye and albacore taken per hundred hooks were determined to be higher (3.03) for the first trip of the M/V MALASUGUI but low and almost identical for the second (1.99) and third trips (1.89).

6. The difference in the total gill raker counts between the yellowfin and the bigeye lies in the mean number of gill rakers in the lower arch: 20.27 for the yellowfin and 18.61 for the bigeye.

7. The length-weight data analysis revealed that although a slight difference in the weight of the fish is noticeable between the sexes, an appreciable difference in weight does not exist.

For the yellowfin tuna the antilog equations of the weight-length curves were found to be for the 99 males,

$$W = 0.00002352 L^{2.84682}$$

and for the 43 females,

$$W = 0.00004322 L^{2.87651}$$

For the bigeye, the antilog equation of the weight-length curves for the 27 males is

$$W = 0.00004786 L^{2.94430}$$

and for the 28 females is

$$W = 0.00001721 L^{2.74669}$$

8. There is a very close similarity in the feeding habits of the yellowfin and the bigeye tunas. About one-third of the food consists of fish, one-third mollusks mostly squids, and one-third decapod crustaceans. The yellowfin tuna seems to favor carangids, snake mackerels and cutlass fish more than any other fish species for its diet. On the other hand, the bigeye tuna relishes mostly the squids, while no particular fish group is preferred.

9. The skipjack, yellowfin, yaito tuna, dogtooth tuna and scaly tuna which were taken by the research vessels of the Philippines Fishery Program of the U.S. Fish and Wildlife Service from 1947 to 1949 were studied for their length-weight relations and gonad indices. The length-weight relations study showed the close relationship between the weights of a given size of the males and females of each species.

The antilog equations of the length-weight curves for each of the troll-caught tuna species are as follows:

Euthynnus yaito or yaito tuna

$$M \quad W = 0.00001358 L^{2.83768}$$

$$F \quad W = 0.00002150 L^{2.94854}$$

Katsuwonus pelamis or skipjack

$$M \quad W = 0.00003267 L^{3.09569}$$

$$F \quad W = 0.00001976 L^{2.96482}$$

Neothunnus macropterus or yellowfin

$$M \quad W = 0.0008047 L^{2.73643}$$

$$F \quad W = 0.0001028 L^{2.78797}$$

Gymnosarda nuda or dogtooth tuna

$$\text{Sexes combined} \quad W = 0.00007325 L^{3.20623}$$

Kishinoella tonggol or scaly tuna

Sexes combined

$$W = 0.0001915 L^{2.30827}$$

10. The monthly troll catch of the five different species of tuna by the Philippine Fishery Program research vessel S.F. BAIRD from 1947 to 1949 showed that the months of March to July make up the tuna season in the Philippines.

11. The monthly mean gonad indices of the five species of tuna caught from 1947 to 1959 were determined by the Kikawa method with the use of the formula $G.I. = W_0/L^3 \times 10^4$.

12. A gonad index (G.I.) of less than 3 was found for the majority of the yellowfin and yaito tunas while a G.I. of more than 3 was found in the great majority of the skipjacks. For the dogtooth and scaly tunas, no conclusion could be safely made due to the limited number of specimens studied.

13. The gonad index study of the first three aforementioned species indicated that even after a fish has reached a minimum length representing length at first maturity with a G.I. of 3, the gonad may decrease in weight during the non-spawning season, which may be accounted for by the period of rest undergone by the ovaries in preparation for the next breeding season.

14. The skipjacks and yaito tuna are more widely distributed over all Philippine water than the dogtooth and scaly tunas which seem to be confined to a few fishing grounds in the southwestern parts of the Philippines.

(ii) Mackerels

Studies on *Rastrelliger kanagurta* and *R. neglectus*, which are caught largely by the basnig or bagnet, are being continued, particularly on specimens taken from the catches landed at Rosario, Cavite (Manila Bay). It is

interesting to note that these fish are available to new otter trawlers which have been provided with twin engines, and are, therefore, fast moving.

Two species of *Pneumatophorus* are very common in the mackerel catch together with *Rastrelliger*. The main difference between the two genera is in the number of the ceratobranchial gill rakers which number 12-13 in the former and 20-22 in the latter.

Observations on the fishery seem to indicate that in both species of *Rastrelliger*, the males and females tend to segregate from each other while in the early stages of maturity (Stages I and II) and mix with one another only when they become older, starting from Stage III. There is no definite pattern of sex ratio in both species.

The chub mackerel specimens that range from 100-150 mm were all found to be in stages I and II. Stage III is found only in specimens no less than 150 mm in total length. Specimens in stages IV and V were found among the samples of *Rastrelliger kanagurta* from Rosario in March 1961. Specimens of *Pneumatophorus japonicus* from Palawan were found to be in stages IV and V during the month of February. Those of *P. australasicus* begin to mature only in March.

(iii) Sardines

The identification of the four species of the gonad *Sardinella* was based on the total number of gill rakers. It was found to be largest in *Sardinella longiceps* and smallest in *S. sirm*, *S. fimbriata*, an inshore form locally known as "tunsoy", was the most abundant species in Manila Bay in 1961 followed by the pelagic form, *S. longiceps*, or "tamban" mostly from Palawan waters. Although location of the definite spawning areas is still undetermined, there are already indications, however, that the different species spawn in the open sea as shown by the fact that the eggs and young are collected from parts distant from the shore. *S. fimbriata* appears to mature in September.

The four species of sardines seem to reach maturity at different size groups. For *Sardinella perforata* and *S. sirm*, the highest stage of maturity attained is stage VI while for *S. fimbriata*, it is stage V. For *S. longiceps*, stage III is by far the highest maturity stage seen.

Sardines, like other pelagic fish species, show a yearly cycle in their abundance. The young specimens enter the fishery about the end of January and become available up to the end of June. Their gradual growth and increase in length, month after month has been noted.

The fat analysis of three *Sardinella* species was started during the latter part of August 1960. Since the experiments are rather slow in progress due to lack of water supply, the data are still too meager to be able to draw definite conclusions. However, a study of the data on hand gives indications that *S. longiceps* has the highest fat content (17.37 percent) regardless of source, sex and stage of sexual maturity. This is followed by *S. fimbriata* (8.17 percent) and by *S. sirm* (7.88 percent).

(iv) *Chanos*

See Section 5(a)

Please also refer to: Report of the Chanos Sub-Committee to Technical Committee I, IPFC, at the 10th Session of IPFC, 1962 by Herminio R. Rabanal (Philippines) Chairman of the Chanos Sub-Committee.

(v) Bottom fishes

(A) *Slipmouths*

The studies on *Leiognathidae* with particular emphasis on availability and accessibility in Manila and San Miguel Bays are still in progress. However, only the catches of the commercial otter trawls and the fish corrals are being utilized. A manuscript entitled, "On the availability of fish of the family *Leiognathidae* Lacepede in Manila Bay and San Miguel Bay and on their accessibility to controversial fishing years", is now in press. Of the 17 species of slipmouths found in Philippine waters, *Leiognathus smithursti* has been reported

for the first time in Philippine waters, and only in San Miguel Bay.

In the first corral samples from Navotas, Manila Bay, *L. splendens* dominated the catch in all months. In the otter trawl fishery, the collected biological materials reveal that each of the abundant species, *L. lindus*, *L. splendens*, *L. rucomius*, and *L. insidiator* had a period of main abundance in the catches. The trawl fishery very likely depends on slipmouth stocks which are replaced by different species from time to time. This happens in a rhythm which may correspond with that of a biological year but may also last longer or may be accidental in character. Fluctuations in the accessibility of fish stocks being formed by a single species cannot be ascertained from the catch statistics alone since the catch records show the presence of too many species, sorting of which is practically impossible in commercial fishing operations. Extensive research work is therefore necessary to recognize the presence of wide fluctuations in the catch.

In both Manila and San Miguel Bays, the larger length groups of the more abundant species are generally found in the deeper areas of the bay. However, *L. bindus*, *L. insidiator* and *L. equulus* are normally more abundant in deeper parts of Manila Bay than the other species. In San Miguel Bay, for *L. splendens*, *L. bindus*, and *L. rucomius* the larger length groups were found only outside the bay.

The collected material indicated that the younger age groups prefer to stay in the shallower areas. Several months after their first appearance in the shallow water fishery, they normally leave the area, having grown considerably in the meanwhile, and migrate to the deeper parts of the bay. Since each species has a different time of entering the fishing ground and leaving for deeper waters to breed, a new group is always available in the different fishing grounds.

Quantitative and qualitative studies of the stomach contents of the slipmouths reveal that *Leiognathus splendens*, *L. daira*, *L. bindus*, *L. blochii*, *L. leuciscus* and *L. equulus* feed on benthic

nic organisms as well as on zooplankton. On the other hand, *L. insidiator* and *L. rucomius* prey on purely animal plankton.

(B) Croakers

Five species of the family Sciaenidae are found in Manila and San Miguel Bays. Of these, *Pseudosciaena aenea* has been observed as the most dominant and commercially important species. In Manila Bay, this species constitutes almost 80 percent of the total catch. *Otolithes argenteus* is found only in San Miguel Bay. From the data on length of specimens, the ranges in length have been tabulated for the corresponding maturity stages of the different species. They appear to be more common in Manila Bay in July, September and October. They seem to mature in July. So far, the advanced maturity stage attained by some specimens from Manila Bay is stage V in 1961 and stage IV during the first half of 1962. For the San Miguel Bay samples, the most advanced stage reached in 1961 and also during the first half of 1962 is stage IV. Other biological data are still being collected, computed and analyzed.

Pseudosciaena aenea is a predator depending mostly on fish and crustaceans.

(C) Lizard fishes

Of the seven species of lizard fishes found in Manila Bay and San Miguel Bay, *Saurida tumbil* is the only species of commercial importance. An increase in the abundance of lizard fishes during the months of February, April, July and October of every year has been assessed through the use of the commercial otter trawls in Manila Bay. Bigger and more mature lizard fishes have been found to be more abundant in the deeper areas than in the shallower areas of Manila Bay. In the mature ovaries, two prominent batches of eggs can be distinguished. This species spawns twice or even thrice a year in the deep areas which may be near the opening of Manila Bay or outside the Bay upon attaining sexual maturity at a length of 17-19 cm for the male and 19-21 cm for the females. However, no definite age estimate can be given as yet.

In the study of the sex ratio, it was found out that in most of the lizard fishes the males are more abundant than the females. It is only in the case of *S. undosquamis* that the females are more numerous than the males. The sex ratio tends to balance in shallower areas.

Fishes, mollusks and crustaceans constitute their most important food items.

(D) *Gerres*, *Pomadasys*, *Apogon*, Flatfishes and *Pentaprion longimanus*

The majarras (*Gerres* spp.), pomadasids, cardinal fishes, flatfishes and glassfishes also constitute a part of the catch of the commercial otter trawls. Although definite conclusions cannot yet be made for these different groups of fishes, some observations and findings are worthwhile mentioning.

Four species of majarras have been found in Manila Bay as well as in San Miguel Bay. They are available during the months of July to September. The fish in Manila Bay mature earlier than those from San Miguel Bay. However, they have almost the same average length. The majarras are plankton feeders. Fish eggs occur most abundantly in their stomachs; these are followed by fish scales, bivalves and gastropods.

Two species of pomadasids have been studied: *Pomadasys argyreus* and *P. maculata*. The former is abundant most of the time while the latter occurs rarely. Specimens that are brought to the laboratory range from 60 to 160 mm in total length. The maturing stages begin to occur when the fish are 80 mm in length. The males are generally one stage behind the females in sexual maturity at any time. Mature individuals occur in the sample almost throughout the year. Their food consists mostly of copepods, annelids, fish eggs and phytoplankton.

The cardinal fish under study have been tentatively identified as *Apogon fasciatus*, *A. ellioti*, and *Apogon* spp. The larger forms of these species are edible while the small ones serve as raw material for fish meal and fish sauce *patis* manufacture. Most of the female

specimens examined showed maturity stage V with a few in stage VI. The male specimens however are only of stage II. There are indications that breeding takes place throughout the year. This group feeds on crustaceans, fishes and fish eggs. Phytoplankton occurs in a small number.

Of the flatfishes landed by the commercial otter trawls, the "kalangkas", *Psettodes erumei* and the "dapang tsinelas", *Cynoglossus bilineatus* are of highest commercial value because they grow up to 350 mm in total length. The rest are small and used commercially for fish meal or patis-making. Specimens studied in the laboratory ranged from 60 to 350 mm long with maturity stages ranging from stages III to VIII.

A marked difference between the flatfish populations of Manila and San Miguel Bays exists; some species found in Manila Bay are not found in San Miguel Bay and vice versa. Flatfishes are observed to be abundant during the months of March and April in Manila Bay and during the months of November and December in San Miguel Bay.

Their main food consists of protozoans (especially foraminiferans), sponges, crustaceans, annelids, fishes and some phytoplankton.

A single species of *Pentaprion* or glassfish has been identified from the samples taken from both Manila and San Miguel Bays. This is *Pentaprion longimanus*. The highest maturity stages so far encountered among the specimens studied were stage IV and V when 11.1 to 14.2 cm in total length. Based on the size of the fish caught, it was found that those caught in Manila Bay are bigger than those caught in San Miguel Bay.

(vi) Prawns and Shrimps

The materials used in the prawn and shrimp investigation are preserved samples taken from commercial otter trawls operating in Manila and San Miguel Bays and freshwater samples taken from the Dagat-dagatan Fisheries Research Station fishponds. The following species have been identified from

Manila Bays: *Metapenaeus monoceros*, *M. intermedius*, *Penaeus semisulcatus*, *P. merguensis*, *P. canaliculatus*, and *Parapenaeopsis maxillipedo*.

Specimens of *P. semisulcatus* are found to be small during the months of July, August and September, and largest during the dry season, i.e., January to April. The females of this species are apparently bigger than the males but the size difference is not significant. The most important species grown in fishponds (known as "sugpo") *P. monodon* is very similar to *P. sulcatus*, both of which grown to large size in both Manila Bay and San Miguel Bay. Both species are caught at the same time most of the year. The female *P. monodon* grows larger and with a more rapid growth rate than the male so that in the end, they would have greater commercial value if they could be segregated from the males before releasing them in the fishponds.

The largest-sized shrimps of all species under study are caught more during April and May than at any other time of the year. It seems that these groups are the mature ones which are on their breeding migration to the deeper waters outside Manila Bay.

During June to September, the young shrimps enter the shallow portions of the bay and enter estuaries, rivers and fishpond where in they attain maturity for the rest of the year. This migration coincides with the fresh water run-off from the estuaries.

In Manila Bay, there seems to be two young shrimp stocks which migrate into the freshwater areas during the year thereby replacing the larger shrimp stock which move out from estuaries when they are from 80 to 90 mm in length. This size group stays in the greater part of the bay for 3 to 6 months; that is from April to July. During this time when they are available to the fishermen and trawlers, they attain sexual maturity, after which they move out of the bay into the deeper portion of the sea to breed. The next generation of young shrimps then moves into the bay and follows the migration pattern to the estuaries.

The food of shrimps consists mainly of benthonic and planktonic foraminiferans, zooplankton, phytoplankton and other benthonic organisms. Among the benthonic foraminiferans *Rotalia*, *Nonion* and *Bolivina* occur most often in all the species studied. Among the planktonic foraminiferans, *Globigerina* is the most encountered. Among the zooplankters, copepods, ostracods and veliger larvae are most abundant. *Coscinodiscus* and *Pleurosigma* form the main phytoplankton food while gastropods and amphipods constitute the main benthos food.

(vii) Molluscs

See section 5(j).

(viii) Marine algae

Various types of edible marine algae are well-liked by the population along the coastal areas in the Philippines. Recently, it was demonstrated that species of *Caulerpa* planted in marine ponds propagate easily and increase rapidly. This is an important discovery because it was previously thought that *Caulerpa* thrives in deep waters attached to rocks and that it disappeared during the rainy period of the year. In shallow marine ponds it not only grows on stones but thrives very well and more luxuriantly on the mud bottom. In closed pond compartments which are small and protected from current and wave action it could probably thrive in this habitat throughout the year and such ponds could be used as algae culture ponds.

(ix) Bluegreen algae

Of interest to the Council would be the paper by G.T. Velasquez (1962) "The Bluegreen Algae of the Philippines" published in the *Philippine Journal of Science*, 91(3): 267-380. This work includes all known species of bluegreen algae in the Philippines: 162 species of 33 genera and 8 families.

The specimens examined have been deposited in the Cryptogamic Herbarium of the Chicago Natural History Museum, United States National Museum, New York Botanical

Garden, Herbarium of the University of California and Cryptogamic Herbarium of the University of the Philippines and Philippine National Museum. Habits and distribution, morphology, species limitation and a systematic listing of the different species together with pertinent descriptions and place and time of collection are included in the report.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(b) Identification of aquatic organisms

(i) The critical review of the identification of the different species of fish under study is being continued through the use of morphometric characteristics and meristic counts.

The plankton and benthos ecology investigations also continue to bring about the identification of other aquatic organisms besides the fish fauna present in Manila and San Miguel Bays.

Upon the recommendation of Dr. Klaus Tiews, former FAO fishery expert and adviser to the Philippine Bureau of Fisheries, rearing experiments on the sea and in the laboratory will be performed to make accurate identifications of fish eggs and fish larvae taken from plankton hauls. It is also being planned to initiate plankton research of waters outside Manila Bay so as to expand the activities on aquatic organisms identification.

(c) Population dynamics, age determination, fish behaviour, and related studies

The catch composition, sex ratio, size composition of the sexes combined and the sexes separated, growth, and length-weight correlation are the phases being investigated under population dynamics. A manuscript on the biology of roundscads which is being readied for publication deals partly with population study.

Both the basnigan fishery in Rosario, Cavite, as well as the commercial otter trawl fishery in Manila Bay provide continuous supply of fresh fish for the daily consumption of the people in Manila and suburbs. Both fisheries also indicate a decrease in their total production. Because of the belief that depletion has set in the Bay waters, in addition to the biological and hydrological studies already started, an estimate of the total production of the Bay is being made through the use of fish market reports.

Perusal of the figures for the total catch in 5½ years of operation (1957-1962) of the commercial otter trawlers does not clearly point to a positive depletion of Manila Bay. The apparent decrease in the total yearly production of the commercial otter trawl fishery can be explained by the decrease in the number of fishing boats and in the total number of trawling hours.

In the case of the basnigan fishery in Rosario, Cavite, the fish market reports from January 1960 to date showed fluctuations in percentage of the total production of fish. The sardines which rank first in production by species showed an increase by 4.97 percent from 1960-1961 to 1961-1962. *Rastrelliger kanagurta* also showed an increase in production. However, for *R. neglectus*, anchovies, round-scads and all the other species, a decrease in the total production was observed.

No conclusive statement may be made yet inasmuch as all the factors that are related to the fishery have not yet been thoroughly investigated. Perhaps, the establishment of a permanent basnigan fishery sampling sub-station at Rosario, Cavite, will help to assess more accurately the fish population and actual condition of the basnigan fishery of Manila Bay and adjacent waters.

The Petersen method continues to be the basis for the age determination of all species being studied.

Because the studies on migration and growth rates of fishes present major difficulties due to the many factors that influence

these two phenomena, Dr. Klaus Tiews, former FAO adviser to the Philippine government on marine fisheries, in his last visit to the country from July 19-26, 1962, recommended that tagging experiments of the most important food fishes be conducted.

(d) Oceanography

The oceanographic study of the surface and bottom waters of Manila Bay during the period from April 1957 to December 1961 gives a picture of the yearly and seasonal variations and fluctuations of the physical and chemical properties of the waters of the Bay. The waters of Manila Bay are affected by river discharges, turbulence and water circulation, and tides and monsoon.

From the study, the following results are indicated:

1. The lowest surface temperatures of the bay were observed during the cold months, December to February. These low temperatures were possibly the result of the cold convergence zone from the Asia mainland. The lowest temperature recorded was 26.59°C. The high temperatures were observed from May to August with 30.1°C as the highest reading. These high temperatures are followed by a decreasing temperature in September. The pattern of monthly bottom temperature distributions is identical with that of the surface temperature changes. These findings bring out the fact that the variations in the average yearly temperature are seasonal in nature.

2. The surface and bottom chlorinities also vary. In the case of surface chlorinity, rainfall is the main factor that affects the dilution of the bay. In the case of bottom chlorinity, it is vertical mixing or marine water inversion that has a greater effect. The low surface chlorinity values are, therefore, observed during the wet season and were found lowest from June to September of 1960 for the five-year period. The lowest mean chlorinity by far recorded is 11.06‰. The highest surface chlorinities occur during the

dry months for each year, following the period of minimum rainfall. A mean chlorinity value of 18.68‰ was taken as the highest on record. High chlorinities are generally accompanied by high temperatures or minimum rainfall and low chlorinities by decreasing temperature and maximum rainfall.

3. During the wet season the dissolved oxygen values of the surface water are high while during the dry season the values are low. The high oxygen content is the result of strong winds and wave action during the wet months. The low oxygen values were obtained from March to June. This phenomenon may be caused by seasonal phytoplankton growth which is followed by the increased dissolved oxygen values. While the highest oxygen value recorded was 0.446, the lowest value taken was 0.387, both of which are expressed in milligram-atoms.

4. The concentration of the phosphates in the bay waters shows variations. The phosphate values tend to decrease after January; the decrease in the values continues during the summer months, finally reaching the lowest values about May. Then they increase after May and continue up to December. The highest phosphate value observed was 0.16 and the lowest value, 0.01 microgram-atom. The average yearly value indicates a periodicity which extends over a number of years.

5. Thus, it is seen that the physical and chemical properties of the bay waters are to a large extent affected by rainfall that is brought by the monsoons.

The Bureau of Fisheries is going to initiate oceanographic research of the waters from the coast of Zambales to Batangas primarily to determine the breeding groups of Manila Bay fishes, to collect fish eggs, fry and larvae and larvae of shrimps.

Dr. Klaus Tiews, in this connection, recommended certain activities to improve the Marine Fisheries Biology Project. He suggested the establishment of at least three shore stations at each of the following points: Corregidor, San Miguel Bay and Zamboanga City.

It is intended to collect daily records of surface and bottom water temperature, salinity and tide level at these stations. Fish egg and larva surveys on the west coast of Luzon and around Mindanao are expected to give a clearer picture of the distribution of the pelagic fish resources in the area. In the event that a new vessel should be made available, prospecting and exploratory fishing of areas beyond the present range of the commercial fishing should be undertaken to provide new fisheries maps for use in commercial fisheries.

(e) Study of basic productivity

The study on primary production using C-14 as a tracer is being continued with the monthly occupation of Station B in Manila Bay. Since February 1961, 102 samples have been collected and treated accordingly with radioactive carbon. Dried materials are sent to the University of Hawaii for analyses. In the near future, an evaluation of the data gathered from these analyses and those collected during the biological and hydrological trips to Manila Bay and adjacent waters as well as their correlation is expected to be made.

In relation to this study, the separation of pigment from the plankton samples has been made possible with the acquisition of a new filtration apparatus from the United Kingdom through the Colombo Plan. Forty-five samples from Station B have been studied in the laboratory.

Observation showed that productivity was highest during the rainy months and lowest in February, the driest month. The water current system of Manila Bay accounts for the highest productivity for stations far from shore. Run-offs and prevailing winds have direct effects on the productivity value in both Manila and San Miguel Bays.

With the brief stay in Manila from August 15-18, 1962 Dr. Maxwell Doty, Professor of Botany of the University of Hawaii, who introduced the C-14 method of measuring primary productivity in 1958, more results are expected to turn out from this basic productivity study. After the termination of the

research work, an estimation of the limits of the bays in their capacity to produce phytoplankton population and its correlation with fisheries production may be made possible.

(f) Aquatic ecology

The study of both the surface and bottom populations of Manila and San Miguel Bays is being carried on. From Stations A-C, 1, 12, 16 and 55 which are occupied at almost every trip to Manila Bay and from Stations B, 17, 19 and 30 at San Miguel Bay, plankton and benthos samples are collected. Since February 1961, 16 trips for plankton samples and an equal number for benthos samples have been made.

(i) Plankton studies

The objectives of the studies together with the methods of collection and the qualitative and quantitative assessments of plankton continue to be taken up to the present time along lines similar to those used when studies were started in 1957. In addition, plankton collections were made on board a bag net (basnigan) both in Manila and Lucena Bays and on board the M/V MALASUGUI during its fishing trips for tuna. The objectives of plankton samplings on board the basnigan are as follows: (1) To determine the spawning grounds of pelagic fishes such as mackerels, anchovies, sardines, etc.; (2) to correlate the plankton population quantitatively and qualitatively with the stomach contents of the pelagic fishes caught at the same time, in view of determining their principal food items and, (3) to make developmental studies of the fish eggs and larvae collected for taxonomic consideration. More emphasis is now given to the quantitative and qualitative assessments of fish eggs and larvae.

The method employed in the quantitative assessment of phytoplankton is by sedimentation. For the volumetric determination of plankton, however, the displacement method which has replaced the setting method is being used.

The progress of the studies can be seen from the following:

1. The displacement method of volumetric determination is found to be more accurate than the settling method, since the latter method includes the volume of the liquid in the interstices between the animals which vary according to shape, size and compactness. Due to this discrepancy the volume that is determined by the latter is found to be 4.7423 times greater than that determined by the former method.

2. Based on computed density, the Marutoku Type "B" net does not differ significantly from the Hensen egg net in catching power. However, fast-moving organisms, like *Sagitta*, are better caught by the Marutoku Type "B" net as shown by the computed average number of *Sagitta* per m² and m³ and as shown by the fact that this type could be retrieved much faster than the Hensen egg net because of its small size and light weight.

3. Determined biomass or wet weight is found to be almost the same as or numerically equal to displaced volume, as 1 cc. of organism is equal to 1.2 grams or 20 cc. of zooplankton is equal to 20.18 grams.

4. There is a definitely distinct and unmistakable seasonal fluctuation or periodicity in biomass, volume, standing crop and numerical values in both Manila and San Miguel Bays which is comparatively similar to seasonal fluctuations of bodies of water in other parts of the world. The standing crop varies both in quantity and quality throughout the year. The variations form a pattern which is peculiar for each station. These variations are rhythmic in nature and are recapitulated every year. Plankton growth and production form a cycle with period of abundance at certain seasons. The said cycle exhibits a succession of one kind after another or of one species after another, as shown by the succession of *Skeletonema costatum* and *Thalassiothrix nitzschoides* in November and December of 1959, respectively. Although there may be a month to month or year to year difference in maximum magnitude or in the time of occurrence, still the periodicity or seasonal fluctuation is unmistakably noticeable.

The graph of standing crop in metric tons in Malaya Bay show that there is a drop from an estimate of about 500 thousand in 1958-59 to the minimum value of about 300 thousand in 1958-59 which gradually rose up to attain a maximum of about 860 thousand in 1960-61. This dropped again to about 650 thousand in 1961-62 after attaining the maximum value.

Ocular analysis and comparison of the compiled two-year data already expressed in average wet weight to San Miguel Bay with those of Manila Bay showed a greater standing crop in the former. The Carbon-14 technique showed that the former has greater productivity than the latter.

Diatoms dominated the phytoplankton forms; copepods dominated the zooplankton group. *Noctiluca scintillans* dominated the dinoflagellates. Of the diatomids, *Chaetoceros*, *Thalassiothrix*, *Rhizosolenia*, *Coscinodiscus*, and *Nitzschia*, were found to be present all throughout the year, their relative and absolute abundance alternating amongst them. Although *Skeletonema costatum* was very irregular in its occurrence, it alternated in abundance with the above-mentioned genera. Other genera like *Biddulphia*, *Eucampia*, *Planktoniella*, *Lauderia*, *Thalassiosira*, *Bacteriastrum*, *Stephanophysis*, *Plakurosigma*, *Asteromphalus*, etc., are either above or below the average numbers and the very irregular in their respective occurrence. These genera, however, accompanied the dominant genus or genera alternately or all together at one time seasonally.

Of the zooplankton group, Copepoda, *Zoea*, *Diphyes*, *Sagitta* and *Oikopleura* were present all throughout the year. Copepods alternated in abundance with the above genera and with *Evadna* and *Penilia aceriostrica* occasionally, although the latter two genera are irregular in their respective occurrence. Copepods constituted by far the most important group both in individual and specific numerical values. Detailed study will be made later, but, generally speaking, the fol-

lowing genera *Euchaeta*, *Corycaeus*, *Oncea*, *Candasia*, *Oithona*, and *Microsetella* were more common of the copepods. *Acartia*, *Euterpina*, *Labidocera*, *Temora*, *Centropages*, *Sapphirina*, *Copilia*, *Tortanus*, and *Rhincalanus* were also noted. Other forms such as the *Mysis* group, Annelida, Siphonophora, Pteropoda, *Pleurobrachia*, Coelenterata, *Doliolum*, *Lingula* larva, Cyphonautes larvae, Echinodermata larvae, Radiolaria, *Globigerina*, *Salpa*, *Thalia* etc., were very irregular in their respective occurrences and are either moderate, rare or below or above the average. They accompanied the dominating genus or species alternately or all together at the same time or at a given time seasonally or annually.

The dinoflagellates, *Ceratium* spp. were present all the year round and they alternated with *Noctiluca scintillans* in dominance. *Noctiluca* was irregular in its appearances although it is the predominating genus of this group. *Dinophysis*, *Peridinium*, etc. were very irregular in their occurrences and were either below or above the average. They accompanied the dominating genus alternately or all together at one or the same time seasonally or annually. *Ceratium tripos* is the dominating species of the *Ceratium* species.

5. Volumetrically, numerically and qualitatively, plankton is more abundant in stations inside than the stations situated outside Manila Bay. Plankton is also abundant at Station B, occasionally at Station C. This alternating condition of abundance may be attributed to the fact that the flow of current is in a centrifugal force-like pattern; that is, the water enters through the Southern channel between Corregidor Island and Cavite and whirls around the Bay thus creating a huge eddy current that concentrates the plankton population and the nutrients at the center of the Bay. While Station B is located right at this point, Station C falls within the periphery of the eddy. Some of the water mass finds its way out through the Northern channel between Corregidor Island and Bataan peninsula.

Qualitatively and quantitatively, fish eggs and larvae were high at Stations B and C indicating that these may be the two places or the areas around them that are the possible spawning places of most of our commercially important fish species belonging to *Stolephorus*, *Rastrelliger*, *Decapterus*, *Sardinella*, etc. The computed values quantitatively showed that anchovies spawn all the year round. Some anchovy eggs were noted at Stations 55, A and D and on some occasions at E but not in large numbers. Counts of *Sardinella* eggs and anchovy eggs were found to be high at Stations B and C. These eggs are found together with other kinds of fish eggs and larvae. Eel eggs and leptocephalus larvae were noted high at Stations D and B which are found outside the Bay.

Plankton research on waters outside Manila Bay, particularly the western coast of Southern Luzon from Zambales to Batangas is intended to be done soon.

(ii) Benthos ecology studies

The benthos ecology studies supplement the finding of the plankton investigation that San Miguel Bay though smaller in area than Manila Bay has greater standing crops and population intensity. However, more representative genera and greater population density are found in Manila Bay. The benthos studies show that Manila Bay presents a mosaic of varying bottom sediment types. Because the use of a standardized method of classifying bottom sediment according to grain size was found impracticable, the classification was based on relative texture and color.

Four general types have been considered. These are: (1) The grayish mud type, found in the vicinity of the Quarantine anchorage and which has been subjected to successive pollution; (2) the greenish mud type, along the Bataan, Pampanga and Bulacan sides where the highest degree of sedimentation occurs due to the huge amount of river discharges; (3) the sandy type, along

the Cavite side in the vicinity of San Nicholas Shoals, being subjected to underwater disturbance; and (4) the sandy-mud type, outside the bay and its approaches. These different bottom types bring about differences in the animal communities found therein. However, there are certain benthonic organisms which tend to be ubiquitous. Such organisms are able to survive by adapting themselves to the different bottom substrata.

The ubiquitous benthos animals are the polychaetes *Leamira japonica*, *Pseudeurythoe* sp., *Nephtys* sp. and *Prionospio pinnata*; the brachyurans *Macrophthalmus* and *Xenopthalmus*. The others are annelid worms such as those belonging to families Aphroditidae, Glyceridae, Eunicidae, Maldanidae, Capitellidae and Terebellidae. Still others are the crustaceans Caridae and Alpheidae and the gastropods, pelecypods and ophiuroids. These organisms have been observed to appear and reappear at different seasons of the year.

The cephalochordate, *Branchiostoma*, was observed to occur only in the sandy type bottom. The same is true for the eunicid *Marphysa*, *Lysidice*, *Onuphis dibranchiata*, *O. holobranchiata* and *O. eremita*. The opheliid *Ammotrypane* and a syllid species are also found to occur only in this type of bottom substratum.

Because of the presence of tests of foraminiferans in the stomach contents of crustaceans and demersal fishes being studied in the laboratory, the inclusion of their qualitative and quantitative findings is taken into consideration. There were 33 genera of foraminiferans identified in the entire bay with some more unidentified species.

Similarly, San Miguel Bay has been divided into areas according to their types of substratum: (1) The grayish mud substratum found in the region which includes the head of the bay; (2) the greenish mud type found in the central portion of the bay which has the greatest degree of silting; (3) the sandy mud type, sometimes clay, forming the substratum of the deepest portion of the bay, (4) the sandy-mud portion of the

bay on its eastern side, the area facing the mouth of Looc River; and (5) the sandy area outside the bay. Here the bottom has either traces or large amounts of mud.

Practically, the same benthonic organisms found in Manila Bay have been found in San Miguel Bay. However, only 18 genera of foraminiferans are represented, making a density that is about 3 times less than that of Manila Bay.

From the data obtained from the two bays, it was found that both bays have varying values with regard to biomass per unit area and total area and population per unit area and total area.

For the period 1957-1958, San Miguel Bay was found to have a total standing crop about 10 times greater than Manila Bay and was about 1.5 times more populated than Manila Bay. No data were available for the period 1958-1959. For the period 1959-1960, San Miguel Bay was about 8 times richer in biomass and 10 times more populated than Manila Bay. For 1960-1961, the total crop of San Miguel Bay decreased to one which was only about 6 times greater than that of Manila Bay; the population decreased correspondingly to one which was only twice as great as that of Manila Bay.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reserviors)

(c) Control or alteration of the chemical features of the environment

(i) *Water pollution control.* There has been an increasing agitation for the control of new sources of water pollution brought about by the establishment of industrial plants. Lack of a coordinating agency and laboratory has made enforcement of pollution regulations difficult.

(ii) *Use of fertilizers.* There has been an increase in practice in the use of fertilizers in fishponds, both inorganic as well as organic forms are being tried. Inadequate supply of

inorganic fertilizer is the setback to the wider use of this for production. The organic fertilizer used is mainly poultry waste.

(d) Control or alteration of the biological features of the environment

(i) *Aquatic weed control.* Luxuriant growths of the softer submerged and floating aquatic weeds have been found to be capable of control by the stocking of herbivorous and omnivorous species of freshwater fishes. A small lake enclosed by one government station stocked with giant gourami (*Osphronemus gourami*), tilapia (*Tilapia mossambica*), common carp (*Cyprinus carpio*) and tawes (*Puntius javanicus*) was practically cleared of its luxuriant soft vegetation within a three-year period.

There has been very little work done on chemical weed control.

(e) Stocking

The Philippine Bureau of Fisheries has been encouraged in undertaking an extensive maintenance stocking and transplantation of fish in the Philippine inland waters after initial successes in some of these waters. *Chanos* fingerlings did well in wide shallow lakes that have luxuriant vegetation. Other freshwater species that are being used and are getting established include *Puntius javanicus*, *Cyprinus carpio*, *Tilapia mossambica*, *Trichogaster* spp. and *Osphronemus gourami*.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish Culture—general

Fish culture is almost wholly devoted to brackish water fish culture for milkfish or *Chanos*. The expansion of this industry in acreage and production for the last five years are as follows:

Year	Area in Hectares	Production in Kilograms
1957	112,619.95	39,413,833
1958	116,546.00	57,624,385
1959	119,582.00	92,944,420
1960	123,251.90	96,191,298
1961	125,810.00	99,144,026

(b) Nutrition

The food habits of a number of Philippine fishes have been studied. However, there are still several species of economic importance whose food habits have not been investigated. Studies on the physiology of fish nutrition are practically untouched. At present the food habits of the principal species exploited in Laguna de Bay Lake are being studied.

(c) Pond fertilization

Experiments in government experimental and demonstration fishponds are being continued. Fragmentary results of preliminary studies are being reported but this will need repetition in order to be conclusive. Limited facilities for experimental work and a lack of the desirable formulations of fertilizers have hampered studies along this line.

In spite of the paucity of data on pond fertilization experiments, a large number of the private fishpond operations are very receptive to this practice and results of their trials have been encouraging. The lack of supply of fertilizers to be used have limited the widespread use of the practice.

(f) Handling and transport of "fish seed"

The use of oxygenated sealed plastic bags has gained widespread application and has been found to be very convenient and practical. It is now being used to transport fry, fingerlings and post-fingerlings of "fish seed".

(j) Special forms of aquiculture**(i) Ricefield Fish Culture**

Experiments on this type of fish culture have just been started at the Central Luzon

Demonstration Fish Farm of the Philippine Bureau of Fisheries.

(ii) Shrimp Culture

Economic species of Penaeid shrimps are raised in *Chanos* fishponds with the fish. Stocking is carried out done in these fishponds but it is seldom that pure culture of shrimp is attempted in ponds. There is a lack of shrimp seed supply.

(iii) Brackish water fish culture

This is the main type of fish culture industry in the Philippines mainly for *Chanos*. (See section 5(a).)

(iv) Oyster culture

Intensive culture of edible oysters in estuarine areas and on the protected coast has gained momentum in the Philippines. This has been enhanced with the establishment of four demonstration oyster farms of the Philippine Bureau of Fisheries at widely scattered places on the island of Luzon. The private sector has taken advantage of the demonstration and has put up projects along suitable areas in many places in the Philippines. The main species are: *Ostrea iredalei*, *O. malabonensis*, and *O. palmipes*.

6. MISCELLANEOUS PROBLEMS

The damage caused by calamities such as typhoons and floods on the fisheries industry is a regular yearly occurrence. Under this predicament heavy losses often occurs. Some system insuring losses in fisheries to ameliorate the industry so that it could attain early recovery needs to be provided.

THAILAND**PANEL A—INLAND FISHERIES****1. INFORMATION SERVICES,
BIBLIOGRAPHIES, REFERENCE BOOKS****(a) Information—generally, and****(b) Bibliographies**

- (i) Survey of the freshwater fisheries resources in the River "Ping" prior to

the construction of Pumiphol Dam.

By Ariya Sidthimunka

- (ii) A method of searching for and collecting the catfish (*Clarias batrachus*) from natural waters by Montri Muangboon. *Thai Fish Gaz.*, 14 (2): 105-112. (in Thai).

- (iii) Life history study of freshwater shrimp (*Palaemon* sp.).
By Manu Potaros
- (iv) Morphological differences among the fry of three species of catfish, *Pangasius sutchi*, *P. larnaudii* and *P. macronemus*.
By Umpol Pongsuwana
- (v) Induced spawning in catfish (*Clarias macrocephalus* Gunther) by pituitary hormone injection.
By Snit Tongsanga
- (vi) Preliminary report of the combination of Plachon (*Ophicephalus striatus* Bloch) and *Tilapia mossambica* Peters by Snit Tongsanga. *Thai Fish. Gaz.*, 13 (1): 1-16. (in Thai).
- (vii) Preliminary report on the combination of Pla Ka Pong (*Lates calcarifer* Bloch) and *Tilapia* (*Tilapia mossambica* Peters).
By Prasit Kessanchai
- (viii) Shrimp culture in Thailand by Vanich Verikul. *Thai Fish. Gaz.*, 14(2): 129-144. (in Thai).
- (ix) Progress report on milk fish (*Chanos chanos* Forskal) culture in Thailand.
By Umpol Pongsuwana
- (x) Progress of rice field fish culture in Thailand.
By Umpol Pongsuwana

2. AQUATIC RESOURCES APPRAISAL

(d) Reviews or synopses of aquatic forms of economic importance

(i) *Chanos*

The milkfish (*Chanos chanos* Forskal) is known locally in Thailand as "Pla nuanchan thale". To encourage milkfish culture, a program was initiated in 1950 and a brackish-water fisheries station was established at Klongwan, Prachuab Province. Experiments on the culture of this species have been conducted there since that time; the results

have been found to be satisfactory. Later on the Extension Service of the Department of Fisheries has encouraged fish farmers to culture this species along the eastern and western coasts of the Gulf of Thailand, where milkfish culture can be practiced. This fish has been cultured by fish farmers since 1956 and the operation has been carried on with success since then.

The demand for milkfish fry increased to one million in 1961, but unfortunately the fish fry collectors were not able to supply such a large quantity. On the contrary, the quantity of fry collected dropped to about one-ninth of the annual catch of 1960 (Table 1). The uncertain quantities of fish fry collected annually influences fish pond owners as whether or not they decide to earn their living by milkfish culturing. Usually, milkfish fry are collected from the small tidal canal at Klongwan where the Brackish-water Fisheries Station is situated. When the fry collected in the area were not sufficient to supply the pond owners in 1961, then other nursery grounds were investigated. At present there are four locations known in the three eastern coastal provinces of Choburi, Rayong and Chantaburi. The other two locations are in the two western coastal provinces of Pechburi and Prachuab. However, more locations may be discovered if the search is continued.

Up to the present, there are about 24 fish farmers who own milkfish ponds, whose area is approximately 235 hectares. Most of the fish ponds are located in the provinces of Smudsakorn, Smudsongkram, Smudprakarn and Chacherngsao. Of the total area of milkfish ponds, about one-fourth has been converted from rice fields to milkfish farms used either to raise fish along with rice or just fish alone. There are some indications that more and more fish farmers are interested in this career. Therefore, it is becoming necessary to search for more fish fry to supply to them.

TABLE 1
The Number of milkfish fry collected at Klongwan, Prachuab Province, Thailand

Year Month	1957	1958	1959	1960	1961	1962
January	26	183	8	248	8	—
February	3	—	12	636	3	—
March	194	75	270	8,141	566	—
April	8,615	2,017	19,435	81,849	4,098	128,194
May	81,379	112,071	81,391	332,573	15,366	593,380
June	9,088	3,925	89,024	178,790	42,413	64,420
July	2,252	751	129,740	29,531	4,524	
August	284	400	2,497	16,895	4,755	
September	1,546	1,558	16,246	6,958	1,999	
October	1,887	298	278	205	72	
November	2,089	669	12,735	3,397	372	
December	349	909	13,543	2,026	—	(incomplete)
TOTAL	107,712	122,856	365,179	661,249	74,176	

(ii) Prawns and Shrimps

The development of shrimp farms along the eastern coast of Thailand has become more extensive since Bang Chan Fisheries Station in the Province of Chantaburi was established in 1958. A hundred shrimp farms are located on the coastal area of Chantaburi, Smudprakarn, Smudsakorn and Smudsongkram Provinces. Six species of commercially important shrimps are produced by these farms: *Penaeus indicus*, *P. merguensis*, *P. monodon*, *Metapenaeus monoceros*, *Palaeomon* sp. and *Leander* sp.

3. RESEARCH, INCLUDING
DEVELOPMENT OF METHODOLOGY
AND TECHNIQUES ON CERTAIN
SPECIALIZED SUBJECTS RELATING
TO FISHERIES

(b) Identification of aquatic organisms

The three species of catfish, *Pangasius sutchi*, *P. larnaudii* and *P. macronemus* are very similar in colour and form when they mix in schools during the young stages. The first

two species are of economic importance in fish culture. The instant recognition of small fry or young larvae of each mentioned species by external morphological studies and observations are very useful when the fry are collected in natural waters.

4. MANAGEMENT OF FISHERY
RESOURCES IN NATURAL WATERS
(Including Reservoirs)

(b) Control or alteration of the physical features
of the environment

The survey of the freshwater fisheries resources in the River "Ping" prior to the construction of Pumiphol Dam was made in 1960-1962, and it could be continued. The purposes of this survey are:

1. To study the physical, chemical and biological properties of the water.
2. To study the species composition of fish in the river during the dry, rainy and cool seasons.

3. To study the relative abundance of fishes and the ratio between herbivorous and carnivorous fish in each season.

The data obtained will be used as basic background information for proper management of the great reservoir or river-lake after the construction of the Dam is completed.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish Culture—general

The development of fish culture in Thailand is one of the most important aims in order to increase the production of fish to satisfy the demand of people for consumption as well as for income. Fourteen inland fisheries stations established in different provinces (seven in the Northeast, three in the North, one in the East and two in the South) are responsible for this matter. A few million "fish seed" produced by the stations were distributed among fish farmers. Several re-

search project outlines were assigned in 1962 to solve various fish cultural problems. Training in fish cultural practices were given to the chiefs of villages, fish farmer groups, and various agricultural youth clubs.

(j) Special forms of aquiculture

Fish culture in Rice Fields

Fish culture in rice fields has been developed in recent years. There are 1,000 hectares of converted rice fields for paddy-cum-fish culture after rice harvesting in the central and northern parts of the country. The experiment on fish culture along with rice growing of Mecho Fisheries Station yielded 50 kilograms of fish with an increase of 250 kilograms of rice per acre. The kinds of fish used to stock are common crap, *Tilapia*, milkfish, sepat siam and cock-up; the first two are very popular. Fish farmers have become more interested in the culture of fish in paddy fields, since not only rice production can be harvested but also a fair amount of fish production can be obtained.

PANEL B — SEA FISHERIES

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

(b) Bibliographies

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2. AQUATIC RESOURCES APPRAISAL

- (a) Country and regional appraisals, reviews or synopses
- (b) Appraisals, surveys or synopses of marine areas or of river basins (inland or individual waters (inland))
- (c) Appraisals or inventories of fish populations

The following developments have pertinence to all of the above fields of activity.

Research vessels:

In the fiscal year of 1962 the Thai Government approved a budget for purchasing a steel research vessel to be used in an exploratory fishing program in the Gulf of Thailand and the Indian Ocean. The boat is being built in Japan by the Niigata Engineering Co. Ltd. This vessel is about 130 tons, 31.5 m in length, 5.90 m in breadth and 2.65 m in depth. It is installed with a 650 HP diesel engine and it will have service speed of not less than ten and a half knots. The boat will be equipped with otter-board trawl nets, long lines, and drift nets, as well as oceanographic instruments. It will be delivered to Thailand in October 1962.

Other than the steel research vessel mentioned above, one wooden research boat of smaller size has been approved and is being built locally. This boat is 23 m long and is of about 50 ton gross. It will be equipped with otter-board trawling set, a fish finder instrument and a radiotelephone set given by the West German Government under the Thai-German Bilateral Agreement on Technical and Economic Co-operation. The smaller wooden vessel is planned to be used also in the exploratory fishing programme. It will be used also for training Thai fishermen in otter-board trawling.

Marine fisheries stations

During the fiscal year of 1962, a marine fisheries station has been under construction at Phuket on the Indian Ocean Coast. This marine fisheries station will be staffed with fishery biologists and a gear technologist, who will be assigned to conduct a biological fishery survey of the Indian Ocean Coast and to do experimental fishing, train fishermen, and to introduce new and efficient fishing methods into this region.

The plan to establish another marine fisheries station is approved by the Board of National Economic Development and the Bureau of Budget in the fiscal year of 1963. This marine fisheries station will be established at the mouth of Songkla lake on the West coast of the outer Gulf. This station will be responsible for the fisheries development of the outer Gulf and adjacent areas and for a study on the life history of shrimp of Songkla Lake.

See also section 2(d) below for details of surveys of particular areas or fish populations.

- (d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

Two species of tuna-like fishes are commonly caught in the Gulf of Thailand, namely, *Euthynnus yaito* Kishinouye and *Neothunnus macropterus* (Schlegel). They are caught with mackerel drift nets, purse seines and stake traps (poh). The total landing of these fish has never been estimated. The bonitos are of low price compared with mackerels, but are economically important as a supply of cheap food for the poorer families. Biological study of the fish has not yet been initiated. However, the Department of Fisheries plans to undertake experimental fishing for these species with tuna long lines in next year's programme.

(ii) Mackerels

(A) *Scamberomorus* sp.: Three species of *Scamberomorus* are caught in the Gulf and Indian

Ocean with mackerel drift nets and stake nets. Of these three species, *S. commerson* and *S. lincolndus* are more common and larger in size than the other one. It has been estimated that about 12,000 tons of *Scomberomorus* having a value of approximately Baht 50,000,000 are landed each year by a fleet of mackerel drift netters of about 950 boats, with an addition of about 2,000 tons (about Baht 12,000,000) by stake nets, from the Gulf and Indian Ocean. Study on the biology of these fishes has not yet been undertaken. However, they are believed to spawn in the deeper part of the sea in February, March and April, for during these months the fish are found to have mature eggs in their ovaries. The peak of the catch by drift nets occurs during the spawning season (January-April) when the fish migrate from the coastal zones to more oceanic waters.

(B) *Rastrelliger*: The total landing *Rastrelliger* species in the Gulf of Thailand dropped below average between 1958 and 1960. However in 1961 and 1962 the fishery started to rise again until by the end of the fishing season off the West Coast of the Gulf it seemed to have resumed its normal level. It should be noted that the *Rastrelliger* fishery of the Indian Ocean has grown rapidly since 1960. The catch was iced and transported to supply the Bangkok Wholesale Fish Market and areas in its vicinity. Studies of the size composition of the fish sampled regularly at the Bangkok Wholesale Fish Market indicated that the average size of the fish from the Indian Ocean side was much greater than that of the fish from the Gulf; this may be attributed to the virginity of the Indian Ocean stock.

According to the preliminary results of the "Naga Expedition" under taken in 1960-1961 it is believed that the abundance of *R. neglectus* on the West and East Coasts of the Gulf is due to the upwellings which are influenced by the Monsoon. But in the case of the Inner Gulf, the abundance of *R. neglectus* may be caused by the great concentration of nutrients drained into the Gulf through the

Chao Phya, Bang-pakong and Mekong Rivers. It is thought that rapid development of the agricultural irrigation system of the Chao Phya Basin since 1956 has led to more water-use and evaporation in inland areas of the central part of the country. This may cause a smaller flow of water into the Inner Gulf and eventually affect the abundance of *R. neglectus* in this fishing area.

In the Gulf, the total catch of *R. neglectus* is much greater than that of *R. kanagurta*; in the Indian Ocean, *R. kanagurta* is landed as much as *R. neglectus*. Since 1958 an attempt has been made to estimate the annual catch of the chub mackerel as well as the fishing effort employed in the whole fishery by two methods: a sampling system for the nonmovable stake nets and a study of the fisheries logs used by purse seiners and gill netters. Fisheries logs were improved in 1961 and 1962. The sampling system for gathering catch statistics of the stake nets was first introduced in 1961 and was revised in 1962. Sampling for size composition of the total catch has also been undertaken following the guidance given in the FAO International Training Center on the Methodology and Techniques of Research on Mackerel (*Rastrelliger*), 1958.

The spawning and development of *R. neglectus* are complicated processes which require careful study. By studying the different stages of gonad development of *R. neglectus*, data on the weights of gonads systematically collected in 1956, 1957 and 1958, and the size composition of the catch in different months of all of the five years-it is concluded that the spawning season of *R. neglectus* in the Gulf lasts nearly seven months: from late January through July with two heavy spawnings, one in February and the other in June. This is confirmed by the two predominant groups of juvenile fish occurring yearly in May and October. During these two peaks, minor spawning takes place as late as July. From study of the gonads of different maturity stages, with adequate data on number and size of the eggs of *R. neglectus*, it is

estimated that a fish may spawn 300,000 to 600,000 eggs in the seven-month period. A fish spawning for the first time produces less eggs than one spawning for the second time. The average size of the eggs spawned for the first time is believed to be smaller than those resulting from the second spawning. All spawning females which have been collected in June (the second spawning peak) were found to have one lobe of the ovary spawned out; only undeveloped eggs were found in the ovary. The other lobe of the same ovary had fully ripe eggs ready to be spawned. It is believed that the spawner usually spawns all ripe eggs from only one lobe and after that from the second lobe.

Study on the development of eggs of both *R. neglectus* and *R. kanagurta* was carried on in the years 1961 and 1962. The size of the eggs and their oil globules were measured. It was found that the mature eggs of the fish of both species were very similar in characteristics; nevertheless, those of *R. neglectus* were smaller, on the average, than those of *R. kanagurta*.

To determine the spawning grounds of the chub mackerel, planktonic fish eggs were separated from 70 plankton samples collected in 1961 and 175 samples in 1962. These fish eggs were observed for certain characteristics. The size of the egg and the size of oil globule were determined. They were compared with the ones described by several outstanding marine biologists. According to the report submitted to the Department by the assigned researcher, these eggs are of

anchovy type, *Sardinella* type, round herring type, carangid type, mackerel type, etc. With the experience gained in studying the size and characteristics of ripe eggs of many species, including those of *Rastrelliger*, a number of planktonic eggs, of different stages, believed to be of *Rastrelliger* were collected from several places along the West Coast of the Gulf off Changwad Prachuab to Koh Pengan. The collection and analysis of plankton samples will be continued in 1963.

Juvenile *R. neglectus* below 100 mm. in total length are most abundant between late April and May on the West Coast of the Gulf, south of Changwad Prachuab, and they are found occasionally until November on the West Coast, of the Inner Gulf and the East Coast area.

(C) Tagging Experiment on Chub Mackerel (*Rastrelliger* sp.) in the Gulf of Thailand

Tagging experiments on chub mackerel were conducted between January 1961 and June 1962. A total of 15,216 fish were tagged with plastic dart tags and released at various points in the Gulf of Thailand. Through June 1962, 3,436 tagged fish or 22.58 percent of the total released were recovered (Table 1). Preliminary results indicated that juvenile and adult chub mackerel migrated extensively along the coast in search for food which was mostly phytoplankton. It is speculated, but no conclusive data is at hand to substantiate the argument, that the chub mackerel may migrate from the shallow area to the deeper part of the Gulf to spawn.

TABLE 1
Date and locations of tagged chub mackerel (*Rastrelliger* sp.)
released and the number recaptured

Date of release	Location of release	Tagged fish released No.	Tagged fish recaptured	
			No.	Percent
1961				
27 January	Pechburi Province 12 miles off shore	397	52	13.10
30 January	"	267	25	9.36
28 April	"	777	30	3.86

TABLE 1 (Cont.)

Date of release	Location of release	Tagged fish released No.	Tagged fish recaptured	
			No.	Percent
1961				
29 April	Pechburi Province 12 miles off shore	778	20	2.57
11 May	"	896	109	12.17
1 June	"	619	70	11.31
11 June	"	619	68	10.99
16 June	"	456	50	10.96
17 June	"	288	36	12.50
3 July	"	576	98	17.01
10 November	Smutsakorn Province	498	283	56.83
15 November	"	461	286	62.04
20 November	"	450	150	33.33
24 November	"	822	365	44.40
3 December	"	154	67	43.51
17 December	"	663	182	27.45
19 December	"	500	130	26.00
26 December	"	1,005	447	44.48
28 December	"	450	157	34.89
1962				
11 January	Seechang Island 25 miles off Prachuab Bay	226	29	12.83
16 May	"	989	111	11.22
19 May	"	1,057	164	15.52
24 May	"	960	317	33.02
12 June	"	926	137	14.08
24 June	"	382	53	13.87
Total		15,216	3,436	22.58

A comparative study was made of two types of tags commonly used in the tagging program: the plastic dart tag and the Petersen disc tag. One hundred fish were tagged with dart tags and another hundred with Petersen disc tags. One hundred untagged fish were used as a control. Both experimental and control fish were in a live box for observations on growth and mortality. The average lengths of the three groups of fish were the same at the initiation of the experiment (Table 2).

Results showed that after three months of detention there seemed to be differential growth between the tagged and untagged fish (Table 2). Moreover, the fish bearing dart tags grew better than those having Petersen disc tags. The fish bearing dart tags did not lose their tags; however, 12 fish bearing Petersen disc tags lost their tags during this period. It was observed that no fish died immediately after they were tagged.

TABLE 2
*Differential growth between the tagged and untagged
 chub mackerel Rastrelliger sp. during a three-month period*

Month	100 Dart tag		100 Plastic Discs tag		100 with no tag (Control)	
	Length mm.	Length increment mm.	Length mm.	Length increment mm.	Length mm.	Length increment mm.
At the beginning the experiment	119.47		119.47		119.47	
1	136.04	16.57	138.84	19.37	140.98	21.51
2	146.71	27.24	142.58	23.11	150.76	31.29
3	154.40	34.93	149.80	30.33	158.37	38.90

Meristic and morphometric studies of both *R. neglectus* and *R. kanagurta* of the Gulf and of Indian Ocean are now being undertaken.

In 1960, attempts were made to determine the age of *Rastrelliger* using hard parts of the body. A number of scales of both *R. neglectus* and *R. kanagurta* were collected from fish of various sizes in different months and were sent to Tokai Fisheries Laboratory in Tokyo, Japan for examination. The finding there was that no annual rings were present on the scales. This confirmed the former examination made by the biologist of the Department that scales of *Rastrelliger* in this region can not be used for age determination.

(iii) Sardines

Many species of the genus *Sardinella* may be found in the Gulf and Indian Ocean. They are caught by stake nets (Poh) and purse seines. Purse seines landed about 962,000 kilograms of the fish in 1961. *Sardinella* is used mainly for duck-feeding, salting and drying. A small part of the total landing goes to the canning factories.

The life history of *Sardinella* has never been studied in Thailand. However the planktonic stages have been examined to some extent.

(iv) Bottom fishes

The first attempt with a trawl fishery in the Gulf was made in 1954 when paired-trawl nets and boats were imported from Japan. In 1960 several purse seiners were converted into paired-trawling boats. Up to 1962 the paired-trawling fleet of the Gulf was composed of about 8 pairs of Japanese-type trawlers of approximately 60-80 tons, 55 pairs of 25-40 ton boats locally built and modified from purse seiners, and 40 pairs of small-class mechanized boats of 10-20 tons. The estimated annual landing of the bottom fish from the Gulf is about 50,000 tons valued at about Baht 100,000,000 (this estimate include bottom fishes landed by otter trawlers).

In 1961 otter-board trawl fishing was first introduced into the Gulf by German experts under the Thai-German Bilateral Agreement on Technical and Economic Co-operation. The trawling experiments were made several times from the front of the Inner Gulf down to the outer region. Results indicated that otter-board stern trawling operated by a single boat is more profitable than the paired-trawling. After that, training and encouragement was given to the fishermen for the development of otter-board trawling. In 1962 an otter-board trawler was imported from Formosa (this trawler was built in the United

States of America) and nearly 30 boats of the paired-trawler fleet built were modified to otter-board trawlers.

It was in 1961 that the first attempts were made for the biological study of the bottom resources. The George Vanderbilt Foundation sent to Thailand a taxonomist, who was accompanied by a fisheries biologist of the Fisheries Department, to collect specimens of the bottom fish caught in the Gulf for taxonomic study. The Department of Fisheries is also conducting a study on the identification and classification as well as life history of some species which are most common in the bottom catch.

An exploratory fishing programme for the fiscal year of 1963 has been approved by the Board of National Economic Development, and a fund for this work has been allocated by the Bureau of Budget. The exploratory fishing is aimed at making appraisals of the demersal fish stocks of the Gulf and adjacent waters as well as of the Indian Ocean. The data are to be gathered for the purpose of developing knowledge on the abundance of fishing grounds, on the characteristics of the bottom, on locating new grounds for the expanding trawl fishery of the country. The programme has been outlined with the kind cooperation of Dr. K. Tiens, the leader of the German fisheries experts under the Thai-German Agreement on Technical and Economic Co-operation which has been extended recently. The exploratory fishing will take place first in the Gulf as soon as the research vessels are available.

To gather the required data, a number of stations are set at 15 nautical miles apart in some areas and 30 nautical miles in the center of the Gulf. One station is planned to be visited six times in different months of a year. Thirty minutes to one hour of fishing with otter-board trawl nets will be done during each visit to collect data on the relative abundance, species and size-compositions of the stocks and other biological information. It is planned that chemical and physical data will also be obtained at each station as well

as other information such as the bottom topography. There will be about 400 stations in the Gulf and adjacent waters with an addition of about 90 stations in the Indian Ocean.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUES, ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(a) Standardization of equipment and methods of assessment of plankton populations

Standardization of plankton nets has not yet been achieved. According to the marine research project, the plankton collection is made for the purpose of qualitative study of plankton population in the Gulf in the year 1961 and 1962. However, plankton samples were measured to some extent by the displacement method. (See section 3(d) below).

(b) Identification of aquatic organisms

A staff of fishery biologists is assigned to study fish eggs and fish larvae. Identification and classification of planktonic species (especially those of coastal types occurring in the Gulf) have been carried on to some extent.

(c) Population dynamics, age determination, fish behaviour and related studies

Hard parts of the body of *Rastrelliger* cannot be used for age determination. (See section 2(d) ii, C). Samplings for length frequency are intensified to obtain length data for the use in age determination. Samplings for size (length) compositions of the total catch of *Rastrelliger* have been made by a staff of fishery biologists throughout the year at many landing places on the Gulf.

(d) Oceanography

The "Naga expedition" under the auspices of ICA terminated at the end of 1960. Since the staff and the vessel employed in this project returned to the United States, the project has been continued with the co-

operation of the Hydrographic Department of the Royal Thai Navy to carry on oceanographic surveys of the Gulf. The Hydrographic Department has undertaken the chemical and physical parts of the work, and the Fisheries Department is responsible for biological study

with special reference to the identification of fish eggs and fish larvae and the determination of spawning grounds and seasons of *Rastrelliger*. The Hydrographic Department's steel research vessel of about 90 tons is used for the field work.

TABLE 3
Number of stations and plankton samples collected in the Gulf of Thailand

Year	No. of trips	No. of station	No. of plankton samples collected	Area
1961	4	70	70	East Coast of the Gulf
1962	6	175	175	West and East Coast of the Gulf

Plankton samples are collected by means of a Marutoku-B plankton net: mouth diameter 45 centimeters and mesh size 0.33 mm. The samples are preserved in formalin solution and sent to the Fisheries Department for measuring by the displacement method. Fish eggs and fish larvae are sorted out for further identification. In addition to the plankton samples, sea water samples are collected and records of their chemical and physical properties are kept.

There is a possibility that the United States may sponsor another "Naga Expedition" in the Gulf and South China Sea. The Thai Fisheries Department has submitted the new "Naga Expedition" Project to the Ministry of Agriculture to arrange it for consideration under the *Joint Research Topic* to be discussed in the ASA meeting which is to be held in Kuala Lumpur, Malaya in September 1962. This project will include the Aquatic Research Institute proposed by Dr. R. Rofen who formerly worked with the George Van-

derbilt Foundation of which, at present, the activity has been ceased.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS

(a) Regulatory (Legislative) Measure

In accordance with the Thai Fisheries Act (B.E. 2490), the Minister of Agriculture has proclaimed a ministerial regulation in order to manage the harvest of the chub mackerel resources in the Gulf. The main articles of the regulation prohibit the operation of purse seiners for two months, from 15 April to June 14, during which juvenile mackerel of about 120 mm. in total length, are most abundant. The reason is that, if the fishing of chub mackerel can be delayed during this two-month period, the weight of the catch may be increased even though the rate of natural mortality may be higher during these two months. Secondly, the average price of the larger chub mackerel is much higher than that of the small ones.

UNITED KINGDOM

SARAWAK

5. FISH CULTURE AND FISH DISEASE CONTROL

Freshwater fish culture is of the utmost importance to Sarawak. Not only can it be

instrumental in paving the way for many isolated communities to obtain regular supplies of much needed animal protein, but it can also provide a cash income near centres

of population and, in conjunction with pig and poultry rearing make possible the efficient utilisation of low-lying land otherwise unsuitable for agriculture.

Present Freshwater Fisheries Extension

Farmers in Sarawak are encouraged to establish fish ponds on their farms. Field staff of the Department of Agriculture give on-the-spot advice on siting and construction of their fish ponds. On completion of their fish ponds the farmers receive free issues of fry for stocking, and also a supply of quicklime for treating the ponds before restocking.

In communal village or kampong land where suitable sites are available, the establishment of community fish ponds are encouraged. Such communal fish ponds are

usually sited on unused low-lying swamp land. Drainage pipes and cement for concreting spillways (when required) are also issued free to community fish ponds, besides the free issues of fry.

Freshwater fish culture has become very popular amongst the inland population particularly the Dayaks in all the Divisions in Sarawak. The idea of establishing fish ponds has also caught on amongst the Kayan, Kenyah, Kelabit, Murut and the Besayah in the interior of Fourth and Fifth Divisions. In the urban and coastal districts the Chinese and Malays are also taking keen interest in fish culture.

The number of fish ponds completed since 1957 is given below:—

Division	1957	1958	1959	1960	1961	1962 Jan./June	Total
I	99	137	543	562	601	346	2,288
II	—	65	145	242	498	189	1,139
III	—	32	87	30	135	89	373
IV	—	33	20	13	295	106	467
V	—	6	5	8	8	87	114
Total	99	273	800	855	1,537	817	4,381

Fry breeding stations have been established for the production of fry for free issue to pond owners to stock their ponds. The

species and number of fry issued are shown below:—

Year	Tilapia mossambica	Trichogaster pectoralis	Cyprinus carpio	Osphronemus gouramy	Helostoma temminckii	Carassius auratus	Total
1957	1,194	1,543	—	—	—	—	2,737
1958	15,934	8,038	254	—	—	—	24,226
1959	40,865	16,613	1,298	210	122	—	59,208
1960	74,165	13,047	14,564	3,514	5,403	2,857	113,550
1961	155,963	54,148	44,078	10,627	27,546	700	293,062
1962 Jan./June	67,009	10,051	61,819	3,969	13,513	252	156,613
Total	355,230	103,440	122,013	18,320	46,584	3,809	649,396

Fish production from ponds in Sarawak has increased since the introduction of the Freshwater Fisheries Development Scheme in 1957. Fish pond operators have already harvested fish for consumption, while some districts are now self-sufficient in the supply of fry of at least three species for restocking the local fish ponds. Due to lack of field staff in the Freshwater Fisheries Division, no accurate figures on the acreage or on pond production are available.

Future Fresh Water Fisheries Extension

A scheme has been submitted and approved by the Freedom From Hunger Campaign covering the years 1963 and 1964. Briefly the main aspects of this scheme are as follows:—

- a) A subsidy of \$100/- per acre for all new ponds constructed, plus free supply of drainage/overflow pipes.

- b) Free issue of fry for stocking.
- c) Loan of equipment, light tools and tractors where practicable.
- d) Treatment of fishponds. Free lime and fertiliser.
- e) Courses in fish culture for farmers.
- f) Additional fishponds. Both for production and observation of new species.

The total value of this scheme over the years 1963 and 1964 amounts of \$ 142,280.

In addition more attention will be devoted to investigations, particularly the rearing of milkfish, *Chanos chanos*, prawn ponds and the behaviour of local river fish when cultured.

A continuation of this scheme covering the years 1965-1968 has been included in the Development Plan.

UNITED STATES OF AMERICA

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

(a) Information—generally

The Fishery Bulletin of the U.S. Fish and Wildlife Service will shortly appear in a new format; journal style issued at irregular intervals.

(b) Bibliographies

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2. AQUATIC RESOURCES APPRAISAL

(d) Reviews or synopses of aquatic forms of economic importance

(i) Tunas

An informal Pacific Tuna Biology Conference arranged by the U.S. Bureau of Commercial Fisheries Laboratory at Honolulu was held at the University of Hawaii, 14-19 August 1961. Fifty papers were contributed; 79 persons attended from 11 countries. (There were participants from the following IPFC countries: Australia, U.K. (Hong Kong), Japan, France (New Caledonia), Philippines, U.S.A.).

The report of the work and results of this Conference includes: summaries of the discussions on distribution, migration, subpopulations, behaviour, tuna oceanography, and taxonomy and nomenclature; reports of two working groups on identification of larval and juvenile tunas and on taxonomy and nomenclature; abstracts of the papers presented; and resolutions adopted by the Conference. (See: Marr, John C. (Ed.), 1962 (Section 1 (b))).

A considerable number of papers were contributed to the FAO World Scientific Meeting on the Biology of Sardines and Related Species held in La Jolla, July 1962—with the U.S.A. acting as host government.

3. RESEARCH, INCLUDING DEVELOPMENT OF METHODOLOGY AND TECHNIQUE ON CERTAIN SPECIALIZED SUBJECTS RELATING TO FISHERIES

(b) Identification of aquatic organisms

The larvae of bigeye tuna, Australian northern bluefin and the Pacific bluefin have been identified. The larvae of albacore have been provisionally identified, but there are still some points of difference to be reconciled between some of the workers in this field. Descriptions of the four species have been published.

(c) Population dynamics, age determination, fish behaviour, and related studies

Considerable progress has been made in the identification of tuna subpopulations through the study of blood group systems. The species studied include skipjack, yellowfin, bigeye and albacore. Most attention has been devoted to skipjack, and different subpopulations appear to exist in (1) the Marquesas Islands, (2) the Society and Tuamotu Islands, (3) the Line Islands, (4) the Hawaiian Islands, and (5) the Palau Islands. In addition, there appear to be two subpopulations within the Hawaiian Islands region (see 3(f) below).

Behaviour studies have continued, through the use of underwater viewing ports in the research vessel CHARLES H. GILBERT and experimental facilities ashore. Analysis of motion picture records of experiments performed at sea show that catch rates were increased with water sprays on vs. water sprays off, with live bait vs. dead bait, and with non-diving bait species vs. diving bait species. Observations have shown that, in addition to the common pattern of horizontal stripes, skipjack at certain times exhibit a pattern of vertical bars. This appears to be primarily connected with feeding and disappears upon satisfaction. Skipjack are readily conditioned and thus may be used in experiments requiring a conditioned response. Studies of visual acuity are in progress. Studies of feeding suggest two daily peaks of feeding activity. Studies of the accumulation of tunas and other species under floating objects are just commencing.

Tagging experiments have previously suggested that the albacore of the North Pacific constitute a single subpopulation. A model, consonant with this hypothesis, has been developed explaining the movements of albacore in the North Pacific. In brief, the spawning grounds are believed to lie in the western tropical Pacific. Recruitment is believed to occur first in the North American fishery, with the center of albacore abundance gradually being displaced to the westward as

the fish increase in size and age. Attempts to locate the spawning grounds of South Pacific albacore have commenced. By analogy, the movements of albacore in the South Pacific may be a mirror image of the movements of North Pacific albacore. Eastern Indian Ocean albacore apparently represent a mixture of at least two subpopulations.

Studies of bigeye tuna in the Hawaiian Islands show a differential growth rate between the sexes. Above 100 pounds the males grow at a faster rate than the females. The asymptotic size for males is estimated at 518 pounds and for females 364 pounds.

Participation is planned in the International Indian Ocean Expedition. Studies of the distribution and abundance of the tunas and other apex predators will be made along north-south transects from the Arabian Sea to 40°S. lat. in the two monsoon seasons. Studies will be made of the distribution and abundance of demersal organisms in the Arabian Sea and the Bay of Bengal.

(d) Oceanography

An intensive study of the oceanographic data from a large area around the Hawaiian Islands has been completed and the results presented in the form of a climatic atlas. As a result of this study, there is planned a study of rates of change of the oceanographic processes of the region. Releases of drift bottles and drift cards from surface vessels in the Hawaiian Islands region have shown interesting seasonal changes in the surface currents. A more intensive study is planned through monthly releases of drift cards from aircraft. Computer programs for the processing at oceanographic station data have been developed. This will make it possible to examine all Pacific as a whole, rather than by small units. Several genera of copepods are being used in indicator species studies. Mid-water trawl collections of fishes are being similarly studied.

(f) Aquatic ecology

The empirically observed relationship between water type boundaries and skipjack

in the Hawaiian Islands regions continues to be used as the basis for predictions of the degree of success of the fishery. One subpopulation of skipjack appears to be related to the boundary between the California Current Extension and the Central North Pacific water; the other may be resident. The seasonal and geographic position of this boundary relative to the island chain thus affects the availability of the "season" fish to the fishery. Studies of the nature of this relationship are being continued.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(b) Control or alteration of the physical features of the environment

Plans for river basin development and harbor development are reviewed for possible effects on fish and wildlife.

(e) Stocking

Threadfin shad (*Dorosoma petenensis*) have been introduced and have become established in several reservoirs in Hawaii. Several species of marine fishes, primarily snappers and groupers, have been introduced by the Hawaii Division of Fish and Game.

5. FISH CULTURE AND FISH DISEASE CONTROL

(j) Special forms of aquiculture

The Hawaii Division of Fish and Game has in operation (for the first time in 1962) a *Tilapia* "farm" of about 21,600 square feet of pond area, with an estimated annual productive capacity of 30,000 pounds of *Tilapia* of about 1- $\frac{1}{2}$ inches in length. The purpose of this production is to provide a supplemental live bait source for the skipjack fishery

6. MISCELLANEOUS PROBLEMS

During the summers of 1961 and 1962, a cooperative gill net fishing experiment was carried out with the Hawaii Division of Fish and Game. It was hoped that the use of monofilament gill nets would free the skipjack boats from their dependence on live bait. Although the nets were tried in a variety of ways, they were not successful on a commercial basis (although they might be a useful sampling tool). The basic reason for non-success was that the skipjack could see, and avoid, the nets in the extremely clear waters of the region. They might be successful in areas with less clear water.

VIETNAM

PANEL A—INLAND FISHERIES

1. INFORMATIONAL SERVICES, BIBLIOGRAPHIES, REFERENCE BOOKS

(b) Bibliographies

A bibliography on the fisheries of Indo-China and South Vietnam is in preparation.

(c) Reference books

A handbook for milkfish (*Chanos*) farmers was edited in Vietnamese.

2. AQUATIC RESOURCES APPRAISAL

(c) Appraisals or inventories of fish populations

Surveys were made of the annual occurrence of *Chanos fry* along the central coast of Vietnam.

Surveys were also made with respect to the occurrence of *Pangasius fry* and other species in the Mekong River (An-Giang province).

(d) Reviews or synopses of aquatic forms of economic importance *Chanos*

A communication was made to the 10th Pacific Science Congress, Honolulu, 1961, on the collection of *Chanos fry* in Vietnam. A contribution with respect to resolution No. 22 of the Congress, concerning the establishment of a research group to study *Chanos* in its marine environment, was also made to the IPFC *Chanos* Sub-Committee.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS

(Including Reservoirs)

(a) Regulatory (legislative) measures

Legislation with respect of the control of inland fisheries is in preparation.

(b) Control or alteration of the physical features of the environment

River basin development. A program of studies and investigations has been established with respect to the effect on fisheries of the construction of a system of multi-purpose dams in the Mekong River drainage.

(d) Control or alteration of the biological features of the environment

An experiment on aquatic weed control using 2, 4-D is being carried out at a governmental fish cultural station.

(e) Stocking

Polyvinyl bags containing water and oxygen are in use for the transportation of small numbers of fingerlings.

A transportation truck of 5 tons equipped with a motor-sprayer pump is used to transport large quantities of fish over long distances.

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) Fish culture—general

Three small fish cultural stations were transferred to local (provincial) administration by the central government.

During the 1961-62 period, 2,216,500 square metres of fish ponds were constructed.

The total amounts of fish fry collected were as follows:

Chanos — 1,000,000 (from the sea)
Pangasius—3,500,000 (from the Mekong River)

Fingerling distribution to fish farmers during 1961-62 was as follows:

Cyprinus carpio — 335,918
Tilapia mossambica — 251,307
Osphronemus — 8,375
Helostoma — 4,276
Chanos — 105,600

More than 2,000 fish farmers have been trained in fish cultural practices.

(f) Handling and transport of "fish seed"

(See section 4(e)).

(g) Economics of fish culture

The collection of milkfish fry from the sea shore from May to August has created new work opportunities in Central Vietnam.

ANNEX II

REPORT OF THE FOOD AND AGRICULTURE ORGANIZATION
FOR THE IPFC INTER-SESSIONAL PERIOD, 1961-62
ON ACTIVITIES RELATING TO THE WORK PROGRAMME OF
TECHNICAL COMMITTEE I, IPFC

The numbering system for the major groupings adheres to that in the standard outline adopted at the 9th Session, 1961, of IPFC, for reporting on the work programme and major fields of activity of Technical Committee I. Any omissions from the outline represent fields for which no major activity was reported.

1. INFORMATIONAL SERVICES,
BIBLIOGRAPHIES, REFERENCE BOOKS

(a) Information—generally

(i) Miscellaneous information was sent to individuals and institutions in IPFC member countries by the IPFC Secretariat and FAO as requested.

(ii) The Biology Branch, Fisheries Division, FAO, continued to prepare, on the basis of its registers of fisheries institutions and experts in fisheries science, lists of institutions and of workers in particular subjects. The following lists were issued during the reporting period:

Fisheries Biology Branch, FAO (1961). A list of experts concerned with the study of algae. *FAO Fish. Biol. Tech. Pap.*, (7): 31 p.

Biology Branch, Fisheries Division, FAO (1962). A list of experts concerned with the study of algae. Supplement 1. *FAO Fish. Biol. Tech. Pap.*, (7-Supp. 1): 8 p.

Fisheries Biology Branch, FAO (1961). A provisional list of experts concerned with diseases of aquatic organisms and associated parasites. *FAO Fish. Biol. Tech. Pap.*, (11): 8 p.

EIFAC Secretariat and FAO Fisheries Biology Branch (1961). A provisional list of inland fishery workers in Europe. *FAO Fish. Biol. Tech. Pap.*, (15): 48 p.

Fisheries Biology Branch, FAO (1962). A world list of experts concerned with the study of the biology of tunas and related species. *FAO Fish. Biol. Tech. Pap.*, (10 Rev. 1): 25 p.¹

FAO Fisheries Biology Branch (1962). Provisional list of names and addresses of experts on pearl oyster, trochus and other nacreous molluscs of commercial interest. 6 p. (mimeo.)

(A second provisional list has been prepared (September 1962) and copies will be available at the 10th Session of IPFC. The definitive version will be issued, probably at the end of 1962, in *FAO Fish. Biol. Tech. Pap.*, series.)

See section 2(d) (ix) for background information.

FAO Fisheries Division Biology Branch (1962). List of marine institutions in the tropics (30°N-30°S) *FAO Fish. Biol. Tech. Pap.*, (20): 8 p.

(iii) The Current Bibliography for Aquatic Sciences and Fisheries

Continues to be compiled with the collaboration and assistance of the International Council for the exploration of the Sea (ICES) and several national laboratories. Volumes 3 and 4 and seven parts of Volume 5 of the printed version have now been published.

¹ This paper, issued in April 1962, is a revision with title change of a first draft bearing the same number (10) issued in Feb. 1961.

Through the courtesy of the Bureau of Commercial Fisheries of the U.S. Fish and Wildlife Service, a small number of issues of Vols. 3 and 4 of the *Current Bibliography* were made available for distribution to members of the IPFC with a view to drawing the attention of the fisheries workers in the region to this publication and ensuring that the greatest possible use of this valuable tool can be made.

The issues were sent to IPFC Administrative Correspondents by the Secretary of IPFC, Bangkok, on 21 March 1962 (IPFC/Circ. 62/5) with the request that they be deposited in some appropriate library or institutions where they would be available to fisheries workers. The request was made that the Administrative Correspondents take action to disseminate news concerning the publication and value for this Bibliography.

(iv) **World List of Periodicals for Aquatic Sciences and Fisheries**

The first volume of this list, containing the titles and their short forms of several thousand periodicals, is now ready for distribution as *FAO Fish. Biol. Tech. Pap.*, (19.1)

The second volume to be prepared in 1963 will give indexes to the list, and detailed bibliographic information, such as languages of texts and summaries, publishing address, subject coverage, availability (exchange, subscription, etc.) and frequency.

(iv) A paper describing "A Developing Aquatic Sciences Information Retrieval System", at the University of Rhode Island and based on the FAO Current Bibliography and related projects, has been published by J.S. O'Conner and S.B. Saila (1962) in *Trans. Amer. Fish Soc.* 91(2): 151-154.

(b) **Bibliographies**

(i) The following bibliographies of interest to IPFC countries were issued by the Biology Branch, Fisheries Division, FAO:

Bernabei, H. (Comp.) (1962). A bibliography of research on tunas for the years 1957-1960. *FAO Fish. Biol. Tech. Pap.*, (16, Rev. 1): 50 p.¹

Benarde, Melvin A. (1961). A partial bibliography on some crabs of commercial importance. *FAO Fish. Biol. Tech. Pap.*, (17)o. 211-217.

Van Campan, W.G. (Comp.) (1962). A bibliography of research on tunas for the years 1954-56. *FAO Fish. Biol. Tech. Pap.*, (23): 22 p.

(ii) The Secretariat of the IPFC (Bangkok) prepared and issued the following bibliographies as IPFC Occasional Papers:

No. 62/1. Preliminary bibliography of the fish and fisheries of Burma. 15 p. (mimeo.) (with IPFC/Circ. 61/18, 27 Nov. 1961)

No. 62/2. Preliminary bibliography of fish and fisheries of Pakistan, 1948-1961. 14 p. (mimeo.) (with IPFC/Circ. 61, 27 Nov. 1961)

No. 62/3. Preliminary bibliography of fish and fisheries of the Republic of the Philippines. 84 p. (mimeo.)

No. 62/4. Preliminary bibliography of fish and fisheries for Indonesia. (Compiled by A. Soulier) 111 p. (mimeo.) April 1962.

No. 62/5. Preliminary bibliography of fish and fisheries for Ceylon. (Compiled by A. Soulier) 38 p. (mimeo.) June 1962.

(iii) The Secretariat of the IPFC (Bangkok) also issued to members of Panels A in 1962:

Preliminary bibliography on nutrition in fish. 7 p. (mimeo.) See section 5(b).

(iv) See section 2(b) (ii) below with respect to a bibliography concerning the Indian Ocean.

¹ This paper, a revision of a bibliography with same title and number (16) compiled by R. Kuennan (1961), was submitted to the World Scientific Meeting on the Biology of Tunas and Related Species, 1962. A further revision will be included with Van Campan (1962) in the Proceedings of the meeting.

(c) Reference Books**(i) Handbook on Fish Culture**

The long-awaited "Hora Handbook" was issued as:

FAO Fisheries Division Biology Branch (1962) Handbook on fish culture in the Indo-Pacific Region. Based on a manuscript by S.L. Hora and T.V.R. Pillay, prepared in cooperation. *FAO Fish. Biol. Tech. Pap.*, (14): vii + 204 p.

(ii) Sampling Manual

Mr. J.A. Gulland (Lowestoft) has finished the draft.

(iii) Manual on Gear Selectivity

Mr. J.A. Pope (Aberdeen) has completed a draft based on the report of the Selectivity Working Group of the International Council for the Exploration of the Sea (ICES) —now in press. This draft has been revised by Mr. E. Cadima (Portugal) who has been working for FAO as a consultant. Mr. Cadima has also tabulated the selectivity data for areas other than the North Atlantic, using the ICES standard pattern. A provisional English edition will be issued in *FAO Fish. Biol. Tech. Pap.* series towards the end of 1963.

(iv) Manual on Fish Tagging

This will be based on the Proceedings of the International Commission for Northwest Atlantic Fisheries (ICNAF) Meeting on the subject held in Woods Hole, Mass. in 1961, which is now in press, and which will be made available by FAO to the IPFC.

(v) Manual on Methods in Fisheries Biology, Second Edition (revised)

The English version is being printed; French and Spanish translations should be printed in 1963.

(vi) Manual of Fisheries Science

The first provisional edition, distributed at the 9th Session of IPFC, is, it is understood, being revised by the author and General Editor (Dr. G.L. Kesteven) on the basis of comments received in the Inter-Sessional Period.

(vii) Manual on Stock Assessment

Little progress has been made with this, but Mr. S.J. Holt and Mr. Cadima have completed drafts of some sections, and other section will be based on the material being prepared by Mr. J.A. Gulland and collaborators for the 2nd Lowestoft Training Course in Stock Assessment to be held in February-March 1963.

2. AQUATIC RESOURCES APPRAISAL**(a) Country and regional appraisals, reviews or synopses**

(i) As an aid to the preparation of such synopses for marine areas, the following paper was issued in June 1962:

Biology Branch, Fisheries Division, FAO (1962) Preparation of regional fisheries oceanographic synopses. *FAO Fish. Biol. Synops.*, (5-Rev. 1): 14 p.

(ii) The Secretariat of IPFC (Bangkok) has prepared, in collaboration with the Biology Branch of FAO's Fisheries Division, a synopsis of the fisheries resources of Pakistan, and synopses for Burma and the Philippines are nearly complete.

(iii) The project for preparation of country and regional synopses has been transferred from the Biology Branch to the newly established Intelligence and Technical Reports Section of the Office of the Director, Fisheries Division, FAO. The arrangements for compiling material are therefore being reorganized.

(b) Appraisals, surveys or synopses of marine areas, or of river basins (inland) or individual waters (inland)

(i) The following report on a project conducted under the Expanded Program of Technical Assistance (EPTA) is concerned in part with this subject:

FAO/UN (1962) Report to the Government of Ceylon on a project of inland fisheries development. Based on the work of S.W. Ling. *FAO/EPTA Report*, (1527): 43 p. (See also section 2(a) (i) above and 2(c) below)

(ii) As a contribution to the International Indian Ocean Expedition (IIOE) a bibliography of the area has been issued by the Woods Hole Oceanographic Institute; this assimilates the preliminary bibliography compiled by FAO and issued in July 1960 as an appendix to document FB/60/T5. It is understood, however, that the early IPFC Document "Bibliography of the Western Sector" was not consulted for this revision.

(c) Appraisals or inventories of fish populations

The following reports on projects within the Indo-Pacific region conducted under the Expanded Program of Technical Assistance (EPTA) and concerned wholly or partly with this subject were issued:

(i) Baschieri-Salvadori, F. (1961) Second report to the Government of India on the pearl and chank beds in the Gulf of Manaar. *FAO/ETAP Report*, (1323): 12 p.

(ii) FAO/UN (1961) Report to the Government of India on a survey of the fishery resources of the Bay of Bengal. Based on the work of V.M. Naumov. *FAO/ETAP Report*, (1393): 60 p.

(Dr. Naumov and his Indian counterparts are preparing detailed scientific reports of their joint work for publication in a special issue of the *Indian Journal of Fisheries*.)

(iii) FAO/UN (1961) Report to the Government of the Philippines on the organization and operation of the Limnology Project, 1959-1960. Based on the work of J.S. Dendy and F.F.W. Morawa. *FAO/ETAP Report*, (1319): 25 p.

(iv) FAO/UN (1962) Third report to the Government of India on the pearl and chank beds in the Gulf of Manaar. Based on the work of Francesco Baschieri-Salvadori. *FAO/EPTA Report*, (1498): 7 p.

(v) FAO/UN (1962) Report to the Government of the Philippines on the development of inland fisheries. Based on the work of John W. Parsons. *FAO/EPTA Report* (being processed)

(d) Reviews or synopses of aquatic forms of economic importance

General—For several years the Fisheries Biology Branch of FAO has been issuing a series of synopses on the biology of species of living aquatic organisms. The earlier papers were mimeographed and several were in provisional form. The first to be published using a xerox process and with stiff cover was on a species of particular interest to the IPFC, the milkfish. This synopsis was issued as:

Schuster, W.H. (1960) Synopsis of biological data on milkfish *Chanos chanos* (Forsk.) 1775. Rome, FAO, FB/60/S4.

It was distributed at the 9th Session of IPFC, and its welcome reception has resulted in a standardization of format for subsequent synopses in this series.

The following paper, prepared in February 1962 and sent to IPFC, describes the scope, purpose and pattern of synopses of biological data concerning living aquatic organisms, collaboration with various institutions and a "synopsis association". It contains the original synoptic outline (version No. 1) and publishes for the first time a new standard outline (version No. 2).

Rosa, H., Jr., (1962) Preparation of synopses on the Biology of species of living aquatic organisms. *FAO Fish. Biol. Synops.*, (1): 53 p.

The paper contains a list of synopses already prepared.

Those of special interest to members of IPFC include ones on the species of Trichiuroidei, *Sardinella* and *Sardinops*, Clupea (*Harengula*) *longiceps*, *Rastrelliger* and *Hilsa*. Revisions of the last two are now in press.

It may also be noted that synopses are now in preparation on the following Indo-Pacific forms: *Coryphaena*, *Leionura atun*, *Arripis trutta*, *Jasus lalandii*, *Nemadactylus richardsoni*.

A synopsis on *Mugil cephalus* has been prepared by J.M. Thomson and issued in a provisional version by CSIRO Australia (1962). A revised version will be issued in

a new series "CSIRO Fisheries and Oceanography, Fisheries Biology Synopsis" having the same format and arrangement as the FAO series and edited in collaboration.

Twenty-nine other synopses on the biology of tunas and related species have also been issued as documents for the Tuna Meeting and will be included in the Proceedings of the Meeting. (See below)

(i) Tunas

The FAO World Scientific Meeting on the Biology of Tunas and Related Species, at which the above synopses were presented, was held 2-14 July 1962 in La Jolla, California.

In anticipation of this Meeting, and in accordance with a recommendation of the Council made at its 9th Session, the Administrative Correspondents of all member countries of IPFC were asked to transmit a paper to the Technical Secretary of Technical Committee I summarizing with respect to the biology of tunas, the present and planned research within their countries or areas of work. Countries replying were: Australia, Ceylon, France (New Caledonia), India, Japan, Korea, Federation of Malaya, Republic of the Philippines, U.K. (Hong Kong) and USA (for Hawaii and Caroline Islands—Trust Territory of the Pacific Islands).

The contributed information from IPFC member countries was listed in: "Information on tuna research conducted and planned by the member countries of IPFC and GFCM and by institutions along the west coast of USA, and specific problems suggested for discussion at the World Scientific Meeting on the Biology of Tunas and Related Species" Information Paper No. 7, 1962, 19 p.

Resolutions of the Tuna Meeting are given in full in an IPFC Working Paper for the 10th Session. Resolutions (3), (7), (11) and (12) pertaining to the Indian Ocean have been transmitted to the United Nations Educational, Scientific and Cultural Organization (UNESCO) for consideration by the 2nd Ses-

sion of its Intergovernmental Oceanographic Commission (IOC) in Paris, September 1962.

The Director-General of FAO has, in response to Resolution (19) established a continuing Committee for Facilitation of Tuna Research consisting of scientists selected from the FAO Panel of Fisheries Experts.

(ii) Mackerels

The Council, at its 9th Session, proposed that a "workshop" on *Rastrelliger* should be held in Malaya under the FAO Technical Assistance Program.

FAO has included this project in its list of proposed regional projects under EPTA for 1964.

At its 9th Session, the Council requested participating countries to send records of length-sampling operations to the Chairman of the *Rastrelliger* Sub-Committee to be referred to the Council Secretariat for publication as an IPFC Occasional Paper.

In 1962 arrangements were made for the reproduction of *Rastrelliger* Length Frequency Distribution forms through arrangements with the Chairman of the *Rastrelliger* Sub-Committee. These forms, together with an explanation of their use (including a model form), were despatched under date of 7 March 1962 directly by the Secretary of the IPFC, Bangkok, to members of the IPFC *Rastrelliger* Sub-Committee with copies to IPFC Administrative Correspondents and members of Technical Committee I and Panel B.

It was proposed that, as a first experiment, summarized data for samples taken during the first half of the calendar year 1962 should be submitted to the IPFC Secretariat for compilation and presentation for discussion at the 9th Session of the IPFC, with a view to initiating a routine compilation from the beginning of 1963.

(iii) Sardines

The "Proceedings of the World Scientific Meeting on the Biology of Sardines and Related Species held in Rome, 14-21 Septem-

ber 1959" were issued in three volumes in June 1962 under a publishing date of 1960 by FAO, Rome:

- Volume I — Report
- Volume II — Species Synopses; Subject Synopses
- Volume III — Stock and Area Papers; Experience Papers; Methodological Papers.

Supplement 1 to the Proceedings (dated 1961) was also issued in June 1962.

(iv) *Chanos*

At the 10th Pacific Science Congress held in Honolulu, 21 August to 6 September 1961, the Freshwater Science Standing Committee submitted a resolution with respect to the milkfish (*Chanos chanos*) for consideration by the Council of the Pacific Science Association.

This resolution called attention to the importance of *Chanos* both as a food fish for man and a bait fish for tuna and recommended a research group to study certain aspects of the species' biology, growth, migration and spawning grounds in its marine environment. The resolution recommended the cooperation of IPFC in establishing such a group.

A copy of the resolution was sent to pertinent members of IPFC by the Secretary of IPFC as IPFC/Circ. 61/13, dated 20 September 1961.

On 6 November 1961, Mr. Lawrence H. Snyder, President of the Tenth Pacific Congress, forwarded to the Director-General of FAO a copy of Resolution No. 22 of the Tenth Pacific Science Congress, adopted by the Congress 2 September 1961, based on Resolution (No. 5) of the Freshwater Science Standing Committee, and although somewhat different in wording—almost identical in content.

On 26 February 1962 the Director-General replied to Mr. Snyder stating that: "Note has been taken of Resolution No. 22, which concerns the establishment of a research group to study the biology and growth

of the milkfish *Chanos* in its marine environment. As you may be aware, the Indo-Pacific Fisheries Council, whose Secretariat is provided by FAO, has a *Chanos* Sub-Committee which has been studying the problems of *Chanos* for some years. Resolution No. 22 has been brought to the attention of: the Chairman of this Sub-Committee, the Secretary of Technical Committee I (Biology and Hydrology) of IPFC, and the Secretary of the Council. Arrangements will be made for a study of the Resolution by the *Chanos* Sub-Committee and Technical Committee I at the Tenth Session of the IPFC, scheduled to be held in October 1962."

(v) *Hilsa*

See section 2(d) (o) with respect to the preparation of a synopsis for *Hilsa ilisha*.

(vi) *Mugil*

See section 2(d) (o) with respect to preparation of a synopsis for *Mugil cephalus*.

(vii) Prawns and shrimps

The Eleventh Session of the Conference of FAO (November 1961) noted that international meetings had been held for the exchange of technical information on fisheries biology and to discuss future lines of research. It subscribed to proposals to hold similar future international meetings, for example, one on *shrimp*, subject to the availability of funds. (Conference Proceedings, Eleventh Session, Rome, 4 November 1961, Provisional Report, 5 December 1961. *Paragraph 234*.) Consideration is being given to include such a meeting in the FAO Program of Work and Budget for 1964-65; the views of IPFC on this proposal would be appropriated.

(viii) Molluscs

The Council, at its 9th Session, recommended that FAO provide a list of workers especially interested in pearl oysters, trochus and other nacreous molluscs of commercial interest. This task has been undertaken by the Biology Branch, Fisheries Division, FAO, which has issued a provisional list based on several sources, especially its Register of Experts in Fisheries Science, entries in the *Current Bibliography for Aquatic Sciences and*

Fisheries, and papers listed in "Mollusques perliers et perles (Bibliographie)" by Gilbert Ranson (avec le concours de Mlle Jacqueline Paretias). *Bull. Inst. Oceanog. Monaco*, (1140), 31 mars 1959, 43 p.

A revision of the FAO list based on further bibliographic search and the comments of persons to whom the first list was sent, is submitted for consideration of the 10th Session of IPFC, and a definitive indexed version will be issued at a later date in the *FAO Fish. Biol. Tech. Pap.* series. (See section 1(a) (ii) for further details.

(ix) **Bluegreen algae**

(A) Professor J. Feldmann (Sorbonne, Paris) and the International Phycological Society are collaborating in the preparation of synopses of seaweeds of economic value following the FAO outline adapted to the biology of plants. Professor Feldmann has drafted an adapted outline for plants, which is being commented on by various algologists.

(B) The document "Some notes on statistical systems covering the seaweed industries of the world", proposed by the Fisheries Division of FAO was presented and discussed at the 4th International Seaweed Symposium (Biarritz 1961) and will be published in the Proceedings of the Meeting.

This paper contained a more detailed classification than has been used hitherto for statistics of aquatic plants and derived preserved and processed commodities; it contained proposals for guiding lines for the improvement of national statistics, where necessary. The classification has been revised on the basis of the comments made by the participants and it has now been adopted for use in FAO statistics, as a first step in the required direction.

(C) The 4th International Seaweed Symposium approved a proposal that national institutes promote research on seaweeds as a basis for the better management of resources, and a more intense and rational use of these raw materials as a potential source of food as well as for industrial purposes.

FAO has been requested to convey that wish to governments and to decide "in consultation with the existing organizations (International Seaweed Symposium, International Phycological Society, national specialized institutions, etc.) on the measures to be undertaken, especially those concerning the problems of scientific documentation and coordination of regional or international research in this field"

These matters have been communicated to governments by the Director-General of FAO.

3. RESEARCH, METHODOLOGY AND TECHNIQUES

(a) Standardization of equipment and methods of assessment of plankton populations

(i) FAO has kept in touch with work of an IOC working group on this subject with reference to the International Indian Ocean Expedition (IIOE). This group has agreed to standard reference methods of zooplankton sampling and field comparisons of different methods are in progress.

(ii) In 1961 the International Council for the Exploration of the Sea (ICES) held a symposium on zooplankton production which included participants not only from Europe and the USSR but also from North and South America and the United Arab Republic, to which Dr. T. Laevastu (then to the Fisheries Biology Branch) contributed a paper on "The adequacy of plankton sampling". The Proceedings of the Symposium are being printed as *Rapp. Proc. Verb. Cons. Int. Expl. Mer.* (153), 1962. They contain important sections on Methods at Sea and in the Laboratory, Food and Tropic Relations, and Distribution, and also reference to the arrangements being made for the IIOE (see (i) above). The symposium proposed that ICES establish a sub-committee to study and advise on the possibility of using standardized gear when comparative sampling is desired. It was also recommended that an endeavour be made to find more precise methods of evaluating the production and overturn of zooplankton as distinct from

the biomass, and also that further research be instigated into the timing of zooplankton spawning in relation to primary production and the spawning of fish.

Most participants preferred at present to use sampling gear with cables and mechanically operated equipment rather than specialized gear operated mechanically, electrically or by sonic apparatus; further research was considered to be needed to make the operation of such equipment simple and reliable. It was also considered that too little is known of the physiology and biochemistry of zooplankton for guidelines yet to be given on the scope of further research and development in this field.

(b) Identification of aquatic organisms

A list of genera of aquatic organisms indexed up to and including Vol. 5 of the "Current Bibliography for Aquatic Sciences and Fisheries" was issued by FAO as:

FAO Fisheries Division Biology Branch (1961). Current Bibliography for Aquatic Sciences and Fisheries—Taxonomic Classification. Alphabetical Key to 8 Digit Code *FAO Fish. Biol. Tech. Pap.*, (12): 84 p.

These names and related information have now been put on IBM punch-cards at the Aquatic Sciences Information Retrieval Center, Rhode Island, U.S.A. which will in future assist FAO in the preparation of supplements, revisions and analyses of the code. Common names of organisms of commercial importance will also be included on the punch-cards, as those are augmented from level of genus to that of species and sub-species.

(c) Population dynamics, age determination, fish behaviour and related studies

(i) Informative letters on the progress towards development of methods of stock assessment without recourse to age determination were sent to members of Technical Committee I, Panel A and Panel B by the Technical Secretary (27 November 1961 and 4 April

1962). Copies of the following papers accompanied the letters:

Gulland, J.A. (1961). The estimation of the effect on catches of changes in gear selectivity. *J. Cons. Int. Explor. Mer.*, 26(2): 204-214.

Holt, S.J. (1962). The application of comparative population studies to fisheries biology—an exploration. pp.51-71. In Le Cren, E.D. and M.W. Holdgate (ed.). The exploitation of natural animal populations. British Ecological Society, Symposium (2). Oxford, Blackwell Scientific Publications.

Since that time, Mr. E. Cadima, working as a consultant to FAO, has made further progress in this matter, an account of which will be published and made available to IPFC at a later date.

(ii) A literature survey and summary of "The influence of temperature on the behaviour of fish" by I. Hela and T. Laevastu (1962) has been issued as *FAO Fish. Biol. Tech. Pap.*, (22): 21 p.

(iii) An important problem in stock assessment is the determination of the selectivity of nets for fish of different species and sizes. Research on selectivity requires standard reference methods and instruments for mesh measurement. After several years of experiments ICES and ICNAF have adopted, for research purposes, the so-called "ICES Mesh Gauge" developed by C.J.W. Westhoff. FAO has, in the interests of comparability, undertaken to call the attention of research workers and organizations outside the N. Atlantic area to the desirability of testing this gauge elsewhere, with a view to its eventual world-wide adoption as a reference instrument. The gauge is described and illustrated in: ICES (1962) Prospectus of the I.C.E.S. mesh gauge. Charlottenlund Slot, Denmark, unpag., 14 p. Copies are available to IPFC.

Appropriate action by the IPFC is requested.

(d) Oceanography

In recent years oceanographic and fisheries research has shown an important expansion at national and international levels. In relation to this development, efforts have been made to adapt the existing international organizations and to meet the increasing need for coordination and co-operation in this field to set up new bodies where necessary.

At the 10th Meeting of the International Commission for Northwest Atlantic Fisheries (ICNAF) in 1961 these matters were analyzed and a recommendation approved that the Commission urge member countries, recognizing the complementary nature of fisheries and oceanographic research to work for the establishment of an international committee which might be convened by FAO in consultation with national and inter-governmental bodies concerned with fisheries and fishery research, with the responsibility of providing advice to the Inter-governmental Oceanographic Commission (IOC) under UNESCO on the oceanographic aspects of fisheries.

Some years ago, FAO recognized that it would be necessary to deal more effectively with these matters as they concerned its programme by the constitution of an advisory body. Bearing in mind this need, and also considering the ICNAF recommendation, an Advisory Committee on Marine Resources Research (ACMRR) has been established by the Director-General on the authorization of the Eleventh Conference of FAO. The first session of the Committee is expected to take place early in 1963. ACMRR is initially composed of thirteen fisheries scientists and experts appointed, after consultation with member governments and regional fisheries bodies, for a one-year period and eligible for reappointment. Regional and subject representation have been taken into consideration but members were selected on the basis of their expert knowledge and not as representatives of governments. Its purpose is to study and report to the Director-General on

the formulation and execution of the programmes of FAO concerned with research on marine fisheries resources, and the dissemination, interpretation and application of the results of such research, special attention being paid to the fisheries aspects of oceanographic research.

The Inter-governmental Oceanographic Commission (IOC) under UNESCO has been informed of these actions, of the 1961 ICNAF resolution that such a committee might serve a useful function in advising IOC of such matters pertaining to fisheries aspects of oceanography, and of the FAO Conference concurrence with this view.

The IOC is considering, at its second session in Paris, September 1962, the question of its own advisory bodies. The various possibilities under consideration included: (a) formation of IOC's own standing committees; (b) acceptance of SCOR (the Special Committee on Oceanographic Research) of the International Council of Scientific Unions (ICSU), broadened in scope to cover fisheries aspects of oceanography, as sole advisory body; (c) acceptance of SCOR with its present scope and also another committee—which might be the ACMRR—as advisors, either as two separate committees or as a joint committee.

In this connection SCOR and its working group on Fisheries Oceanography, in which FAO is participating, has been considering the scope, achievements and tasks of "fisheries oceanography", and the results of their discussions will be communicated to IOC (at time of reporting these results are not known, but they will be communicated to IPFC verbally by the Technical Secretary).

The report of SCOR and the decisions of IOC will influence the agenda of the first ACMRR meeting, a background paper for which has been prepared by D.H. Cushing (1962) "Fisheries Oceanography" as *FAO Fish. Biol. Tech. Pap.*, (24): 11 p.

Coordination of the activities of the UN Agencies concerned with marine sciences

at the Secretariat level is being achieved through the Sub-Committee on Oceanography of the Administrative Committee on Coordination (ACC).¹ This Sub-Committee met in 1961 and again in 1962 and reported through ACC to the Economic and Social Council of the UN See also section 2 above for other information on oceanography.

(e) Studies of basic productivity

A paper by H.R. Krause (1962) "Investigation of the decomposition of organic matter in natural waters" has been issued as *FAO Fish. Biol. Rep.* (34): 14 p.

4. MANAGEMENT OF FISHERY RESOURCES IN NATURAL WATERS (Including Reservoirs)

(a) Regulatory (legislative measures)

In 1961 the Economic Branch, Fisheries Division, FAO, conducted an expert meeting on the effects of fishery regulations (mainly with reference to marine fisheries).

The FAO Biology Branch and several fisheries biologists participated in this meeting, and there was a considerable discussion of the biological bases of regulatory measures.

The background papers and discussion will appear shortly in a report entitled "Economic effects of fishery regulation. Report of the Expert Meeting on the Economic Effects of Fishery Regulation held in Ottawa, from 12-17 June 1961".

(b) Control or alteration of the physical features of the environment, reservoir fish management

Through the courtesy of the Sport Fishing Institute (USA), copies of a useful review of the history of fisheries work on

North American reservoirs (including a good bibliography) were sent, 1 February 1962, to members of Technical Committee I and Panel A:

Jenkins, Robert M. (1961). Reservoirs fish management—progress and challenge. Sport Fishing Institute: 22 p.

(c) Control or alteration of the chemical features of the environment

(i) Water pollution control

(A) General—The Organization, with IAEA and the Regional Office for Europe of WHO, was a co-sponsor of the Conference on Water Pollution Problems in Europe, convened by the UN's Economic Commission for Europe (ECE) in Geneva in 1961.

One of the papers presented, "The position of the Food and Agriculture Organization with respect to Water Pollution Control" contained a summary of the work of IPFC in this field.²

The Report of the Conference and its documents were

United Nations (1961). Conference on Water Pollution Problems in Europe, held in Geneva from 22 February to 3 March 1961. Documents submitted to the Conference. Vols. I-III. United Nations, Geneva. 600 p. (mimeo.)

Although the Conference was concerned primarily with the water pollution problems of Europe, a large number of the papers are of universal interest especially as they deal with principles of pollution control, the organization of surveys, and the administrative, legal and economic aspects of water pollution in both national and international waters. For this reason, the Secretary of

1 (The UN Agencies involved are: FAO, UNESCO, World Meteorological Organization (WMO), International Atomic Energy Agency (IAEA), International Civil Aviation Organization (ICAO), Intergovernmental Maritime Consultative Organization (IMCO).

2 ECE Document WATER POLL./CONF./21 by Wm. A. Dill. (Reproduced in UN (1961), Vol. I: 120-126.)

Technical Committee I procured enough copies of the Report and its documents to send to all members of Panel A (April 1962) ¹

(B) *Water quality criteria for fish* — One of the discussions at the Conference on Water Pollution Problems in Europe centered around the necessity of knowing “..... the water quality requirements desirable for each of its several uses (as a source of drinking water, water for industry and agriculture, fisheries, general amenity, etc.”. It was stated that it would be most helpful if these could be expressed quantitatively, and with respect to fisheries the Conference suggested that the European Inland Fisheries Advisory Commission (EIFAC) take the initiative in drawing up recommended water quality criteria.

The suggestion was laid before EIFAC at its 2nd Session, Paris, May 1962, with the result that :

“The Commission agreed that the proper management of a river system demands that water of suitable quality be provided for each use that is made or intended to be made of it and that the attainment and maintenance of such quality is normally to be sought through the control of pollution. It would be necessary therefore to know the standards of quality required for each particular use in order to determine the degree of pollution control necessary and to forecast the probable effect of augmented or new discharges of effluents.”

“With such reasoning in mind, it was proposed and agreed that the establishment of water quality criteria for European freshwater fishes be undertaken by the Commission.²

A working party is being established to erect such criteria. It is planned that the

group will make a critical examination of the literature and very possibly will suggest experimentation to clear up contradictions and fill in gaps of knowledge. On the basis of this survey, decisions will be made on the minimum, maximum and especially the optimum or desirable requirements for various fishes or groups of fishes with respect to quality of water, e.g., temperature, pH, dissolved oxygen content, dissolved solids, etc.

It is obvious that the role of the Commission is advisory and that national regulations on pollution will not be superseded by the erection of such criteria. Nevertheless, agreement on the basic criteria of optimum water quality requirements for the production of aquatic life in the freshwaters of Europe by such a representative body as EIFAC should go far towards promoting uniformity in pollution control legislation and in aiding enforcement of regulations.

Similar criteria have been proposed for aquatic organisms in North America, and it is suggested that the IPFC may wish to consider the same matter with respect to the Indo-Pacific Region.

(C) *Radioactive wastes*— There was participation by FAO at two meetings of the *ad hoc* Panel on Radioactive Waste Disposal into Fresh Water, convened by the International Atomic Energy Agency (IAEA) in Vienna in May and October 1961.

It is expected that the report of this Panel will be issued by IAEA late in 1962. It is hoped that the report will be useful to both the expert and the layman in situations where potential contamination of fresh water bodies, particularly international waters, by radioactive wastes is involved.

¹ Unfortunately, a scarcity of copies limited their distribution with IPFC to members of this Panel and the library of the Secretary of IPFC in Bangkok. It is believed that copies of UN (1961) are no longer available. However, a selection of Conference papers of general interest has been published by WHO, on behalf of all the agencies concerned, as “Aspects of water pollution control”. *Public Health Papers* (13), WHO, Geneva, 1962. It is available (as a priced publication) from WHO.

² EIFAC (1962) Second Session, Paris, 7-12 May 1962, Report. Rome, FAO: 49 p.

(D) *Pesticides* — The attention of the Executive Committee of IPFC was called to the growing concern of various agencies to the danger to aquatic life resulting from the use of pesticides. (ExCo/34/WP2, July 1962.) Examples follow:

The Tenth Pacific Science Congress, Honolulu, 21 August to 6 September 1961, adopted the following Resolution (13):

"It is generally recognized that the wide use of chemical pesticides is essential and that those developed and put into general use within the past two decades are more practical and more effective than ever before. However, these new pesticides pose threats to man and to desirable plants and animals, including fish and wildlife, especially in large-scale programs."

"RESOLVED that in all pest-control operations appropriate safeguards be provided to prevent injury to public health and to desirable plants and animals. All interests should be considered in deciding on when and where control is advisable: what materials, formulations and methods of application are indicated; and what safeguards are necessary".

The Eleventh Conference of FAO (November 1961) also drew attention to the risks to man, plants and animals from chemical pesticides:

"Particular attention was called to the pollution of inland and estuarine waters through the extended use of pesticides. This was considered especially critical since it adversely affects the breeding and nursery grounds of many commercially important species of fish and shell-fish. The Conference stressed the need for the Fisheries Division to take an active part in the FAO program on the use of pesticides."

(Conference Proceedings, Eleventh Session, Rome, 4 Nov. 1961, Provisional Report, 5 Dec. 1961. *Paragraph 236.*)

With respect to the "FAO program on the use of pesticides", it should be noted that an FAO Committee on Pesticides in

Agriculture was authorized by Resolution No. 8/61 of the Eleventh Session of the Conference. (*Ibid. Paragraph 161.*)

(E) It should be of interest to IPFC members to know that the Organization for Economic Cooperation and Development (OECD) has commenced work on the preparation of an "international directory of water pollution research institutions". It has received advice from FAO on this matter.

(d) **Control or alteration of the biological features of the environment**

(i) **Aquatic weed control**

(A) The following paper, prompted to some extent by inquiries received from IPFC member countries, was issued in September 1961:

Biology Branch, Fisheries Division, FAO (1961). Some Notes on the use of the manatee (*Trichechus*) for the control of aquatic weeds. *FAO Fish. Biol. Tech. Pap.* (13): 6 p.

Aside from the technical information presented, the paper clarified the position of FAO and IPFC in the matter.

(B) The Eleventh Conference of FAO (November 1961) recommended that: "Effective steps should also be taken to promote international measures for the control of water hyacinth in collaboration with CCTA (Commission for Technical Cooperation in Africa South of the Sahara) and other interested inter-governmental agencies".

(From Paragraph 165 of Conference Proceedings, Eleventh Session, Rome, 4 Nov. 1961. Provisional Report, 5 Dec. 1961.)

5. FISH CULTURE AND FISH DISEASE CONTROL

(a) **Fish culture—general**

(A) In noting that international meetings had been held for the exchange of technical information on fisheries biology and to discuss future lines of research, the Eleventh Session of the Conference of FAO (November

1961) urged that a Symposium on Freshwater Fish Culture be held in 1964.

(Conference Proceedings, Eleventh Session, Rome, 4 November 1961, Provisional Report, 5 December 1961, *Paragraph 234*.)

Consideration is being given to include such a Symposium in the FAO Program of World and Budget for 1964-65.

(B) See section 1(c) with respect to issue of the "Handbook on fish culture in the Indo-Pacific Region" in 1962.

(C) The following paper, based on reports submitted during an FAO fellowship awarded under EPTA to a fellow from Ceylon, was issued in March 1962 as:

Pillai, T. Gottfried (1962). Fish farming methods in the Philippines, Indonesia and Hong Kong. *FAO Fish. Biol. Tech. Pap.*, (18): 68 p.

Copies were sent to the host countries, and members of IPFC Technical Committee I and Panel A.

(b) Nutrition

The 9th Session of the Council urged Member Governments to initiate and develop studies of pond fish nutrition and to forward such relevant information to the IPFC Secretariat for dissemination. On 19 April 1962, (IPFC/Circ. 62/8) the Secretary (Bangkok) sent members of Panel A a preliminary bibliography on fish nutrition asking for additions, corrections or amendments for incorporation into a final document to be submitted to the Tenth Session as a Working Paper for Panel A. (See section 1(b) (iii).

(c) Studies of fish breeding, including genetics

A list of workers on fish genetics is being compiled by the Biology Branch, Fisheries Division, FAO.

(d) Aquatic weed control

(See under 4(d)).

(e) Handling and transport of "fish seed"

Material for a review of the anesthetics and tranquilizers used in the transport of fish continued to be gathered by the Biology Branch.

(f) Disease and parasite control

A list of workers on fish parasites and diseases is being compiled by the Biology Branch.

(g) Economics of fish culture

The Economics Branch of Fisheries Division, FAO, has prepared a draft handbook on the economic analysis of fish pond operations. On the basis of this study an outline has been evolved for a study on the application of linear programming techniques in the economic management of fish ponds. It is expected that this will be issued shortly in the *FAO Fisheries Papers* series.

6. MISCELLANEOUS

(a) Technical Assistance Experts

During the Inter-Sessional Period, 1961-62, four FAO/EPTA experts in fisheries biology were assigned to countries within the IPFC region as follows:

(i) India:

Project: Survey of peal and chank beds in the Gulf of Mannar.

Expert: F. Baschieri — Salvadori, FAO/EPTA Marine Fisheries Biologist.

Period: 4 December 1961-20 February 1962.

(ii) Federation of Malaya:

Project: Fish Culture: technical training, survey, extension and development.

Expert: S.W. Ling, FAO/EPTA Inland Fisheries Biologist.

Period: 5 June 1959 - continuing.

(iii) Pakistan :

Project: Survey (in cooperation with a gear technologist) of the pelagic and demersal fishery resources of Bay of Bengal.

Expert: Kenneth Hall Bain, Marine Fisheries Biologist.

Period: 9 April 1962—continuing.

(iv) Philippines :

Project: Inland fisheries and limnological investigations and aid in the development of a freshwater investigations unit.

Expert: John W. Parsons, Inland Fisheries Biologist.

Period: 16 April 1961-March 1962.

It is expected that two new FAO/EPTA inland fisheries biologists will be assigned in the autumn of 1962 as follows:

(i) Philippines :

Project: Continuation of the above inland fisheries biology project.

Period: Autumn of 1962—to continue through 1964.

(ii) Thailand :

Project: Development of a research programme in inland fisheries biology and fish culture.

Period: Autumn of 1962—to continue through 1964.

The remainder of the programme for 1963-64 cannot be outlined at present.

(b) Fellowships

During the Inter-Sessional Period, FAO/EPTA fellowships in fisheries biology were awarded to five fellows from four member countries of IPFC: Japan, Malaya, the Philippines and Thailand. At the time of reporting, only the fellowships for Thailand had been implemented.

Thailand :

Fellows: Prasit Aguru and Suchit Bhinyoying

Study programme: Fish Culture

Host Country: Malaya (under FAO/EPTA Inland Fisheries Biologist, S.W. Ling)

Period: 1 November 1961-28 February 1962.

Other fellowships will be granted during the 1963-64 period.

ANNEX III

REPORT OF THE CHANOS SUB-COMMITTEE
TO TECHNICAL COMMITTEE I, IPFC
FOR THE INTER-SESSIONAL PERIOD, 1961-62

The Sub-Committee finds that the present status of the culture of the milkfish (*Chanos chanos*) in confined waters has been thoroughly discussed in several papers to which the attention of the IPFC has previously been called. The practice in Indonesia was described by Sunier (1922) and Schuster (1952); in Taiwan by Chen (1952); and in the Philippines by Herre and Mendoza (1929), Frey (1947), and Rabanal, Montalban and Villaluz (1953). Subsequently sporadic reports of progress attained from various countries have been brought to the attention of the Council through the Chanos Sub-Committee.

During the intervening period, there were some reports on *Chanos* that were brought to the attention of the Council. Kuronuma reports on the presence of milkfish larvae on the eastern coast of Vietnam and Le Van Dang on the *Chanos* fish culture program of that country (Pacific Science Congress, Honolulu, Hawaii, 1961). Australia has reported that the status of the *Chanos* fishery from Australian Papua and New Guinea is mainly one of exploitation from the marine environment of a limited amount of maturing forms and breeders.

In Thailand, the program for milkfish culture was initiated in 1950 with the establishment of a brackish water fisheries station at Klongwan, Prachuab Province. By 1956, a number of private projects had been established and these have demonstrated success. The demand for milkfish fry increased to about one million in 1961 but the supply from the known grounds in the provinces of Choburi, Rayong, Chantaburi, Pechaburi and Prachuab has been unsteady.

The Federation of Malaya is undertaking a survey of its *Chanos* fry resources. It is very much interested in developing *Chanos* culture but is handicapped by lack of knowledge of the "seed fish" supply. Samples of milkfish fry and juveniles have been received from Indonesia to be used by field fishery officers in that country for this survey.

Present attention is being directed to studies on *Chanos chanos* in its natural marine environment. A recognition of the lack of knowledge on this phase of the life history of this species has led the Tenth Pacific Science Congress held at Honolulu, Hawaii, in 1961 to call for international collaboration on this phase of study.

**Status of the Culture of *Chanos*
in Confined Waters**

Chanos culture in Indonesia has continued to expand in area. Improvement of culture techniques is being promoted by newly established experimental fishponds and nurseries as well as existing demonstration extension as well as instructional government pond projects.

In India, government experimental pond projects have been planned and are being set up.

Thailand has found *Chanos* fry along its coast and suitable swampland regions for establishing *Chanos* fishponds. At present, 24 fish farmers with ponds covering some 235 hectares have been reported. These ponds are mostly located in the province of Smudsakorn, Smudsongram, Smudprakarn and Chacherngsao. Undoubtedly there are still extensive areas of estuarine swamplands for building fishponds and the

milkfish pond industry will continue to expand. There will be need of more fry grounds and greater production of the seed fry.

Vietnam has recently reported the presence of *Chanos fry* along its coast which makes the establishment of fishpond projects appear feasible.

From Ceylon, report has been received that preliminary experiments on the culture of *Chanos* in brackishwater ponds with green and bluegreen algae have proved successful; the first harvest from these governmental experimental ponds was scheduled for September 1962. The ponds are being extended.

For the Philippines, the area of *Chanos* fishpond projects has increased from 123,250 hectares in 1960 to 125,810 hectares in 1961. Within the last five years (1957-1961), the increase has been from 2,000 to 4,000 hectares each year. Improvement of culture techniques has also been noted especially with the wider use of fishpond fertilizers. Lack of adequate desirable fertilizers has been hampering the wider use and standardization of this practice.

Taiwan has been carrying on *Chanos* culture in an intensive way. Pond poisoning to remove predators, pond fertilization and artificial feeding of fish stock is a standard practice in Taiwan in its *Chanos* culture. Limitation in areas of expansion has led to better husbandry of the ponds and naturally relatively higher production.

The *Chanos* Resolution of the Tenth Pacific Science Congress

The original resolution adopted by the Division of Limnology and Freshwater Fisheries of the Tenth Pacific Science Congress was as follows:

WHEREAS, the milkfish, *Chanos chanos* is a very important food fish cultured intensively throughout Southeast Asia and especially in the Philippines, Taiwan, Hong Kong, Indonesia, Vietnam, Thailand and India, and

WHEREAS, the intensive culture of this fish in brackish-water ponds is a well-established industry whose expansion would greatly increase the production of desirable proteins so urgently needed for human nutrition throughout these areas, and

WHEREAS, the expansion of milkfish production is handicapped by the fact that the adult fish of this species spawn in unknown areas of the Pacific and Indian Oceans and adjacent seas; and that fry for stocking ponds must be collected along coastal shores; and that fluctuation in the available supply of fry is unpredictable because of lack of information on the biology, migration routes and spawning areas of this species in its marine habitat; and

WHEREAS, young *Chanos* are important as bait for tuna long line fishing, but are not available in sufficient supply; and

WHEREAS, this Congress is aware of the efforts made by the Indo-Pacific Fisheries Council of Food and Agriculture Organization of the United Nations to increase the general knowledge on the culture and biology of the milkfish and has compiled through its *Chanos* Sub-Committee a comprehensive report on the present status of research on this species which stresses the inadequacy of present information; now,

THEREFORE, BE IT RESOLVED that the Tenth Pacific Science Congress recommends the establishment and financing, either through an International Commission or by other means, and in cooperation with the governments concerned and with IPFC, a research group, adequately staffed and equipped, to study the biology and growth of *Chanos* in its marine environment from the fry stage to maturity and to locate their exact migration routes and spawning grounds; and

BE IT FURTHER RESOLVED that copies of this resolution be transmitted to the heads of the fisheries departments of the governments of all the nations concerned and to FAO/U.N., and IPFC and to other international agencies and scientific or educational institutions with interest in this problem.

The idea of this resolution arose after H.R. Rabanal (Philippines) read a paper on "Status and Progress of *Chanos* Fishery in the Philippines", and K. Kuronuma (Japan) presented "Milkfish Larvae in the Eastern Coast of Vietnam" and Le Van Dang (Vietnam) gave "Remarks on the *Chanos* Program of Vietnam". It crystallized after these reports, that while some advances have been attained in the culture of *Chanos* in impounded waters, very little is known of the biology of this fish in its natural marine habitat. Scientists who have been closely associated with the Indo-Pacific Fisheries Council, in attendance in that scientific congress, unanimously supported this resolution. These included K. Kuronuma (Japan), H. Saanin (Indonesia), B. Indrambarya (Thailand), M.K. Soong (Malaya), P.R. Needham and H.S. Swingle (U.S.A.) also gave their support to the resolution.

The framers of this resolution realized that the increase in fishpond acreage in countries where *Chanos* culture has been established has continued. Likewise, in other countries in Southeast Asia where the *Chanos* "seed fish" has been found to be present, a program for the opening of milkfish culture projects has been initiated. In addition, the rapid improvement of fish culture techniques will, in the future, require two to three times more seed fry for stocking present fishpond acreage even without increase in area.

Since the *Chanos* culture industry is well established, it is bound to expand and improve, and will continuously demand more and more milkfish fry, the supply of this seed fish will remain to be a controlling factor regulating the industry. It is therefore highly desirable that some control by man of this phase of the industry be achieved. A thorough knowledge of the biology in the natural marine habitat is a step in this direction. This can be followed by finding ways and means to stimulate spawning if possible or by initiating appropriate conservation measures for the spawners at sea. In this way, it is hoped that the future of the industry can be assured. In this respect, the need of international collaboration is deemed urgent.

The big problem in this project is financing. Since FAO through the Indo-Pacific Fisheries Council has for some time been interested in this problem, the Pacific Science Congress thought it wise to refer this resolution to this body for possible implementation. The idea is to give this body the opportunity to negotiate the financing from the most appropriate agency that it would deem proper. It is likewise necessary to have preliminary talks on the nature of organizational set up, the extent of the physical plant and equipment and budgetary outlay necessary to carry out the project and subsequently to solicit the necessary funds from the appropriate agency based on the objectives set by this body. At this planning stage, the necessity of wise suggestions from all interested governments in this area will be needed.

Comments of Various Countries on the Proposal to Establish an International Research Group to Study the Biology of *Chanos* in its Marine Environment

United Kingdom

The establishment of such a research group would be welcomed and it is hoped that the territorial waters of North Borneo be included in such a study. Hong Kong reports that the fishery for *Chanos* is of minor importance in that territory.

Vietnam

Vietnam fully endorses the idea specially with the discovery of *Chanos* fry along its coast. That country is setting up the development of *Chanos* farming.

Japan

Japan considers that it would be worthwhile to establish a research group on *Chanos* in view of its importance in Southeast Asia. But with the scarcity of these species in Japanese waters, that country may not be able to play a very active part.

Australia

The mainland country of Australia has no comments to offer in the establishment of research group on *Chanos*. However, it points

out the existence and extent of the *Chanos* fishery in Australian Papua and New Guinea. That country also observed that the IPFC work has been mainly in the hands of fish culturists so that the "true biology" of the species is little studied.

Netherlands

J.J. Schuurman commenting for the Netherlands states that the point of paramount importance with regard to the study of *Chanos* is to see how we can realize the possibility of making *Chanos* spawn in confined waters. He claims that the man who could give the clue to this problem solves the problem and that nobody has made certain that this is impossible. It is also claimed that the program is too general and does not point to the general problem of studying the biology and growth of *Chanos* in confined environment with special purpose of finding a way to make *Chanos* spawn in these waters.

Philippines

Biological evidence obtained by experienced fishpond operators in the Philippines has shown that *Chanos*, in spite of attaining large size with prolonged rearing (as long as 10 years) showed that the fish did not develop their gonads to maturity in this habitat. Likewise, the usual catch from natural marine waters although large in size can only be considered to be in the maturing stage. Fully ripe fish have been reported but it is doubtful whether the specimens labelled as such have been correctly identified. This shows that we have no exact knowledge and that the spawning grounds may be very inaccessible or unexplored. The approach of the fry along the coast and tidal rivers would indicate that they have already passed some days at some unknown place before they are noticed. There is great variation in the peak and appearance of fry in different fry grounds although they have been noted to appear at the same time in the same place each year. In some places, only one peak is noticed; in others, a bimodal peak exists. The fishery

for *Chanos* in the marine environment is also confined at a definite season and disappears the rest of the period. Whether there is a pattern of high sea migration from one region to another needs to be studied. All these unknowns are fundamental knowledge in the formulation of measures in increasing the production of seed fish and in conserving the spawners which are the life lines for the expanding *Chanos* culture industry in this region.

Summary and Recommendations

1. Adequate appraisal of the status of *Chanos* culture in confined waters has been made from the areas in Southeast Asia where this is an established industry.
2. Increase in acreage in *Chanos* fishponds is continued while the setting up of *Chanos* culture programs in other countries where this is previously non-existent is underway.
3. Member countries should continue to report to the Council any advances attained on the *Chanos* fishery in their respective areas for dissemination to other members.
4. Inadequacy of knowledge of the biology of this species in its natural habitat in the sea is a blind spot in the proper control, development and progress of the *Chanos* fishery.
5. Scientists meeting at the Tenth Pacific Science Congress in Honolulu, Hawaii, realizing this deficiency, have invited international collaboration through the establishment of a research institution group for *Chanos* study in its marine environment.
6. It is earnestly suggested that the physical and organizational set-up and budgetary outlay be thoroughly discussed in this Council Session (10th) and recommendations be made for its immediate implementation.
7. Application for the financing of this proposed research project or institution should be explored and made so that the project may be implemented at the earliest possible time.

CHAPTER III
CRAFT AND GEAR

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A. FISHING CRAFT

IMPROVEMENTS IN FISHING CRAFT

Design

The developments during the intersession period between the 9th and 10th Sessions in the field of design of new types of fishing craft are as follows:

Because of the general mechanised state of the *Australian* fishing fleet, and because of the satisfactory level of competence in fishing vessel design and boat building in Australia, it is considered that any developments in craft are a continuation of long-standing development, rather than new developments. Duties and taxes on fuel used by fishing craft have been abolished since 1958. The FAO Naval Architect has been invited to visit Australia to advise on fishing boat design.

In *North Borneo*, in 1961 two wooden inshore trawlers were launched in Sandakan; one measured 20 m. in length (overall) designed by William Garden of Seattle, U.S.A. and the other was a 9.1 m. stern trawler designed by Peter Gurtner, FAO Naval Architect. The stern trawler is operated by the Government for demonstration and training purposes.

In *Hong Kong*, the first departure from the traditional junk design occurred in 1961 when two local fishermen commissioned the construction of a pair of modified deep-sea 'Kwong-sun' type trawling junks of 26.21 m. length overall. These vessels differed from the traditional junk in so far as the stems were raised and forecastles were built for crew accommodation. The two traditional deckhouses normally situated on the poop deck, together with the after platform at the end of the poop, were omitted, thus providing a lower super-structure at the stern. These vessels were fitted with semi-balanced steel rudders, wheelhouses and bridge controls, and have been operating successfully. A second pair of vessels of 26.82 m. length overall were subsequently built with no poop aft which left the vessels with a clear stern

for working the net, and facilitated hauling and shooting of the gear. Whereas the first two boats were built with the traditional bulbous stern and had to be ballasted to attain correct trim, this subsequent pair had improved hull forms giving a better flow of water to the propellers, and required no ballasting. On the speed trials, the second pair proved 0.63 of a knot faster than the earlier pair. A third pair of trawlers has recently been completed with a deck layout similar to the initial pair but with a greatly improved hull form. East of these six vessels are propelled by one marine diesel engine of 240 h.p. at 1,000 r.p.m. fitted with a $3\frac{1}{3}$ to 1 reverse/reduction gear box. Construction was in accordance with traditional methods but six templates were used in each case.

There are two major problems in fishing boat efficiency in *Korea*. Eighty five percent of the fleet consists of small non-powered units that depend upon hand sculling or wind to get them to the fishing grounds and back. The loss of fishing time consumed in this travel is one of the principal reasons for the low income of this class of fishermen. To assist in this problem, eight small boats of a slightly modified design are being constructed, in which low-cost, non-reversing air-cooled, kerosene burning engines are to be installed. These boats will be demonstrated throughout the fishing areas with the object of encouraging fishermen to mechanize their existing boats. In the large boat class, all vessels work only during a particular fishing season and then are tied up until this season returns. A steel vessel of 70 gross tons of U.S. design is being constructed which can be used as a multi-purpose (purse seine, trawl, longline, etc.). This vessel will be completely mechanized in regard to deck equipment and electronics and will be used to demonstrate efficient year round operation.

In *India*, special designs of boats of 7.31 m., 9.75 m., 10 m. and 36 ft. are being constructed by State Fisheries Departments

and issued to fishermen at subsidized prices. This is necessitated because some of the traditional type of fishing craft are not capable of being motorized by simple alterations economically. The Departments of Fisheries of a number of states operate 13 boatbuilding yards which supply new types of mechanized fishing boats to fishermen's cooperative societies, district cooperative federations and groups of fishermen.

In *Netherlands New Guinea*, there are only indigenous fisheries which are still in a primitive stage and as a rule form only part of the subsistence economy of the population. The inhabitants of the coast—350,000—annually land some 4,000 tons of fish. In the environs of the urban centres, fisheries have developed as a result of the general development. The native canoes have been mechanized through the use of outboard motors. Despite this progress, fisheries should not be regarded as being practised as a professional trade. Most fishermen derive their income also from other activities. Even in Geelvink Bay, where the Sea Fisheries Division has organized fishermen's groups in the various fishing villages, fishing should still be considered a part-time occupation. A restrictive factor in this regard is the fact that regular work is not yet felt to be a necessity. Living requirements are still limited, and the fisherman deriving his low income from fishing feels content that he can supply himself in a satisfactory manner. The fishing vessels now used are generally of the dug-out type, equipped with outriggers. They vary in length from 4.57 m. to 9.14 m., in width from 0.45 m. to 0.76 m., and have about the same depth. No special improvements have been introduced in this type of craft. The Sea Fisheries Division has built a number of powered wooden craft (length o.a. 7.92 m.; width 2.13 m. depth 0.91 m.) with insulated fish holds and Victor Vixon diesel engine propulsion. These craft have, by way of experiment, been placed at the disposal of indigenous fishermen on a cooperative basis, the fishermen contributing 40 per cent and the cost of operation being

for the account of the Government. The objective of the experiment is to find out the results achieved by the indigenous fishermen. Thus far the results have been rather inconstant, due to seasonal influences.

In *Pakistan*, the following improvements were introduced recently in designs and construction of the mechanised fishing crafts. The mechanised fishing crafts are now generally provided with the deck in one level, a spacious wheelhouse and a suitable crew cabin. An inset rudder coupled to a wooden steering wheel is provided just to facilitate the smooth operation of the vessel and to maintain the balance. Now most of the powered vessels have an insulated fishhold to save the catch from spoiling during the fishing operation and till the vessel reports back to the port. A power operated trawl winch and deck gear are now being fitted and becoming popular for stern trawling. A further improvement have been made to build a trawler suitable for gill-netting, to achieve this objective, the cabin is located in the centre leaving the forepart for gill-netting and the aft part for trawling. Medium sized (19.81 to 22.86 m.) North Sea type steel trawlers were imported into the country for trawling in the deeper offshore waters. Two of the trawlers are now operating from Chittagong in East Pakistan and the other two from Karachi in West Pakistan. One of the two based in Karachi is equipped with a freezing unit to freeze approximately one ton of fish every day. A 26.67 m. combination steel vessel has been built at the Karachi Shipyard for survey work in the Bay of Bengal. The vessel is rigged for trawling, purse seining and gill-netting, etc. It will set sail for Chittagong in September this year, where it will operate under the supervision of a team of FAO experts to determine the fish resources of the Bay of Bengal. Negotiations are underway for construction or purchase of a similar vessel for West Pakistan. Thirteen improved type gill netters, one stern trawler and one shallow water research vessel have been built in East Pakistan. All of these vessels have either been leased out

to fishermen or sold to them on hire-purchase system. The research boat is however, being utilized for *Hilsa* investigation purposes. Eleven gill netters, two fish carriers, one shrimp trawler and one small research boat have been built for operation on Mekran Coast of West Pakistan. These boats have been given over to the Fishermen's Cooperative Societies to be worked there on cooperative basis. The research boat is however, being utilized for shrimp and sardine investigations. In the private sector also, a number of new boats (mechanized and non-mechanized) have been built. Figures given below show the overall rate of new construction:

	1960	1961	Increase
Mechanised trawlers:	87	114	+ 27
Motorised gill netters:	257	292	+ 35
Sail boats:	4,400	4,550	+150

In late July 1961, a 19.8 m. shrimp trawler was about ready to be launched from a shipyard in Mazatlan on Mexico's west coast for the Government of Pakistan. The new vessel is a conventional shrimp trawler equipped with a Diesel. It is reported that if arrangements can be made, the Government of Pakistan may order additional shrimp trawlers from Mexican shipyards. M.F.V. NEW-HOPE, a 11.58 m. trawler is conducting exploratory fishing on the coasts of Sind and Karachi in the inshore waters. The NEW HOPE made 45 trips, the total absence from the port being 370 hours 13 minutes. The number of actual trawling hours was 187 hours. The operations were conducted between 2 and 14 fathom contours. The vessel surveyed areas facing—Phitti, Khai and Khuddi on the Sind coasts and areas facing Buliji, Korangi and off Anchorage on the Karachi coasts. The vessel incidentally caught 3,065 Kg. of shrimps and fish valued at Rs. 2,226.09. A batch of five students of the Vocational Training Institute is receiving training in rigging, manipulation of trawl gear, longlines, mechanized fishing and navigation, etc. A Japanese Expert under Colombo Plan, accompanied the departmental

vessel on the survey trips and has tried Japanese longline on three trips staying overnight at sea. The results so far are not encouraging. Later on the departmental vessels M.F.V. MACHCHERA and NEW HOPE were both engaged in sea exploratory operations. *Machchera* made 15 trips, caught 1915 Kg. of fish and shrimps valued at Rs. 1688.54, while *New Hope* made 15 trips, caught 515 Kg. of fish and shrimps, valued at Rs. 398.54. Thus both the vessels made a total 30 trips, caught 2430 Kg. of fish and shrimps valued at a total sum of Rs. 2087.18. Despite the rough condition at sea, the vessels operated on Sind and Karachi coast, and conducted fishing between 18.3 to 27.4 m. (10 to 15 fathoms) continuously in the unexplored areas. In Mekran Coast, 10 launches have been completed and their delivery taken for fishing operations. A research vessel is under construction at Karachi Shipyard. First installment of Rs. 208,000 has already been paid to the firm for the construction of the said vessel. In the Bay of Bengal, 85% of the construction work of the 12 boats has been completed. It is expected that the construction of the boats will be completed within the stipulated time. Two boats of Khulna Fish Preservation and Marketing Corporation are now engaged in fishing and fish carrying operations in the Khulna estuaries. Some of the other boats are carrying fish in Chittagong, Cox's Bazar, and Khulna areas.

In the U.S.A., the most notable design change has been on the U.S. east coast where a stern ramp trawler has been developed. A new stern trawler has been designed to double as a purse seiner when necessary. The new design is scheduled to be launched in the late summer of 1960. The prime feature of the new design is the stern net handling arrangements. A stern ramp will be used in conjunction with the standard American net strapping method. The new trawlers will eliminate strapping and haul in the catch clear of the stern and on to the deck. The new vessel will be a combination stern trawler and purse seiner to take advantage of whichever type of fishing is most profitable. Principal dimen-

sions are: length, o. a. 23.16 m.; beam, 6.55 m.; draft (light), 2.44 m.; main engine, 340 h.p. diesel driving a 1524 mm. 3-blade controllable pitch propeller; cruising range, 5,000 nautical miles; fishhold capacity, 99.1 m³ (90 tons).

In *Vietnam*, with regard to the shape of the hull, it is noticed that the round form hull of Vietnamese fishing boats is more convenient for sailing than for motorizing. Some tentative modifications are being made but the Fisheries Directorate in Viet-Nam prefers to have the problem fully investigated by an expert on fishing craft. Request has been made to FAO but it is likely that experts on this subject are not available. The Vietnamese Fisheries Directorate wishes that FAO reconsider it and send to Vietnam an expert on fishing craft in the very near future.

Summing up, it can be seen that in general appreciable progress is being in the introduction of new types of fishing vessels in the Region as a whole. A significant development has been the successful trials with small (about 9.1 m. overall length) stern trawlers in India and North Borneo.

Construction Techniques and Materials

The recent developments in the improvements in boatbuilding techniques as well as introduction of new materials of construction, in the Region is as follows:

Korea does not produce the types or quantity of lumber required for wooden fish boat construction. Pine the principle domestic source of lumber can be taken in only limited amount because of the need for protecting and building up its forests. Fishermen prefer cedar because of longer life, resistance to salt water and ease of handling. Thus a large quantity of the cedar-logs are imported from Japan every year. Korea is beginning to produce some steel plate and the 5 year plan calls for an increase in steel production. Since suitable lumber has to be imported greater study is being made of steel boat construction. Plastic materials have not as

yet received consideration because of their present high cost.

In *Pakistan*, there is no remarkable change in the construction material except that the material now used is of better and superior quality. Generally the material used is teak wood and mould steel. Now the rudder is fitted with zinc plates to avoid chemical action of sea water.

Aluminum and fiberglass have headed the list of materials being used in new ship construction in the *United States*. These materials have been used on the west coast for construction of gill-net vessels for the Alaskan salmon fishery.

MOTORIZATION

Progress

The progress in the development of motorized fishing fleets in the Region either by motorization of traditional craft or construction of new motorized craft is reviewed as follows:

In *North Borneo*, the progress of motorization of fishing craft is shown in the Table below:

Year	Number of fishing craft in N.B.	Motorized with	
		inboard Diesels	Outboard motors
1959	6,290	128	4,645
1960	6,954	141	5,079
1961	7,232	152	5,816

At the end of March 1961, there were 3,520 motorized vessels in *Hong Kong*. During the financial year, 1st April, 1961 to the 31st March 1962, 1,497 fishing junks were motorized, 108 mechanised vessels were converted to sail or to trading vessels and 285 mechanised vessels were cancelled from the register. The actual increase during the year was 1,104 making a total of 4,624 vessels in the mechanised fishing fleet.

In *India*, the target tentatively set for mechanised fishing boats is about 4,000 under the Third Five Year Plan ending 1966. The installed capacity for fishing boat production is about 1,000 per year. About 1 to 2% of India's fishing boats are mechanised; the

present trend has been to develop new designs for boats, rather than fit up engines in the indigenous boats. The cost of a mechanised boat varies according to its size and the horsepower of the engine. It ranges from Rs. 8,000 (US\$1,680) per boat of 6.7 m. in length to Rs. 50,000 (US\$10,500) per boat of 11 m. in length. The estimated increased landings of fish by mechanised boats are about 70,000 tons per annum. Emphasis continued to be given during 1961 to the expansion of marine fishing by mechanization of fishing craft, improvement of fishing methods and provision of facilities for landing, preservation and marketing of fish catches. The total number of mechanized boats in India is at present over 2,400 as against 850 in 1957. Special designs of boats 7.31 m. to 9.75 m. are being constructed by State Fisheries Departments and issued to the fishermen at subsidized prices. The mechanisation of the fishing craft has progressed actively in the State of Gujarat, Maharashtra Mysore, Kerala, Madras, Andhra Pradesh and Orissa. New designs have been developed by the Officers in charge of Craft in these states in consultation with the Central Institute of Fisheries Technology and FAO Naval Architect. Improved designs for large size craft and economic trawling have developed in Gujarat, Maharashtra, Kerala, Madras and Orissa. In Andhra Pradesh, improvement has been effected on the earlier designs based on local "Nava" type. In Orissa, because of the peculiar conditions of river mouths and the limitation of fishing day, mechanised craft has to be necessarily large enough to make longer trips and powerful enough to operate the trawls effectively. In addition, designs are also being developed for operating lines. In view of the availability of hard timber at reasonable rates, most of the mechanised boats are constructed of timber, especially of teak, Ventek, Ayini and Mango. An experimental boat built of fibreglass in one of the local firms in Bombay gave satisfactory results. The construction of steel vessel is now limited to the sizes more than 50 tons, but efforts have now been made to construct

a few steel vessels of the Dory type. In the earlier stages of mechanisation, marine diesel engines were of 10 to 12 h.p., but the present trend of mechanisation based on the results of economic operation and necessity to keep the boat in operation for the maximum number of days, is that the fishermen are now coming forward for larger boats fitted with higher h.p. engines. The boats of Gujarat-Maharashtra coast are big enough to take 22, 30 and 45 h.p. engines. In Mysore, Kerala and Madras, trawling is becoming popular and necessarily the range of h.p. of the engine is increasing. At present, the demand for marine diesel engine is mainly for 25 to 45 h.p. even though in some regions, engines of 60 h.p. are preferred.

In 1961 there were a total of 32,733 fishing boats in *Korea*. Of this number, 28,677 or 87% were non-powered. In order to increase the effectiveness of the existing fishing fleet steps were taken in 1960 to provide government support for fishing boat mechanisation. During 1960, 18 boats (201 h.p.) and 1961, 21 boats (706 h.p.) were equipped with semi-diesel or diesel engines under this program. During 1962 mechanization is limited to diesel engines only and it is estimated 1840 h.p. will be installed under the government support program. This project will be continued as a part of the 5 year program for Economic Development which covers the period 1962 through 1966. The Government of *Korea* is studying the combination type fishing boat which can be operated year around with a small number of the fishermen in accordance with the change of fishing season. As of today, one combination type wooden fishing boat of 58 tons is in commercial operation. In addition, the Government has also constructed a steel 75 ton combination vessel for research purposes. It is a USA west coast type and can be operated for purse seine, and both longline and bottom towing net fishing. This boat is now engaged in stern trawling for shrimp on the East coast, and it has decreased personal expenditure by $\frac{1}{3}$ and increased the catch by $\frac{1}{3}$ in comparison with the old type boat. It can be

easily changed to operate in other fisheries with change of fishing season. Most of the coastal fishing boats are small non-powered boats of less than 10 gross tons. It is important that the efficiency of these boats be improved. In 1962 the Government will start a demonstration program on the mechanization of small boat of less than 2 tons. This project will test small and simple engines of from 2.5 to 7.5 h.p. costing about 15,000 to 35,000 Won. It is hoped successful use of these engines will increase operating hours, improve quality of fresh fish, and prevention accidents from sudden bad-weather.

In the *Federation of Malaya*, the progress in mechanization of fishing boats is shown below in the Table which gives comparative figures of the number of engined boats licensed in 1960 and 1961.

	<u>Outboard</u>	<u>Inboard</u>	<u>Total</u>
1960	5,002	3,938	8,940
1961	4,841	4,824	9,665

The figures for these two years show a definite trend towards inboard engines. During the first quarter of 1962, the trend of mechanization towards inboard engine continued as only 124 boats were newly installed with outboard engines as compared with 255 boats with inboard engines. Selangor has again led in mechanization especially in new inboard engines which totalled 83 units as compared with only 7 new outboard units. Perak, Malacca and West Johore also accounted for a fair share of newly licensed inboard engined craft in the country with 47 units, 29 units and 30 units respectively. The increase of 29 units in Malacca has been due to the construction of new boats for the State's Kuala Linggi Fishermen's Co-operative Scheme. Among the States on the east coast, Trengganu was the most progressive during the 1st quarter of 1962. Altogether 30 inboard and 2 outboard boats were newly licensed in this State. In the case of new outboard boats, Penang and West Johore figures most prominently in the country with 40 units and 25 units respectively.

In *Netherlands New Guinea*, the fairly satisfactory fish prices and the purchasing power of the urban centres have induced local fishermen to purchase outboard motors. The prices of this equipment are, as a rule, within the means of the average fisherman and the engine can be easily attached to his canoe by sawing off the stern vertically and fixing a counter instead by closing the sawn-off part with a 1½-2 in. board reinforced by additional ribs. Most progress was made in the years 1957 and 1958, when the number of craft rose from a few to some tens of vessels.

	<u>Number of vessels</u>		
	<u>1956</u>	<u>1957</u>	<u>1958</u>
Hollandia	4	30	35
Manokwari	-	5	12
Sorong	3	6	14

This advance is probably due to the fairly favourable fishing season. It is a remarkable fact that when this period was followed by a less favourable season, a decline in the number of outboard motors was noticeable. The most popular brands of outboard motors are Johnson, Evinrude and Mercury. Their capacity generally ranges from 16 to 25 h.p.

In *Pakistan*, the progress in mechanisation has been very satisfactory. The mechanised fishing fleet now consist of 195 gill-nets fitted with inboard engine and 114 fully equipped stern trawlers.

In *Singapore*, the mechanisation of fishing boats which was most rapid during the period 1948 to 1955 has now been stabilised. Attempts are now made by the fishermen concerned to achieve more economical operation of their mechanised craft by the replacement of old worn-out engines by new ones. The boats which were converted second hand cargo boats have now been replaced by new vessels. The Fisheries Mobile Unit which carries out repairs on fishing boat engines at the fishing villages has now extended its field of operations to include instruction on the maintenance and repair of marine diesel engines. A stock of spare parts is carried by

this unit for sale at cost to fishermen in case of short supplies.

In *Vietnam*, approximately 300 engines which have been specially adapted for installation in traditional bamboo-bottomed fishing craft, were distributed to the fishermen in the Government program of motorization of these craft.

Engines

Types, makes, prices and fuel

The motorization of fishing craft with various types of engines is reviewed as follows:

The following types of engines are used in fishing craft in *North Borneo*:

(A) Outboard :—

Seagull
Anzani
Johnson
Evinrude
Mercury
Gale

(B) Inboard :—

Daiya
Kubota
MWM

Bukh
G.M.
Petter
Lister
Perkins
Gardner
Yanmar

Fuel supply is ample. Prices at Jesselton ex-pump are :—

- (a) Petrol M\$1.08 per gallon
(b) Diesel M\$0.82 „ „

Servicing facilities are fair.

Petrol is comparatively cheap in this country, but diesel fuel is expensive. Prices of fuel oil in *North Borneo*, *Singapore* and *Malaya* are :—

	M\$ per Im. gallon		
	North Borneo (Jesselton)	Singapore	Malaya (K.L.)
Petrol	1.08	1.91	1.97
Diesel	.82	.57	.71

Engines used in *Hong Kong* in fishing vessels are all of the inboard diesel type. Numbers and makes of diesel engines installed in fishing vessels during the period of 1st April, 1961 to 31st March 1962 are as follow :—

Trade Name	Engines		Horse-Power	
	No.	Sub-Total	Range	Most Popular Rating
(A) British				
Gardner	522		24-200	60-72
Kelvin	11		44-240	240
Lister	22		18-30	18
Ruston	17		11-76	13
A.E.C.	2		100	100
Ailsa Craig	5		20	20
Meadows	2		112-116	112
Enfield	1		6	6
Shanks	1		10	10
Cleniffer	1		120	120

Trade Name	Engines		Horse-Power	
	No.	Sub-Total	Range	Most Popular Rating
Perkins	1		27	27
Petter	10		10-20	10
South Iron	2	597	22-24	22
(B) Japanese				
Daiya	355		3-22	7
Yanmar	416		3-16	4
Kubota	37		4-20	10
Komai	51		13-22	13
Malsan	20		3½-8	3½
Origin	1		6	6
Akasaka	2		250	250
K.W.D.	1	883	6	6
(C) American				
Cummins	9		133-189	189
Hercules	2		144-160	144
Caterpillar	2	13	160	160
(D) German				
Deutz	1		70	70
Guldner	2		20	20
M.W.M.	2		22-44	22
Farymann	6		6-23	6
Bauscher	1	12	6	6
(E) Swedish				
Bolinder	17	17	11-23	23
(F) Danish				
Bukh	15	15	10-36	24
(G) Belgian				
De-la Meuse	1	1	12	12
		<u>1,538</u>		

Remarks: 1,497 fishing vessels were mechanised in 1961/62.
41 boats were fitted with two engines each.

A list of engine prices based on horse-power are given below of various engines:—

Inboard Engines (with reverse/reduction gear box)

3 h.p.		H.K. \$1,870
4 h.p.	range varies from	\$2,630 to \$2,830
5 h.p.		\$2,980
6 h.p.	" " "	\$3,700 to \$3,900
7 h.p.		\$3,980
8 h.p.	" " "	\$4,500 to \$5,350

9 h.p.		\$4,980
10 h.p.	range varies from	\$5,400 to \$5,860
11 h.p.		\$5,950
12 h.p.	" " "	\$6,500 to \$6,800
13 h.p.	" " "	\$6,100 to \$6,500
16 h.p.		\$7,940
18 h.p.	" " "	\$7,500 to \$7,880
20 h.p.	" " "	\$6,000 to \$8,380
22 h.p.	" " "	\$8,500 to \$10,125
40 h.p. to 56 h.p.	" " "	\$12,085 to \$17,854
70 h.p. to 84 h.p.	" " "	\$20,350 to \$25,990
110 h.p. to 120 h.p.	" " "	\$36,000 to \$34,715
142 h.p. to 150 h.p.	" " "	\$40,000 to \$53,830
180 h.p. to 200 h.p.	" " "	\$47,000 to \$66,130
240 h.p.		\$72,150

In addition to new engines many second-hand vehicular diesel engines are also employed by fishermen to mechanise their fishing craft. The most popular second-hand engines have horse-powers ranging from 60 to 70. Some of these engines are coupled to original vehicular type gear boxes and some to second-hand or new marine type gear boxes. Prices of such second-hand engines depend on their condition, but range from HK \$2,500 to HK\$3,400 for a 48 h.p. to 60 h.p. engine and from HK\$3,800 to HK\$4,400 for a 72 h.p. engine.

Supplies of diesel fuel are available in all the larger fishing ports. Fuel oil prices fall into two categories: dutiable and non-dutiable. Fishing vessels with a net registered tonnage of below 60 tons pay HK\$279 per ton for dutiable diesel fuel whereas fishing vessels with a net registered tonnage of over 60 tons may purchase non-dutiable fuel oil at HK\$253 per ton.

Servicing facilities exist in most ports and major overhauls and minor repairs are carried out by local engineering firms.

In *India*, besides inboard marine diesel engines, outboard motors are in use only in Gujarat coast. They are fitted in dug-out canoes, which are operating from surf beaten coasts. There are more than 300 dug-out canoes operating in this region. Outboard motors are not popular in any other region of

the Indian coast for fishing. The most popular marine diesel engines are Bukh, Lister, Kelvin, Gardner, Petter, Ruston, etc. At present in view of the difficulties in importing engines due to the foreign exchange position, efforts are being made to import certain engines from the rupee payment countries and some other types of engines under aid programmes. With the increasing number of mechanised boats in the various sectors, the fisheries department and cooperative societies are arranging to provide servicing and spare part facilities. Special workshops have been installed either with Boat Building Yards of the Fisheries Departments or as separate workshops organised by Fisheries Cooperative Societies.

At stated earlier, in the *Federation of Malaya*, the popularity of the inboard diesels is now well-established. Besides the installation of inboard diesels in newly constructed craft, more and more of outboard-engine-fitted boats are changing over to inboard diesels.

In the *Netherlands New Guinea*, inboard engines have thus far not been used by the indigenous fishermen, whom the Marine Department has forbidden the use of petrol engines in view of the risk of fire. The wooden craft placed at the disposal of the indigenous fishermen by the Sea Fisheries Division, and which are propelled by a 16-18 h.p. Victor Vixon inboard diesel engine, are

intended as a means of training the fishermen to make an efficient use of mechanical propulsion and to operate these engines.

Prices Outboard Engines (in Dutch Florines)

3 h.p.	—	fls. 900.
5½ h.p.	—	fls. 1475.
10 h.p.	—	fls. 1685.
18 h.p.	—	fls. 2000.
40 h.p.	—	fls. 2700.
50 h.p.	—	fls. 3300.
75 h.p.	—	fls. 4300.

In the urban centres fuel is no problem. Diesel oil, petrol and mixed fuel being available in litres. Outside the towns, however, these items are harder to get or not available at all.

Prices are as follows:—

Fuel, mixed	fls. 0.55 a litre
Petrol (gasoline)	fls. 0.43 a litre
Diesel oil	fls. 0.33 a litre

Good servicing facilities are available in the bigger towns, but the cost of servicing is generally high. Most owners of outboard engines still lack enough knowledge to do simple repairs so that this item weights heavily. In the frequently occurring event of heavy repairs, therefore, the necessary funds are often lacking and as a result the outboard engines will be placed out of commission for a shorter or longer period.

The different types and makes of engines used by fishing boats of *Pakistan* are as follows:

Type: Marine diesel mostly high speed both air and electric starting.

Make: Kelvin, H.S.A., Yanmar, Bukh, Ruston, North Power, Gardners, G.M., Lister, Perkins, National Superior, Caterpillar, Atlanta, Penta, Philipino, Ricardo.

Price: Prices of these engines have been procured are given below:—

<i>Kelvin :</i>	44 h.p.	Rs. 17,000
	66 h.p.	Rs. 23,500
	88 h.p.	Rs. 27,000
	120 h.p.	Rs. 47,000
	132 h.p.	Rs. 42,500
<i>Ruston :</i>	75 h.p.	Rs. 34,500
	112 h.p.	Rs. 40,000
<i>Yanmar :</i>	55 h.p.	Rs. 18,200
	60 h.p.	Rs. 18,300
	75 h.p.	Rs. 25,500
	90 h.p.	Rs. 28,500
<i>Gardner :</i>	75 h.p.	Rs. 24,000
	114 h.p.	Rs. 38,000
<i>H.S.A. :</i>	50 h.p.	Rs. 20,347
<i>North Power :</i>	90 h.p.	Rs. 40,098
	40 h.p.	Rs. 12,210
	10 h.p.	Rs. 4,909
<i>Bukh :</i>	20 h.p.	Rs. 6,655
	30 h.p.	Rs. 7,700

Prices exclusive of sales tax, customs duty.

Fuel Supply is adequate. A diesel pump has been installed at the pier of fish harbour wherefrom fishing boats, launches and trawlers take their supply Mobil oil etc., is also provided at the pump and at other fuel stations in the City.

The current price of diesel oil is Rs. 1.17 per gallon. Mobiloil is sold at Rs. 10.50 per tin of one gallon.

There is no difficulty in repairs and servicing of engines as both these facilities are available in Karachi and Chittagong. There is only one dry dock in PIDC Ship Yard hence dock/slipway facilities are however inadequate because the number of the mechanized vessels which need dry docking is increasing rapidly.

Powered fishing boats in the *Philippines* are increasing every year since World War II. In 1957, out of the 1,112 commercial fishing boats (more than 3 tons gross) 877 were powered; in 1959, of the 1,477, 1,189 were motor propelled and last year, 1,309 out of the 1,560 were also motorized; 983 were diesel engines and 257 gasoline engines.

The situation regarding engines in U.S.A. is as follows: Diesel outboard engines have recently been introduced in the U.S. fisheries and have given dependable service. Very little improvement in inboard engines has been noticed. Recent trend is toward higher horsepower ratings and weight reduction through use of aluminum alloys for construction. Steam propulsion machinery is no longer used aboard U.S. fishing vessels. U.S. diesel engine manufacturers have continued development of compact high speed engines permitting utilization in small fishing craft and resulting in space savings at higher horsepower ratings in larger vessels. No recent developments in servicing facilities in the United States are noted.

Fishermen in *Vietnam* operate with 2 main kinds of boats:

- all wood boats
- and half wood, half bamboo ones.

For the second category of boats, there are some difficulties when the motorization of fishing boats was started in 1957, as the hull of the boat built up with woven bamboo, is not strong enough to bear the vibrations the engine. But these difficulties have in the end been overcome with the use of the horizontal piston small diesel engines operated with a belt and fixed at the stern of the boat like ordinary outboard engines. Results were quite successful.

Indigenous Production

During the 9th Session considerable interest was expressed in the possibility of assembling or even indigenous manufacture of marine engines suitable for installation in fishing craft and the progress made in the Region with respect to this is as follows:

There is no assembly of engines in *Hong Kong* but one firm manufacture small engines for marine and land use. Some of these engines are in use in local fishing vessels.

Marine engines specially meant for installation in fishing boats are now being manufactured in *India* since 1961. This is in addition to diesel engines already being manufactured in the country for a long time which though not classified as marine diesels, could be adopted for use in fishing craft with slight modifications. Other ancillaries such as stern bearings of metal and rubber, etc. are also produced indigenously. Five firms are producing marine diesel engines in *India* in collaboration with established foreign manufacturers.

Korea began producing diesel engines this year (1962) but as yet the engines do not meet the standards required for marine use. Therefore it is expected that it will be necessary to continue importing marine diesel engines for several more years. In order to encourage mechanization, marine diesel engines imported for fishing boats are except from sales tax, import duty, and indirect tax. However the fuel oil used in fishing boats is still subject to all customs

duties and taxes. There are 93 engine factories located around the coast towns of *Korea*, and semi-diesel engines are produced sufficient to supply home demand for this type of engine. However as indicated above the government wishes to encourage the use of the diesel engine because of its lesser size and weight and lower fuel consumption. Because fishermen mostly are unskilled in the operation and maintenance of high speed diesels, fishermen generally prefer the low speed diesel engines which have greater similarity to the semi-diesel with which they have had more experience.

In *Pakistan*, there is no indigenous production of engine. Only the parts of engines which are imported from foreign countries are assembled.

Government Assistance

Information received on various forms of Government assistance with respect to modernization of fishing craft in the Region is as follows:—

In *India*, with reference to the mechanisation of fishing crafts, the Central and State Governments provide all facilities for import of marine diesel engines and supply to the fishermen either through the Fisheries Departments or the Cooperatives. The Fisheries Department extends financial assistance in the form of loans and subsidies. The Government provides *ad hoc* licence for import of marine diesel engines.

The *North Borneo Credit Corporation* has given loans to fishermen, at 7% annual interest, which amounted to M\$16,500 in years 1959-61.

The Government of the *Netherlands New Guinea* renders assistance by granting credits.

These credits, e.g. for the purchase of an outboard engine, fishing gear, etc., can be applied for through a special body, the so-called "Bureau for the Promotion of Indigenous Industries". The applicant is required to supply 25 per cent of the initial cost, which measure is intended to stimulate saving.

The Government assistance in procurement of supplies in *U.S.A.* is that the *U.S. Bureau of Commercial Fisheries* provides technical advice concerning various fishing vessel and equipment designs or construction. No procurement assistance is provided.

Effects of Motorization

Extension of fishing grounds and increase in catch and fishermen's earnings

In view of the comparatively rapid development of motorized fishing fleets in the Region, a study of the effects of such motorization is very important and information received from Governments regarding this is given below:

In *Hong Kong*, mechanisation has had the effect of extending the radius of activity of fishing vessels. The mechanised deep-sea trawlers now fish at a depth of from 50 to 60 fathoms at a range of approximately 240 nautical miles from Hong Kong. Sailing trawlers are generally still limited to grounds within a radius of 100 nautical miles. Whereas the activities of sailing small longliners are normally confined to Hong Kong waters, mechanised vessels of this type now venture in fine weather as far as 60 to 70 nautical miles away from Hong Kong. Catches have also been improved by mechanisation and a comparison between landings of mechanised and sailing vessels is given below:

	<u>Company Trawlers</u>	<u>Traditional Type Junks</u>	<u>Foreign Vessels</u>	<u>Sailing Junks</u>
1st April, 1961 to 31st March, 1962.	95,173 pic.	589,306 pic.	16,829 pic.	208,806 pic.
	10.46%	64.75%	1.85%	22.94%

Remarks: 16.8 pic. = 1 English ton.
1 English ton = 0.9072 Metric ton.

Although mechanised vessels comprise less than half the fishing fleet, they land over 75% of the total quantity of fish sold through the Fish Marketing Organisation wholesale markets. In general, earnings of fishermen

employed on mechanised fishing vessels are considerably better than those of fishermen employed on sailing vessels. The following table gives a comparison:—

	Motorised Vessels		Sailing Vessels	
	Monthly Wages	Bonus	Wages	Bonus
Trawler's Fishermen	HK \$110	HK \$100	HK \$40	HK \$60
Longliner's Fishermen	15	240	15	110
Shrimp Trawler's Fishermen	100	70	No	hired workers
Purse Seiner's Fishermen	30	50	————	do —————

Because of the expansion of the fleet in recent years, there is a good demand for labour in the industry. There is a shortage of crews for longliners, and shrimp trawlers now find that crews are reluctant to be engaged unless the vessels possess power handled gear.

In *India*, the results of the mechanisation of fishing craft have encouraged the fishermen in coming forward for installation of engines and construction of improved types of boats on larger scale. The range of fishing has now extended to 20 miles off the coast. The fish catches and fishermen's earnings have increased nearly thrice that of the earnings of the local non-mechanised boats. With mechanisation, the number of crew in each boat has been reduced, thus contributing to increase in the earnings of the fishermen, working in the mechanised boats.

In *Pakistan*, recently there has been considerable extension in the range of operation of the mechanized fishing crafts as a result of which new fish and shrimp grounds were discovered. The range of operation of mechanized crafts is about 300 nautical miles from Karachi upto the border of Iran. As regards the shore fishing the trawlers and mechanised launches are making successful attempts to extend their fishing operations even beyond 20 fathoms. It has been observed that as a result of mechanization of the fishing fleet of West Pakistan, the fish catch increased with an average annual rate of 2.9 thousand tons.

Year	Production in Tons in W. Pakistan
1957	83,000
1958	84,000
1959	94,000
1960	100,500
1961	102,500

During the last 3 or 4 years, the fishermen's earnings has almost become double. There or four years back the fishermen's average monthly income was Rs. 60 to 70 while now the earnings range from Rs. 120 to 150. Captains and Mates employed on trawlers are paid monthly salary of Rs. 350 to 450. Apart from this, the crew get free food during the period they are out on fishing. The fishermen have now definitely better opportunities of employment in fishing industry as the number of trawlers and mechanised launches have considerably increased.

In *U.S.A.*, in recent years the extension of fishing grounds by U.S. fishermen has been for economic reasons. The trend in the United States towards use of engines of greater horsepower among vessels in the trawling fleet enables operators to increase catches with savings in time, fuel, and maintenance. For U.S. fishermen in earnings for the past five years has been stable. This varies, however, from one fishing industry to another. For the past 10 years there has been a tendency for employment in the U.S. fisheries to decline.

TRAINING OF BOATBUILDERS

Appointment of Craft Technicians

Considerable discussion was centered on the question of appointment of trained craft technicians in government fisheries departments to advise the industry on the modernization of fishing craft. The present situation is that only in a few Governments are craft technicians employed in fisheries departments. The main functions of the craft technicians include advising the industry on suitable design materials and methods of construction of craft, installation of engines and ancillaries, and organization of training centers to train boatbuilders, etc.

It is understood that full time craft technicians are employed mostly as research workers only in India, Japan and Korea. There are no Craft Technicians or Naval Architects in Government Fisheries Department in U.S.A., as few functions of these people are carried out by Government Departments. Individual shipyards train their own personnel.

Training of Boatbuilders in Modern Carpentry Work

Information is available only from North Borneo, Korea and Netherlands New Guinea. In Sandakan, *North Borneo*, there are at least three trained commercial boatbuilders who are able to build boats from the drawings of a Naval Architect.

In *Hong Kong*, there are approximately 100 junk building yards in the Colony and these construct over 95% of the vessels in the fleet. These yards build in wood and by traditional methods. Courses of instruction for workers in the fishing junk building industry are organised by the Fisheries Division of the Department of Co-operative Development and Fisheries. The intention of these courses is to impart an understanding of working drawings and the ability to build boats in accordance with plans. Attention is directed mainly towards 'laying off' or 'lofting out' of the correct lines of a boat. In all, 43 junk builders have graduated from these

courses since the first course started in 1960. One graduate has already applied his new knowledge in the construction of a pair of modified type junks built from 6 templates designed and prepared by himself.

In *India*, the Central Institute of Fisheries Technology had trained earlier, Officers for designing fishing boats and also carpenters for undertaking construction on improved lines. Most of the States have taken advantage of this training and the States will continue to send candidates for training in the proposed Operatives Training Institute. The Craft designers and Craft and Tackle Officers of the Departments of Fisheries of the States are already engaged in this work and they are in close touch with the Central Institute of Fisheries Technology. The problems connected with the construction of boats, mechanisation and maintenance are being solved in consultation with the Central Institute of Fisheries Technology. The Central Institute of Fisheries Technology is undertaking researches on propeller, construction methods, economic boat types, deck equipment, etc.

In the *Netherlands New Guinea*, there are no facilities in this Territory for wooden boatbuilding training. During the construction of wooden vessels by the Sea Fisheries Division a number of indigenes were trained in the trade. In addition, 4 students from Netherlands New Guinea attended the 2-years, boatbuilding course, which was started by the South Pacific Commission at Tulagi, British Solomons Island, in 1960.

In *Korea*, the Ministry of Commerce and Industry has responsibility for the administration and promoting the growth of shipbuilding activities. During the coming four years, this Ministry plans to train about 800 technicians and specialists who are presently engaged in shipbuilding.

DEVELOPMENT OF FISH HARBORS

In *North Borneo*, the fish landing and marketing facilities are managed by the local government (District Councils or Town-

boards). The Townboard of Jesselton is to build a new fish market in the near future.

In Ceylon, a fisheries harbour is being built at Galle by the Government of Ceylon at total cost of Rs. 6.6 million (U.S. \$1,400,000). This harbour will be completed by the end of 1964 and will provide about 1,200 feet of alongside accommodation for boats needing less than 20 feet of water. Approximately 150,000 sq. feet of land are available for the construction of the shore facilities that will be needed for the operation of a fleet of deep sea fishing boats from the harbour. The requirement of roads for the movement of vehicular traffic within the operating area will have to be deduced to arrive at the actual figure of land available for construction, but it should be pointed out that the area will allow a building with several floors to be constructed if needed. At present, Ceylon is importing about three quarters of the fish and aquatic products needed for local consumption. In an attempt to develop a more favorable trade balance, the Government is prepared to consider proposals from foreign governments or companies to assist in the development of the fisheries. A proposal for a fishing project operating 10 or even more boats from Galle is under consideration. With an initial unit of 10 boats and the necessary shore facilities, such a project is likely to cost between Rs. 15 to Rs. 20 million of which about a quarter will have to be invested immediately on the shore facilities and perhaps a couple of boats, while the balance will be needed over the subsequent years depending on the schedule for additional boats. Offer from foreign governments and commercial concerns for operating a fishing venture based on Galle are likely to be very favourable considered. The project will involve:—

(a) The construction of buildings to house the ice plants, freezers, cold stores, processing rooms, machine shop, stores etc.

(b) Full equipment and installation of ice plant, freezing and other machinery, equipment of workshop, stores, office, etc.

(c) Introduction of a specified minimum number of large boats over a specified period; probably 10 boats over about 5 years, each boat capable of catching a minimum of 750 tons of fish a year.

(d) Organisation of a satisfactory setup to handle the boats, plant and workshops and the marketing of the produce including any transport organisation that may be needed.

(e) Employing the necessary managerial and technical staff and the training of understudies to all foreign officers.

While the details that would govern the entry of foreign capital either through a foreign government or through foreign private investors will have to be worked out with interested parties, the board principles would be somewhat as follows:—

(a) The body to whom the project is handed over will be given adequate guarantees with regard to the transfers of profits and the ultimate transfer of its capital back to its own home country.

(b) This body will be required to contribute either the entire or a specified part of the capital needed. In the latter case the balance capital will be subscribed by Government or by the local public.

(c) It will be allowed to bring in all the managerial and technical skills which it considers cannot be satisfactorily found in Ceylon when the scheme commences, provided that Ceylonese understudies are carried for all these skills and replace the foreign counterparts as soon as they are sufficiently trained.

(d) After a predetermined period of operation, the foreign capital will gradually be replaced by local. The manner in which the foreign capital in the project is to be valued is one of the details that will have to be settled. In a similar manner, the management will also pass over gradually entirely into Ceylonese hands—government or private.

(e) A specified number of boats will have to be introduced over a prescribed period and at the same time all the necessary shore facilities installed and a satisfactory scheme organised for the profitable marketing of the catch.

(f) The activities of the organisation will not be needlessly circumscribed or restricted, but a specified number of Ceylonese will have to be on the Board of Directors of the organisation. All technical information should be available to the Department of Fisheries and facilities should be made available for research officer to accompany the boats.

In *Hong Kong*, three ice manufacturing plants have been established at the fishing ports, two in Aberdeen and one in Castle Peak. Fuel oil supply stations in various fishing ports now offer a 24 hours supply service.

In *India*, maritime States Fisheries Departments have already taken action in the development of fishing ports in important centres. At present five ports are developed in Gujarat, three in Maharashtra, two in Mysore, four in Kerala, three in Madras, two in Andhra Pradesh, one in Orissa and one in West Bengal. Adequate facilities for landing and packing are also provided in these regions. The Fisheries Departments have already taken up the work of boatbuilding yards for construction of improved designs of fishing crafts. At present, the Department of Fisheries are operating one boatbuilding yard in Mysore, two boatbuilding yards in Kerala, one boatbuilding yard in Madras and one in Andhra Pradesh. A Fishermen's Co-operative Society is operating a boatbuilding yard in Maharashtra and a Cooperative Society has already initiated the construction of a boatbuilding yard in Gujarat. There is adequate boatbuilding capacity in the country for the construction of mechanised boat proposed in the Third Five Year Plan.

There are 1,327 large and small fishing ports in *Korea*. The need for maintaining and improving port facilities for the protec-

tion of fishing boat and for the landing of the catch is well recognized. The Government supports 80% of the repair expense of fishing ports (breakwater, wharf, and land place etc.) and the local fishermen assume the remaining 20% of expense.

In the *Federation of Malaya*, the increasing fleet of motorised fishing boats are now operating far out to sea and they now return to port at all times of the day and night. At night during rain or foggy weather, fishermen have found it extremely difficult to strike at their home ports and the provision of lights has become a necessity. Electric flash lights, gas lights and oil lamps have now been installed in a number of fishing centres along both the east and west coasts of the country. Investigations are continuing to select suitable sites for lights to be installed in fishing centres which require them. Besides the installation of navigation lights at fishing centres, jetties are also being built for assisting fishermen in landing their catches. Jetties in Kuala Besut, Kuala Linggi and Pulau Tioman have already been completed while one is under construction in Pulau Langkawi. Besides these centres, tenders are now being called for the construction of jetties in Tumpat, Kuala Dungun and Kemaman.

At Karachi Fish Harbour, Karachi, *Pakistan*, all the facilities of landing, transport and handling and marketing of fish are available to the fishermen who go out for fishing. Schemes to provide similar facilities on Mekran Coast and in East Pakistan at Chittagong are now under active consideration of the Government. Some of these schemes have already been implemented. The work of boatbuilding has been undertaken by P.I.D.C. at the Karachi Shipyard, West Wharf. A number of mechanized launches and trawlers have already been built at P.I.D.C. Shipyard. The entire fish Harbour Project at Karachi has been completed with the exception of floating jetty, slipway and workshop. The remaining work will be taken in hand as soon as the revised estimates have been sanctioned. The harbour project comprise of 1750 ft. long concrete jetty, a spacious fish

market with attached cold storage and ice plant, fishery cooperative office, fishermen's restaurant and rest hall, a post office, banks, petrol and diesel pump, model curing yard, a seafood restaurant, fisheries laboratory and plots for various industries associated with fish. A number of industries have since been established on these plots. A similar project has been planned for Chittagong in East Pakistan. Mr. Saito, Harbour Engineer provided under the Colombo Plan has prepared the design of the proposed harbour and 40 acres of land has also been acquired for this purpose. Construction phase of the project is expected to start shortly. Fishing jetties are also planned for other important fishing centres like Gwadur, Pasni and Ibrahim Hyderi in West Pakistan and Khulna in East Pakistan. Two fisheries training courses for young people, mainly the children of fishermen, residing at fishing villages were started in Singapore during the year. The students were taught, inter alia, (a) the rule of the road at sea, (b) maintenance and repair of fishing boat engines, (c) construction and use of fishing gears, (d) elementary fisheries technology including icing and freezing of fish as well as canning of fish.

In U.S.A., landing, packing, transport and marketing facilities have had very little change in fishing industry. Some fishing port facilities have been improved by construction of new docks and processing and unloading facilities. In recent years the U.S. boatbuilding industry has not expanded. Several yards on the Pacific and Gulf coasts have improved existing facilities to permit construction with improve materials.

RESEARCH ACTIVITIES

Institutions

Only three countries, India, Japan and Korea, have research institutions engaged in work on the improvement of fishing craft. In *India*, this work is carried out at the Craft Wing of the Central Institute of Fisheries Technology, Cochin. In *Japan*, the Fishing Boat Laboratory, Tokyo, under the Fisheries

Agency is responsible for research work in this field. In addition, work is done also at the various universities and prefectural research laboratories. In *Korea*, the research work on fishing craft is done mainly at the Central Fisheries Experimental Station, Pusan. The institutes in India and Japan are provided with tanks for testing of experimental models of fishing craft.

Research Programs

The research program of the Craft Wing of the Central Institute of Fisheries Technology, Cochin, *India*, include designing of new types of hulls with reference to stability as well as economy, investigation of new materials of construction and research into engines, propellers and other ancillary equipment. During the intersession period between the 9th and 10th Sessions, the Craft Wing of the Institute has published the following articles of a semi-technical nature for utilization of technical information by the industry.

Fish Technology Newsletter, Vol. II, No. 3, October 1961

Selection of Propellers
Anchors for Fishing Boats
Timber for Boatbuilding-Part III. Protection against Marine Borers.

Fish Technology Newsletter, Vol. II, No. 4, January 1962

Operation of Small Stern Trawlers—Important Do's and Dont's Admiralty Anchor-Welded Type
Galvarizing of Mild Steel Parts in Boats—Essential Requirements
Motions of a Fishing Boat at Sea—Stability Versus Comfort
Engine Installation and Fittings—Do's and Dont's.

Fish Technology Newsletter, Vol. III, No. 1, April 1962

Hull Planking in Wooden Fishing Boats, Design Considerations 32 Feet Trawler—MK IV.

Fishing Boat Design I

25 ft. Open Power Fishing Boat.

In *Japan*, the Research Reports of the Fishing Boat Laboratory and various other fishery periodical such as Bulletin of the Japanese Society of Scientific Fisheries, etc. contain original researches carried out on fishing craft.

In *Korea*, the research programs include development of small motorized craft suitable for inshore fishing as well as design of larger multi-purpose boats.

DOCUMENTATION

During the intersession period, the following documents were issued to the members of the Technical Committee II from the Secretariat.

1. Proceedings of the International Economic Conference on Small Craft for Fisheries and Transportation, New York (IPFC/Circ. 61/3).

2. Proposed Handbook on Fishing Boat Design (IPFC/Circ. 61/6). There has been welcome response so far from the governments of Australia, Hong Kong and Philippines, to this circular and some valuable and interesting suggestions which it is hoped may be used as a guide in the preparation on the handbook have been received and transmitted to Mr. Jan-Olof Traung, Chief, Fishing Boat Section, Fisheries Technology Branch, Fisheries Division, FAO, Rome.

3. Experience in Fishing Boat Building by J.O. Traung. The article which was submitted as a Technical Paper at the 9th Session, was published in the IPFC Current Affairs Bulletin, No. 30, April 1961. This article may be regarded as a draft and first short outline of the proposed Handbook on Fishing Boat Design. Reprints of this article were distributed to the members of the Panel A, Technical Committee II.

FAO TECHNICAL ASSISTANCE ACTIVITIES

During the intersession period, the following technical assistance program under

the EPTA were concluded or were in operation.

Ceylon: Marine Engineer has been working in Ceylon since 1953. His program of work includes: to assist and advise in establishing an overall program of servicing the hulls and machinery of the fishing fleet and conduct courses to train engineering personnel in the operation and maintenance of marine engines and deck machinery; to serve as a mechanical advisor in the purchase of fishing craft by the Government; and advise on the installation of suitable machinery in fishing craft.

Boat Builder started his assignment in Ceylon in 1959 which is continuing. His duties include: to introduce better practiced in fishing boat construction, and make boat designs in connection with the FAO/EPTA work on small craft mechanization and gear technology.

India: Naval Architect concluded his two years assignment in India. His work included designing of new types of motorized fishing boats for extended fishing operations to replace local traditional sail and row boats and catamarans. Also he assisted in organizing the program of research of the Craft Wing of the Central Institute of Fisheries Research, Cochin.

Another expert took up a one year assignment as a Marine Engineer in December 1961 to assist in the organization of a Special Engine Section at the Craft Wing of the Central Institute of Fisheries Research, Cochin. He will also advise on the servicing and maintenance of engines on local fishing boats.

Fishing Harbour Engineer spent one year in Indian during 1961. He assisted the Central and State Governments in the survey of suitable centers for development as fishing ports and also in preparing plans for providing landing and berthing facilities for mechanized fishing vessels in existing as well in new ports.

Thailand: Mr. Jan-Olof Traung, Chief, FAO Naval Architect, spent two weeks in

Thailand during October/November 1962 to advise the Government on the construction of research vessels.

PERSONNEL OF THE FAO REGIONAL OFFICE FOR ASIA AND THE FAR EAST

Due to budgetary restrictions, it has not yet been possible to implement the request of the Indo-Pacific Fisheries Council for the appointment of a full time Craft and Gear Technician at the FAO Regional Office for Asia and the Far East, Bangkok. However, subject to availability of funds, FAO Naval Architects, from Rome have visited the countries (e.g. Thailand, Pakistan, Korea, India) to advise on specific problems.

SUMMING UP

A survey of the developments in the countries of the Indo-Pacific Region in the field of fishing craft reveal the following highlights and trends:

(i) Due to the fact that in many countries traditional craft cannot be modernized, new designs are being developed. A significant development has been successful trials with small (9.1 m. overall length) stern trawlers in India as well as North Borneo. A recent trend in Thailand has been the large scale conversion of purse seiners into trawlers for fishing in the Gulf of Thailand. Another trend in some of the countries (e.g. Korea) has been the development of multipurpose fishing boats. There have been no developments in beach landing surf boats.

(ii) Construction techniques are being modernized by use of better materials, fastenings, paints, etc. With the exception of Japan where large boats are constructed of steel a large proportion of the fishing craft are built of wood.

(iii) Development of motorized fishing fleets has been progressing well. The general trend has been towards the use of inboard Diesels in preference to outboard gasoline

engines. The recent development of outboard Diesels in U.S.A., has not had any influence on the existing trends in this Region so far. The motorization of traditional craft is still characterized by the use of a large number of types and makes of engines thus complicating the servicing problems. However, recent trends indicate that the advantages of having a limited number of types and makes has been realized, particularly in servicing, procuring spare parts, etc. In a few countries, manufacture and/or assembling of engines has started.

(iv) In general, the development of motorized fishing fleet in the Region has resulted in some cases in the extension of fishing grounds, increase of fish catch and increase in the net earnings of the fishermen. However, the full potentialities of the motorized fishing boat have not been utilized by the fishermen in some countries, e.g. use of larger and more efficient forms of gear, increase in fishing time, etc.

(v) Only in a few countries, Craft Technicians have been appointed in Government Fisheries Departments. Training of boatbuilders in modern methods of construction has been made slow progress.

(vi) There have been encouraging developments in the provision of landing facilities and harbors for fishing boats. Extensive surveys have been carried out in a number of countries on suitable sites for fish harbors. This is a very important development as fish is a perishable product, the increase in fish catch must go hand in hand with provision of increased facilities for landing, handling and quick disposal of the catch ashore.

(vii) There has been an increase in research activities in the field of fishing craft in some countries. A new Craft Wing in the Institute of Fisheries Technology has been established in India. The research programs include hull design, marine borers, engines and propellers.

B. FISHING GEAR

MECHANIZED HANDLING OF GEAR

The progress in the use of mechanical aids for handling and operation of fishing gear is as follows:

Use of Line Haulers, Winches, etc.

In *Australia*, hydraulic winches are beginning to replace mechanically-powered winches. In addition, there are now three vessels equipped with Puretic power blocks of 18 in., 24 in. and 28 in. respectively.

In *North Borneo*, winches driven by power take-off from the main engine has been introduced in small inshore trawlers.

In *Hong Kong*, in the last 18 months, about 400 shrimp trawlers have been installed with winches which are driven from the main engine. Recently some purse seiners have installed capstans for hauling purse lines.

In *Korea*, efforts are being made to help the big scale fisheries which need comparatively large numbers of fishermen to rise fishing efficiency, by extending the hours of fishing operations and by greater mechanization of the operation. In the purse seine fishery which needs about 60 fishermen, the Government imported and demonstrated 4 sets of power blocks (U.S.A. made) to mechanize the operation. These tests demonstrate that sets could be made more rapidly and fewer crew were required, but the gear and method have not spread by reason of unskilled operators, unsuitable boat types, and high price of installation.

In *Pakistan*, the mechanical aids to handle fishing gears are provided in almost all the powered vessels such as winches, line haulers and reels, etc.

In *U.S.A.*, all major fishing vessels in the United States are equipped with mechanical equipment for handling gear.

Effect on Employment, Earnings

There is no effect on employment by mechanization of fish handling in *Pakistan*

because the number of vessels is increasing and more crew are employed by these mechanized vessels.

In *U.S.A.*, the recent introduction or development of mechanical aids to handle fishing gear has resulted in a further decline in employment in the United States.

IMPROVEMENTS IN FISHING GEAR

Use of New Materials

During the intersession period the progress made in the Region in the introduction of improved materials for making of fishing gear is as follows:

In *Australia*, there is a pronounced swing towards the use of synthetic fibres for nets. Many of the Danish seine nets, used in the South Eastern trawl fishery, are now made of synthetic fibre, as are numerous beach and purse seines. Most of the material used is Japanese knotless netting.

In *North Borneo*, synthetic fibres are used in fishing nets and are of the following types: Kuralon, Newlon, Nylon, Polythene Marlon. Floats: Synthetic rubber, Plastic, Metal (aluminum alloy). The Fisheries Department gave advice on several concessions to fishermen on buying synthetic nets. Lines, gill nets and trawl nets of synthetic material are in popular use.

In *Hong Kong*, monofilament nylon is widely used for gill nets and polyethylene for trawl nets.

In *India*, cotton, hemp, sisal, coir and manila are the chief materials used for fabrication of the different fishing gear. Most of these materials are of indigenous origin. Synthetic twines (like polyamide, polyester and polyvinyl) are also used but their use is at present restricted to mechanized fishing centers. Systematic investigations were being undertaken to evaluate the dynamic properties of these gear materials. The samples of twines analysed for determination of the characteristics were those actually used by the fishermen, or supplied by the traders within

the country and those that were made in the laboratory under specified conditions. Many of the interrelationships were worked out for each kind of twine particularly the relation between the direction and the amount of twist per unit length on the one hand and the strength on the other. These findings have been communicated to the industry through the Central Institute of Fisheries Technology's Newsletter and technical papers, so that a better quality twine is produced for fishing purposes. Synthetic fibre is becoming popular with fishermen operating gill nets and long lines. The Government are extending financial assistance in the form of subsidy. Synthetic twines are at present imported. However, a factory in the country has been recently commissioned for the production of monofilament and multifilament polyamide yarns. These products are now being tested for suitability in fishing.

The *Japanese* mothership-type salmon fleets appear to be convinced of the merits of a new special monofilament nylon gill net described as a "transparent net". The fleets plan to use these types of nets next year on a large scale. The "transparent net", produced jointly by two Japanese firms, was supplied to all 12 fleets engaged in the mothership-type salmon fishery on an experimental basis this year. Catch per unit of gear is said to have been about twice that of nylon-type gear normally used and cost was limited to less than 60% of regular gear. The net is most effective when used in the ratio of 3 shackles of regular nylon-type gear and one shackle of monofilament gill net. Other Japanese net manufacturers hope to start producing "transparent nets" in the near future and experiments are now being conducted to utilize the "transparent net" for other fisheries. The success of this new gear is said to mark a revolutionary step in the field of gear development. Japanese has been experimenting with a monofilament gill net for three years. Experiments were first conducted by utilizing hatchery fish, and in 1960 the Japanese salmon mothership fleets used this gear on a trial basis. Although extremely

effective, it was found to be difficult to handle due to its bulkiness (stiffness). Also, knot slippage occurred. These shortcomings now appear to have been overcome. In 1960, the salmon motherships were furnished with about 5,000 shackles (Japanese shackle is approximately 4.5 m. long), the land-based Eastern Hokkaido salmon fleet with about 1,500 shackles, and the Japan Sea pink salmon fleet about 500 shackles. Advantages of the monofilament gill net are described as follows: (1) transparent characteristic of net makes it most effective; (2) gilled fish are not scarred; (3) gilled fish do not fall off; (4) net does not "roll" (entangle) in rough sea; (5) net is more durable than existing nets.

The *Government of Korea* introduced and demonstrated chemical fibres for fish nets, and quite a bit of the fish netting being made in Korea is being made from these fibres. At present gill nets are chiefly constructed from synthetic fiber netting except for some special species. The rate of catch in comparison with the cotton fiber net is as much as 3 times greater. In the trap net fishery, about 20% of the fishermen use the PVA (Polyvinyl alcohol) net or vinyliden chloride net, and in the purse seine fishery, most of fishermen use nets of chemical fiber as well as synthetic fiber rope. The value of the chemical fiber net is widely recognized by the other fishermen, also but due to the higher initial cost has not spread in these other fisheries. The chemical fiber yarn is imported into Korea and is made into netting in local factories. However because of unskilled techniques in treatment some of the products still are of poor quality. In order to stimulate better quality the Government permits limited import of synthetic fiber net, except nylon net, free from indirect tax and sales tax.

In the *Federation of Malaya*, the use of synthetic fiber nets which has, since their introduction to this country in 1959, been confined to the gill/drift net fishery, has spread to the purse seine fishery. Increasing numbers of the 80 units of purse seine of the larger type in Kuala Kedah and Pangkor on the west coast of the country are now

switching over from cotton to synthetic nets. On the east coast, there is a similar tendency among operators of the 3 units in Trengganu, 6 units in Pahang and 18 units in Johore. It is worthy of note that the purse seine which is regarded as the most efficient type of gear in South-East Asia has now been well established in this country. This gear is now found on the extensive coastline of both the east and west coasts of the country. A notable development on the east coast, particularly in Trengganu, has also been the change over from natural to synthetic fibres in a smaller version of the purse seine, known as pukat jerut bilis, which is employed for the capture of ikan bilis (anchovy). In former days pukat tarek (beach seines) were mainly used for the capture of anchovy in this State. These gears, however, were limited in scope as anchovy shoals frequently occurred in deeper waters beyond their reach. The efficiency of the synthetic pukat jerut bilis may be gauged from the fact that whereas in 1960, 19 units of this gear of cotton fibre caught a total quantity of only 386 tons of fish, in 1961, 28 units of the new synthetic nets took in all 2,525 tons of fish, an increase of 444% per gear in terms of landings.

The marine fishing nets are now generally made of nylon twine instead of cotton yarn, in *Pakistan*. Approximately 154,187 Kg. of nylon were supplied to the fishermen so far by the Government, at the rate of Rs. 4.53 and Rs. 5 per Kg. Nylon twine and ropes of fishing industry are exempted from the payment of Customs Duty and Sales Tax.

In *Singapore*, the use of nylon to replace ramie in drift nets was started a few years ago. This replacement is going on at a steady place.

Recent trends in the U.S. fishing industry have been toward exclusive use of synthetic twine of polypropylene and nylon.

In *Vietnam*, a great majority of fishermen are still using natural fibers such as cotton and ramie to make net though quite a number of them realize now that synthetic fibres

are advantageous. The slow adoption of synthetic fibres is due to poverty of fishermen and partly to their conservative habits. In spite of this, 7 fishing net factories have bought new equipment and engaged technicians to make nets with synthetic fibres. About the use of synthetic fibres, Vietnamese gill-net fishermen on the East Coast, where water is clear and the continental shelf is rocky and deep, prefer monofilament to nylon twine. Through experience they say that catch more fish with monofilament nets which have become more popular than the multifilament nylon twine nets.

Traditional and New Types of Gear

Improvements in traditional fishing gears as well as introduction of new types of gears are going on and the progress achieved during inter-session period is as follows:

Certain localised improvements have taken place in gear used in *Australia*. Two tuna purse seines have been delivered, and they are expected to be used before the end of 1962. One, 300 fathoms x 30 fathoms, was imported as a unit from Japan, while the other, 400 fathoms x 25 fathoms, was built in Australia using Japanese synthetic material. Most Australian fishing vessels have mechanical aids for hauling fishing gear.

In *North Borneo*, Hong Kong-type beam trawls have been introduced for prawn fishing. Otter trawls and other trawls of Australian, British and American design are also in use. A Japanese firm has also been experimenting with Gulf of Mexico type twin shrimp trawls operated from outboard booms. Off the east coast of North Borneo, a Japanese company has introduced tuna fishing by use of live bait. Preliminary trials with purse seines were not successful. The craft used are typical 15 m. Japanese tuna boats with live bait tanks. Each boat carries a crew of about 20. The live bait consisting mostly of small sardine, and anchovies are caught by other boats specially engaged in catching live bait. These are sold to the tuna boats and each tuna boat carries approximately US\$40 worth

of live bait which is sufficient for one day's operation. The fishermen of North Borneo are being trained in this method of fishing and one of the Japanese boats is almost entirely used for training of local fishermen. On a good fishing ground about 3 tons of tuna can be caught by this method in about twenty minutes.

The Fisheries Division in *Hong Kong* has introduced a number of local pair trawler fishermen to the practice of fishing with a V-piece overlap between the top-wings of the trawl to act as a square and to give an overhang to the foot-rope. This idea has been adopted by several of them. Aluminium floats have been introduced but the preference is still for the glass-floats which are considerably cheaper. Stern trawling has been demonstrated by the Fisheries Division both at Tai Po and Aberdeen. Fishermen have shown great interest in this method of fishing and an important aspect of the work of the Fisheries Division is the investigation of the possibility of introducing single boat stern otter trawling in place of the local traditional method of pair trawling.

On the East coast of *Korea*, shrimp used to be caught in small amounts by bottom towing nets (Danish Seine) within 50 to 200 meters depth, and the processing of the shrimp had not been developed as an enterprise. In 1958, the Government imported the balloon type shrimp trawl net which was being operated in the Gulf of Mexico. This was demonstrated in these same waters along the East Coast. The results were unexpectedly effective, and the development has progressed to the point that an independent fishery was established in June 1962. In 1961, the Government experimented with the two boat mid-water trawl which is now used successfully in various countries of Europe. Unfortunately the fish schools were so sparse that the results were not very good. Hair-tail and corvina which swim near the bottom and are the object of the trawl or bottom towing net fisheries could be easily caught but not in commercial quantity. The crowded schools of horse mackerel that are nearer to the

surface and are fished by the purse net could not be caught, during the several trials with the net. An effort has been made to exploit scallop beds under more than 30 meters depth, in which the regular scallop divers cannot operate. The Government attempted to improve the old type scallop dredge and to introduce a new type scallop dredge similar to that used on the U.S. East coast. However it did not achieve the expected results. Tests with the Calico-Scallop Trawl of U.S. East coast are being continued. Lobster pot fishing is being experimented in order to develop production of fish having high value for export.

In *India*, the Central Institute of Fisheries Technology has been conducting a detailed survey of the indigenous fishing gear and methods. Most of the areas, including inland fisheries have been covered in the past two years. When the survey is completed, it is hoped to draw up an illustrated classification of Indian fishing gear and methods. Probably no form of sea fishing gear has ever dominated the thoughts and work of fishery workers in this country to such an extent, as the trawl is doing at the present time. For more than two decades many experiments have been conducted with trawls at selected centers. Nevertheless at none of these centers this gear was extensively used in commercial fishing until a few years back. At Cochin, in particular, otter trawling for prawn has become the chief method in mechanized fishing. As efficiency determines the utility of a new fishing method, study of the gear under practical fishing conditions has assumed greater importance than ever before. Several new designs of trawl nets were made to suit boats of length from 25 ft. to 36 ft. and the various aspects of the gears from the different angles to improve their efficiency have also been studied. The gear is now extensively used in commercial fishing. Beam trawl was also tried on an experimental scale at the Central Institute of Fisheries Technology. The conventional gear like the traps and the anchor hooks were found to have many handicaps in successful operation. A

gill net suitable for lobsters was designed and effectively operated at the different lobster fishing centres. This gear is being slowly taken up by the commercial interests. Trolling for seer, tunny, barracuda, etc., is an important method of fishing at some centres in this country. The lines used in indigenous fishing are of a crude design. New designs of artificial jigs and line stabilisers were made at the Central Institute of Fisheries Technology and their relative utility was successfully demonstrated. The attraction of the different fish to various colours of artificial feather jigs were also studied. The gear is being slowly popularized at the different centres through demonstrations. Work has also been initiated on a two boat purse seine suitable for sardines and mackerel. The gear has been fabricated and it will be tried during the ensuing season.

In the *Federation of Malaya*, discouraging results were obtained during the trials carried out in the past few months, with the set net (Techi-Ami). A complete set of Masu-Ami (Japanese set-net) ordered from Japan has arrived and operation is expected to begin early. The operation will be carried out under the guidance of the Colombo Plan Set-net Expert with the Principal, Marine Fisheries School and the Fishermen Trainees participating in the actual operation. An experiment with Japanese set-net (Techi-Ami) was carried out in the vicinity of Pulau Ketam in depth of about 9.14 m. (5 fathoms) water on a muddy seabed. The operators were Japanese under the management of a Japanese firm working in conjunction with a Fisheries Cooperative Credit and Marketing Society, the object being to explore the efficiency of this gear under local conditions with the ultimate aim of using it as a replacement for fishing stakes.

The common fishing methods in *Netherlands New Guinea* are: Handling, which is practised in dark nights, using lamps as a light trap. Casting nets or beach seines, where coastal conditions allow of the use of these devices. Fixed traps and pelagic trawl in the

murky water areas. The methods themselves have not been improved upon, but the devices employed in fishing have been gradually developed in the course of time. Formerly handlines were made of cotton or seagrass, pandanus or orchid fibre. Bent pins were used as hooks and a stone or shell as lead. Nowadays nylon lines, Mustad hooks of various sizes and lead are being used in handlining. Trolls used to be made of cotton, to which feathers, fish or pieces of crinum, a lily-like beach plant, was attached. The cotton line has been replaced with nylon, at the end of which a swivel has been attached connecting a steel leader with a hook. In troll fishing use is made of artificial bait made of rubber in the shape of squid or other species suitable as bait, which are imported from Japan. Some trolling fishermen use paravanes, which device has been introduced by the Sea Fisheries Division for the purpose of trolling at certain depths. The nets are mainly beach seines or rectangular nets, which were formerly made of pandanus or seagrass fibre. These nets are wide-meshed and the headline is weighted by means of shell. An improvement was the introduction of cotton nets, whose shape is adjusted to the trend of the sea bottom along the coast. The centre piece has a smaller mesh size than the wings. The aforesaid improvements have been readily accepted by the population.

Improvements in design of traditional gears and introduction of new methods and types of gear have been going on in *Pakistan*. The improvement in the traditional gear has been made in the sense that their parts are made of modern material, for example, gill net has been considerably improved. Synthetic floats and lead sinkers are now respectively used in place of drift wood and stones. Cotton has been replaced by nylon twine and the length and depth of the nets have been increased manifold. The shrimp trawl net is the only exotic gear adopted by the fishermen. They make it locally, preferable of nylon. An average trawl net has the following dimensions:

Length	19.81 m. - 22.86 m.
Mouth Opening	12.19 m. - 15.24 m.
Mesh	51 mm. body & 38 mm. cod-end.

Discouraging results were obtained during the trials carried out earlier this year, with the Japanese type longlines. These operations were conducted in 20-30 fathoms water on board research vessels, under the guidance of a Colombo Plan Japanese expert, in which the fishermen trainees also participated. Japanese set-nets were also tried a couple of times, in the creeks (4-6 fathoms) by the same expert, but these two were not encouraging.

Until recently the major fishing gear used in Thailand were the purse seine of various types, the Poh (bamboo stake trap) and the nylon drift gill net which was introduced under the U.S. Technical Assistance. Other gear such as set bag net, lift net, hook and line, seine, etc., were only of local importance. All these gear utilized chiefly the pelagic fisheries resources of the country. The fish of the largest economical importance was by far the chub mackerel (*Rastrelliger* species). The annual catch of this species amounted on an average to some 45,000 metric tons; another catch of some 50,000 metric tons consisted of *Mytilus smaragdinus* and other mollusks. The rest of the annual marine fish production amounting to approximately 50,000 metric tons consisted of a large variety of fish species such as spanish mackerel, mullet, etc. The total annual marine catch of some 150,000-170,000 metric tons was more or less steady during the last years. However this picture may be due to the inefficiency of the statistical system since the fish are landed at several hundred ports along the coast of approximately 1,300 nautical miles, to the great variety of fishing gear in use, to the great number of fish species caught, and due to the lack of personnel. Although the Gulf of Thailand is one of largest natural trawl fishing grounds of Southeast Asia which has the size of approximately 64,000 square miles, only little attention has been paid by the Thai fishing industry to utilize the

available demersal fish resources of this water. The first trial of the Japanese paired-trawls in 1954 became a failure because of the lack of market for this kind of fish. In the year 1958 the paired-trawl fishing resumed and since then it has slowly developed. Upon the recommendation of Dr. K. Tiews, Fisheries Biologist of the Fisheries Research Board of the Federal Republic of Germany in 1958, emphasis was placed by the Thai Department of Fisheries to explore the possibility of the trawl net fishing in the Gulf of Thailand. During the course of this endeavour new experiments were made through the initiative of the Thai fishing industry with Japanese built paired-trawler and through the bilateral agreement between the Thai and German Governments regarding economic and technical cooperation. Under the agreement, the German Government was asked to advise the Thai Government of the best means to explore the demersal fish resources and to conduct a survey for the quick estimation of the size of the stock. Reference is made to the report of Dr. K. Tiews, "Experimental Trawl Fishing in the Gulf of Thailand, Its Results Regarding the Possibilities of Trawl Fisheries Development in Thailand" submitted to the meeting (IPFC/C62/CP12) describing in full the results of this experiment. Because of the highly satisfactory results obtained, the Thai fishing industry has adopted, in the meanwhile, to an unexpected degree the successful trawl net fishing technique. At present some Thai purse seiners have been converted to paired-trawl and otterboard trawlers. The present catch capacity of this fleet is being estimated to amount to some 50,000 metric tons having a value of some 100 million Bahts (U.S.\$ Five Million). This rapid development is chiefly caused by the partial failure of the chub mackerel fisheries with Tang Kae purse seines, which have new keen competitors, namely; the chub mackerel gill net and Thai purse seine. Due to the efficiency of the trawl fishing gear, it is expected that the trawl fisheries will be increasingly adopted by the Thai fishermen in the near future. The

introduction of trawl net fishing has completely changed the structure of the Thai marine fisheries particularly within the last year. Unfortunately the quick development has caused some marketing problems. Several of these could be solved in the meanwhile through the Department of Fisheries by demonstrating the proper means to utilize these fish. Recently the Section of Food Technology successfully demonstrated the smoking of threadfin bream, lizard fish and others which led to an increase in the demand and consequently to an increase of the wholesale price.

Very few design changes in traditional gear have occurred in the *United States* in the past 10 years. The most notable introduction in the United States has been the nylon purse seine and the power block.

Since its initiation, nearly a century ago, the Maine sardine industry has been dependent upon passive types of gear—weirs and stop seines—for the capture of its basic raw material, the Atlantic herring (*Clupea harengus harengus*). Such gear, although effective in capturing inshore schools and in incorporating the necessary provision for holding the live fish for several days, is not effective in coping with the schools when, as often happens, they remain in deeper water off-shore. Failure of the herring to move inshore has often resulted in cannery supply shortages. Realizing the need for a more active and far-reaching type of gear, the U.S. Bureau of Commercial Fisheries began, in 1955, to experiment with other types of gear. Research activities were largely based on the premise that, since the herring are easily-frightened fish, a device that would frighten them might also be used to drive or guide the fish from deep water to the areas where they could be taken in the weirs and stop seines. In the past three years, the usefulness and effectiveness of an air-bubble curtain for driving and guiding the herring has been demonstrated to the industry, and at least 12 air-curtain units have now been constructed by members of the Maine industry.

Essentially, the air bubble curtain consists of several lengths of 13 mm. to 19 mm. polyethylene pipe, weighted to lie on or near the sea bottom, and from which columns of bubbles escape through 0.4 mm., holes bored in the pipes at regular intervals. Air is supplied by a shipboard compressor. The bubble curtain is used to surround the fish and slowly draw them to the seines, or to otherwise direct them in the direction of the weirs and seines by cutting across their normal path of movement.

Equipment List

A. Equipment for a 731 m. air-bubble Curtain

1. Compressor: Capacity 5.5 m³/min. or higher (free air rating). Pressure rating 5.62 Kg/cm² or higher.

2. Compressor engine: Gasoline, 30 to 50 continuous brake h.p., or shaft h.p., air or water cooled.

3. Aftercooler: Compressed-air pipe-line aftercooler, capable of cooling 5.5 m³ per minute of air to within 5.5°C., of the temperature of the cooling water.

4. Exhaust valve: 25 mm.—diameter pipe size.

5. Safety valve: Set to open at 5.27 Kg/cm²

6. Air-pressure gauge: Containing a 0-10.54 Kg/cm²

7. Polyethylene plastic pipe: Pressure rating 5.27 Kg/cm²

First Section: 30.5 m, 25 mm.—diameter, undrilled and unweighted, attached between after cooler and drilled sections.

Second Section: 183 m., 25 mm.—diameter, drilled at 0.30 m. spacings with No. 80 drill, weighted with 227 g. of lead per 0.3 m. (to sink completely to bottom). Leads can be attached 0.9 Kg. per 1.22 m. spacing.

Third Section: 183 m., 19 mm.—diameter, drilled at 0.30 m. spacings with No. 79 drill, weighted with 136 g. lead per 0.3 m. (to sink). Lead can be attached 680 g. per 1.52 m. spacing.

Fourth Section: 183 m., 19 mm.—diameter, drilled at 0.3 m. spacings with No. 78 drill, weighted with 136 g. lead per 0.3 m. (to sink).

Fifth Section: 183 m., 13 mm.—diameter, drilled at 0.3 m. spacings with No. 78 drill, weighted with 91 g. lead per 0.3 m. (to sink).

8. Hose Reel: Revolving drum 1.22 m. long, 1.37 m.—diameter with 0.57 m.—diameter core. This may be of wood or metal construction and should be power driven for easiest operation.

9. Self-priming 19 mm.—pump: (neoprene impeller type) to supply cooling water for after-cooler, belt driven by compressor engine or other engine.

B. Equipment for 457 m. Air-Bubble Curtain

1. Compressor: 3.68 m³/min. or higher rating 5.62 Kg/cm² or higher maximum pressure.

2. Compressor engine: 25 h.p. gasoline engine, *continuous* shaft h.p., or 15-h.p. electric motor.

3. Aftercooler: Pipe-line aftercooler or sufficient capacity to cool 3.68 m³ per minute of air to within 5.5°C. of the temperature of the cooling water.

4. Exhaust valve.

5. Safety valve.

6. Air pressure gauge: 0-10.54 kg/cm²

7. Polyethylene plastic pipe: 5.27 kg/cm² pressure rating:

First Section: 30.5 m., 25 mm.—diameter, undrilled and unweighted attached between aftercooler and drilled sections.

Second Section: 183 m., 19 mm.—diameter, drilled at 0.30 m. spacings with No. 80 drill and weighted with 136 g. of lead per 0.3 m. of length.

Third Section: 183 m., 19 mm.—diameter, drilled at 0.3 m. spacings with No. 79 drill and weighted with 136 g. of lead per 0.3 m. of length.

Fourth Section: 91.4 m., 13 mm.—diameter, drilled at 0.3 m. spacings with No. 78 drill and weighted with 91 g. of lead per 0.3 m. of length.

8. Hose Reel: Revolving drum 0.91 m. long, 1.37 m.—diameter with 0.51 m.—diameter core, otherwise as described above for 731 m.

9. Self-priming 19 mm. pump: (neoprene-impeller type) for aftercooler water.

C. Special Tools for Drilling Plastic Pipe

Special small drills, chuck and drill motor are needed for boring the very small holes in the plastic pipe. A high-speed motor from a carving and engraving set was found to be most satisfactory for this use. A set of drills, No. 61 through 80 and a special small chuck to adapt the drill motor chuck to the small drills are also needed. These tools can likely be obtained from a hobby shop, a well-stocked hardware store, or a mail-order house.

A new type of power block designed to improve handling of crab-pot gear and long lines has been introduced. The equipment consists of a hydraulically-driven aluminum block weighing approximately 59 Kg. and having a bronze V-sheave that can be preset to accommodate lines from 8 to 16 mm. inch in diameter. This block is suspended from a short boom that can be raised or lowered hydraulically. Besides handling the gear faster with less work, the block is said to eliminate line slippage and, thus, does not wear or melt plastic pot warps. By means of special hydraulic controls, the maximum pulling power can be adjusted to a point where it

will not exceed the parting strength of the line. This feature is important to the fishermen working in rough seas or with stuck gear. When the gear is to be hauled, the boom is swung outboard to clear the side of the hull and is lowered to allow the warp to be placed in the V-sheave at the time the buoy is picked up. The boom is then raised to a point where the pot will clear the bulwarks. The buoy and the hauling warp are played back into the water. When the pot has been raised to its maximum height, it is pulled inboard, the sheave is simultaneously reversed, and then the boom is lowered. After removal of the warp from the sheave, the block is ready to receive the next pot warp. Trials of the equipment by experienced commercial crab fishermen have shown that a loaded Dungeness crab pot with 64 m. of warp can be handled completely in 1 minute. Operations are continuous while the boat is under way. It is reported that strings of up to 50 pots have been hauled in 60 minutes.

California's tuna "clipper" fleet has put into use purse seine gear and methods which may have a profound effect on ocean seining throughout the world. A fishery which for over 30 years was predominantly conducted by the colorful pole-and-line (bait boat) method, has successfully adopted in recent years fishing gear and techniques which required conversion of the majority of its pole-and-line "clippers" to seiners, and the training of many fishermen to a method foreign to them. The mass conversion of the California clipper fleet, which progressed at an almost unbelievable rate, is an unparalleled event in the history of major United States fisheries. Conversion of a large segment of the California tuna fleet from clippers to seiners was stimulated by the successes of the early conversions and the need to reduce costs of raw fish, in order to stay competitive with foreign producers of tuna and domestic producers of other protein foods. News of attempts to adjust to this competition through conversion of the California clipper fleet to seiners was followed closely by the fishing industry throughout

the world. The rapid change to seining and subsequent success of the fleet in distant waters is having a considerable impact on design of new tuna vessels and methods of harvesting tuna. It may also initiate a trend toward greater use of large seines in other ocean fisheries. The success of the tropical tuna seining venture stems largely from (1) the adoption by the fishing fleet of synthetic twines (all-nylon seine), (2) the advent of the Puretic "power block" which increased the hauling speed of the nets, (3) use of aircraft, and (4) possibly favorable oceanographic conditions influencing availability of fish.

In *Vietnam*, six two-boat trawlers of about 80 gross tons have been imported from Japan by three enterprises and are operating with, per pair, 7 or 8 Japanese technicians who will be by stages replaced by local staff. The catch is good but the poor selling of fish and the inefficient organization of these enterprises make them not so prosperous.

Attraction of Fish

Concentration of fish within a limited area by using certain agents such as light is widely practised in the Indo-Pacific Region.

In *Hong Kong*, purse seine fishermen use bright lights for attracting fish.

In *Korea*, a large quantity of anchovy is caught in the South Sea by various kinds of fishing methods. The method utilizing the light-attraction of fish is often adopted. Scoop nets are used with a simple light or the anchovy purse seine net, which is comparatively big is used with 100 volt electric lights of from 500 to 2,000 watt size, but the light power is locally limited or prohibited to prevent competition with the other coastal fisheries. The purse seine fishery which is an important typical coast fishery in Korea chiefly catches horse mackerel at night using one or two light-boats (100V, 1,000W to 2,000W) which searches, leads, and attracts the fish schools. The catch of cuttlefish has been about 35,000 to 40,000

metric tons in a year. This fishery is operated with pole angling on small boats of 5 to 20 gross tons. The fishing method is being improved year by year, and an automatic angling method has been recently designed. Pole angling also has improved in that the hook is lighted by a small battery (6V) to attract the fish. These improvements have raised the catch efficiency in comparison with the old method, and in 1961 the catch amounted to 82,000 metric tons.

In the *Federation of Malaya*, experiments in the use of light to attract fish to shoal have been conducted with reasonable success both by the Fisheries Division of the Ministry of Agriculture and Cooperatives as well as by fishermen themselves. A Colombo Plan fisheries expert from Japan attached to the Fisheries Division experimented on stick-held dip net fishing with the aid of light. Various types of lights were tried including kerosene gas lamps and submarine and overhead electric lamps. The results obtained, though not entirely successful, were satisfactory in that they provide data for more conclusive experiments to be made in the future. In the case of light fishing by fishermen using lift net (pukat tangkol), through the efforts of the Fisheries Division and the help of a local importer, unbreakable mica-glass globes were supplied to these fishermen for experiment in the first instant. These mica globes were used to replace ordinary glass globes in petromax lamps as a protection against sprays in choppy seas which have until a short while ago been responsible for breakage of the lamps. Successful results obtained in these experiments have been followed by increased interest in fishing with the use of light by the lift-net fishery. Experiments in fishing with the aid of light have also been successfully carried out by pukat jerut (purse seine) fishermen using the same type of petromax lamps. An increasing number of these units, particularly those based in Kuala Kedah and Johore are now also using light for attracting shoals of fish.

In *Netherlands New Guinea*, handlining is generally practised by lamp light, particularly when fishing for *Rastrelliger* sp. and horse mackerel.

Echo sounders are used in virtually all fishing vessels in *Australia*. Sandon mercury vapour lamps are also used in certain fisheries.

No significant developments have taken place in attraction of fish (by light, etc.) within the *United States*. Air bubble curtains have been introduced as a guiding device, but the commercial industry has not used this method for catching fish.

In many other areas such as *Sarawak*, traditional parau fishing for pomfrets continues to be employed. In this method fish are attracted by floating groups of clumps of nipa palms on the water.

Detection of Fish

The use of echo sounders to detect fish, while it is very popular in Japan, is making slow progress in the Region.

In *North Borneo*, seven inshore trawlers use rather expensive echo sounders but two or three hand line boats which have installed low priced transistorized echo sounders has been very successful. The following makes of echo sounders are used in North Borneo: Ferrograph, Kelvin Huges, and Furuno.

In *Hong Kong*, to date only six vessels operated by commercial trawling companies are equipped with echo sounders; these are not fish-finders but record the depth of water only.

In *Korea*, on the whole, the fish finder is quite widely used in the fishing industry. At the present time about 170 sets of fish finder are being used in fishing industry of Korea. Of this number, 34 sets of fish finder were for the first time introduced to the fishing industry in 1958 under ICA assistance program. To this were added 13 sets of fish finder in 1959, and in 1960, 10 sets were installed on the fishing vessels under national subsidy. In 1962, 120 sets of fish finder are

being equipped under the national subsidy. 30 units of all purse seine fishing fleet are equipped with the most efficient fish finders, while half the number of drag net fishing crafts over 50 tons class are using this equipment. The recent trend of purse seiners is to have more sensitive and more effective instruments.

In *Pakistan*, echo sounders are not used at all. Older methods of detecting fish by means of visible signs are still in practice. However, there is growing realisation specially amongst the trawler fishermen that the use of echo sounders will enormously increase their catches.

In the *U.S.A.*, the use of fish finding echo sounders is almost universal but during the intercession period no significant technological developments have taken place.

SUPPLY OF FISHING GEAR

Indigenous Production and Import Policy

In *Australia*, there are no netting factories for making synthetic fibre netting.

In *North Borneo*, apart from traditional manual methods of making fishing gear which is a family industry, there are no fishing net factories. Synthetic fiber twines and gear are imported. The import duties on fishing nets have been exempted since November 1961. Previously, there was a 15% duty on imported fishing nets.

There are four modern fishing gear factories in *Hong Kong* which produce synthetic fibre or monofilament nylon fishing twine and nets. A large variety of imported gear is available locally. A few pair trawler and beam trawler fishermen still use China Grass *Boohmeria nivea Gaud* to make nets, but in recent years this material has been largely replaced by synthetic fibre.

In *India*, a factory has started production of nylon multifilament yarn and twine for fishing nets since April 1962. With the increase in size of fishing crafts, the use of deck equipment like winches and line haulers is becoming popular with the fishermen. With the mechanization and the need for

handling a large number of units of fishing gear, a few firms have come forward with bulk manufacture of fish nets and machines are now being introduced in selected centres for fabrication of nets.

In *Korea*, some 30 factories exist for making fishing nets and three factories for making wire ropes and the indigenous capacity is sufficient to meet local requirements. The synthetic fibre yarn is imported into Korea and made into webbing by local factories. To stimulate the local factories to improve the quality of their products, the Government has permitted the import, free of indirect taxes and sales tax, of synthetic fiber webbing other than nylon.

In *Pakistan*, gill nets which are generally used by fishermen were previously made of cotton. Due to the import of nylon, cotton yarn has been replaced by nylon as it is more durable than cotton. Government issues licences twice a year, either from the aid funds or from her cash resources for the import of fishing requirements including fishing gear. These licences are issued in the name of Karachi Fishermen's Cooperative Society who invites world wide tenders for finally deciding the best make, in consultation with the fishermen. There is no net making factory in Pakistan. All the nets are hand made. The fishermen prepare their own nets with their hands according to their requirements but a webbing machine has been imported by the Provincial Fisheries Directorate of East Pakistan. The Government is giving full facilities to procure fishing requirements and in pursuance of this policy the Government has exempted the following commodities from customs duties and sales-tax:

1. Nylon twine
2. Nylon rope
3. Coir rope
4. Teak
5. Marine diesel engine
6. Synthetic floats
7. Fish hooks
8. Spare parts of marine diesel engines
9. Navigational instruments

10. Mast wood
11. Lead
12. Other miscellaneous requirements
13. Dug-out canoes.

In *Pakistan*, 2 Marine diesel engines (one of 10 h.p. and the other of 40 h.p.) were issued to fishermen, procured under I.C.A. aid through the Fishermen's Cooperative Society in the beginning of the quarter. All the 95 Inboard marine diesel engines allotted for Karachi area procured under I.C.A. aid were issued to fishermen through the Fishermen's Cooperative Society Ltd., Karachi, with the exception of one 90 h.p. engine which was allotted to the Zoological Survey Department, Karachi for installation in their research vessel. In addition to the above aided items, Karachi Fishermen's Cooperative Society has issued a number of fishing articles procured under import licences issued to them by the Government. A list of all such articles which the society procured and sold to the fishermen during the year ending on 30th June 1961 is given below:

Name of the Articles

Nylon twine
 Marine diesel engine
 Coir rope
 Katachu
 Floats
 Trawls nets
 Canoes
 Fish hooks
 Teak wood
 Winches
 Spare parts
 Nylon rope
 Mast wood
 Navigational lights
 Echograph
 Bamboo
 Life jackets
 Compasses
 Manila rope

Total Sales Rs. 4,481,041.40

In *Singapore*, fishing gears are in plentiful supply. No import duty is charged on imports of fishing gear.

It appears that *U.S.A.* will have a free trade policy on gear imports.

Government Assistance

Some of the data under this subject are covered in the section on indigenous production and import policy.

In *Australia*, fishermen are exempt from sales tax on gear but customs duty is payable and varies on the country of origin. The Australian Government will leave the question of manufacture of synthetic fishing gear materials in Australia to be solved by the manufacturers. Various governmental funds are available to Australian fishermen in most States. These are either from State-operated banking institutions or funds built up from fishermen's contributions. In addition, the Commonwealth Development Bank may be approached if the State sources cannot assist.

PRESERVATION OF FISHING GEAR

In *Australia*, many prawn fishermen are changing from coal tar to creosote to preserve their cotton prawn trammels.

In *North Borneo*, fishing gear made of natural materials such as cotton are regularly treated in cold with extracts of cutch (from *Acacia catechu*). No further attempts are made to fix the cutch with copper sulphate. The drift nets are treated every two weeks overnight and are stated to last some two years.

In *India*, considerable studies have been made on the durability of fishing gear materials and methods of preserving the same. Since the majority of Indian fishing nets are made of vegetable fibre twines, preservation and care of nets made of such fibres are important problems facing the indigenous fishermen. Tannin is the method of preservation generally adopted. The sources of tannin are usually the barks, leaves, fruits, seeds, coats, etc. of various local plants and trees. The Central Institute of Fisheries Technology conducted a detailed survey of the indigenous preservation methods and the raw materials used as sources of tannin. The efficacy of the different methods were also

evaluated. The two major defects observed were:—

- a. low concentration of the extract; and
- b. insufficiency in the number of initial treatments.

In the laboratory it has been estimated that a 4 to 5% extract in solution gives maximum effectiveness and by repeated 3 to 4 initial treatments the efficiency can be increased considerably. Tannin being soluble, its preservative effect is lost quickly when a tanned net is immersed in water. The modern trends in tannin preservation is to fix the tannin. The fixing reagent tried at the Central Institute of Fisheries Technology was 1% solution of copper sulphate admixed with small quantities of ammonia. By this fixation method, the efficacy of the preservative can be increased almost twice. Coal tar treatment was also tried with great advantage. A subsequent treatment with coal tar on tannin fixed twines has been found to be a very effective preservative method.

The following gives abstracts from some of the papers published during the intersession period.

Fish Technology Newsletter Vol. III, No. 1, April 1962

Note No. 3, pp. 7-8

During the initial treatment of a net with a tannin dyeing bath, proper attention has to be paid to the number of the treatments to be given to ensure maximum effectiveness of the preservative. A survey conducted on the methods of tannin preservation followed by the fishermen has indicated that they are not paying sufficient attention to this aspect. An investigation was started to find out the optimum number of treatments that should be given to cotton fishing net twines to ensure maximum effectiveness of the preservative and the results are presented in this note. Cotton twines of specification 20s/3/3 soft twist were treated 1-8 times in a 5% boiling extract of Aina bark (*Terminalia*) for half an hour. Then they were allowed to remain in this solution for 12-16 hours. Subsequently they were taken out and dried in the shade.

They were then subjected to continuous immersion in Cochin backwaters and the strength of the twines were recorded at regular intervals. The results reveal that the rate of reduction of the original breaking strength decreases with increased number of treatments. And by 4 repeated treatments the maximum effectiveness of the preservative can be obtained. Hence, it is advisable to give 4 repeated treatments at a time for a fishing gear to ensure maximum effectiveness of tannin method of preservation.

Another paper "Effect of Boiling Fishing Net Twines *Current Science*," pp. 319-20, August 1961, gives the following data: Net materials of vegetable origin, particularly those of cotton (*Gossypium* sp.), Sunnhemp (*Crotalaria juncea*) and Italian hemp (*Cannabis sativa*), due to their susceptibility to rotting by bacterial and fungal action, are usually treated by Indian fishermen with "tannins" to ensure their longevity. The sources of "tannins" are barks, twigs, leaves and seedcoats of different indigenous plants and trees. They are extracted by boiling the material in water or by exposure of admixture of the material and water to the sun of a few days. The netting fabric is treated in the hot, cold or pre-cooled extract. While some fishermen prefer the 'hot dip' process to obviously accelerate the amount of impregnation of the preservative, others use a cold dyeing bath under the belief and personal conviction that heat might affect the strength property of the treated twine. To ascertain the possible effect of heat or boiling on the resultant strength, netting twines, of cotton, sunnhemp and Italian hemp after determination of their original breaking strength, both in the dry and wet conditions, were immersed in boiling water for periods of 20, 40, 60, 80, 100 and 120 minutes and their strength determined after such exposure. Results showed that there was apparently no effect on the strength of the twines by boiling up to 120 minutes.

In *Netherlands New Guinea*, the use of nets made of traditional material, sea-grass or *Pandanus* continues and the cotton nets now being introduced are not sufficiently treated

with preservatives. Preservation of cotton nets is effected by treatment with cutch.

The materials used for the preservation of gear in *Pakistan* are as under:

- (i) Katchu locally known as 'Khatha'
- (ii) Bark of *Acacia arabica* locally known as 'Babool'
- (iii) Lime (Calcium Oxide)
- (iv) Coal Tar

Only the traditional methods of preservation of the nets in the solution of the above materials are prevalent and no new method has so far been invented or discovered.

In *U.S.A.*, synthetic fiber netting has largely replaced the natural materials which need frequent preservative treatment and hence the question of preservation of fishing nets does not arise.

WEATHER FORECASTING

At its last Session, the Council noting that weather forecasting services for fishermen exist in some countries, strongly recommended that similar services should be developed in those countries where they do not exist at present. The progress achieved so far is as follows:

Action is being taken in *Australia* to evaluate the needs of fishermen in regard to weather forecasting with a view to extending the coverage of existing forecasts to make them of more use to fishermen. The cooperation of the Bureau of Meteorology has been promised in providing improvements in weather forecasting for fishermen.

In *India*, the State Fisheries Departments have arranged for broadcasting of weather forecast for the use of the fishermen through the All India Radio. The Departmental staff on the coastal area get telegraphic communication from the Meteorological Department on impending bad weather and this is communicated to the fishermen.

In *Korea*, weather forecasts are broadcast several times every day. The information is passed on to fishermen, not having

radio, through weather signal towers which are located at the important fishing ports. For urgent reports and for fishermen who are very far from the weather signal towers, the weather forecast is transmitted to each village through the local Fisheries Cooperative Unions. The weather signal towers were established by the Government at 69 strategic places around the coast in 1961. Installation of wireless on fishing boats has been encouraged since 1960 with a subsidy of 50% from Government funds. The project resulted 70 sets being installed in 1960 and 50 sets are being installed this year. This program will be continued until 1966 under the Government plans to support a program to supply small radios to the small boats for prevention of marine accident due to weather.

Weather forecasting services for fishermen also exist in the *Federation of Malaya* where daily forecast over Radio Malaya since 1958.

In *Pakistan*, there are two main sources of weather forecasting. Twice a day Radio Pakistan broadcasts weather forecast. Besides this, Port Authorities at Karachi and Chittagong, also indicate impending storms and disturbances in the sea by hoisting signals in the port.

In *Singapore*, the broadcast service of warnings to fishermen in the event of expected bad weather is continuing satisfactorily with the cooperation of the Broadcasting and Meteorological Departments. This service has proved to be of great value to fishermen.

The *U.S.* Weather Bureau, Coast Guard, and various shore radio stations provide regular weather forecasts for the benefit of vessels including the fishing fleet. At no time would any radio-equipped fishing vessel be beyond forecast range.

FISHERMEN'S TRAINING

At its 9th Session, the Council noting that a few permanent national training centers for fishermen have been established in certain countries, urged the Member Governments to extend such training facilities and

establish these in those countries where they do not exist at present. The progress achieved up-to-date is as follows:

In *Australia*, training of fishermen is being considered as long term project.

In *Ceylon*, an agreement was signed on 20 March 1961, between the Governments of Ceylon and Japan, to establish a Fisheries Training Center at Negombo, a fishing town on the coast above Colombo. The project was originally offered by Japan in August 1958 and details were discussed in February 1960. The training to be provided at the Center will provide: (1) courses in fishing gear for 20 trainees, every four months, selections being made by the Government of Ceylon from local fishermen who will in turn carry the benefit of their training to their fellow fishermen in their villages; (2) courses in the operation and maintenance of marine engines—ten trainees will be trained every year; and (3) instructions in general aspects of the fishing industry. The Government of Japan is to send a training vessel and other equipment as well as eight Japanese experts. Capital aid from Japan over the three-year period of the agreement will amount to Rs. 1.3 million (US\$ 274,000). The Government of Ceylon is to provide the buildings, accommodations, Ceylonese student staff, and running expenses, incurring capital expenditure of about Rs. 250,000 (\$53,000). The project is expected to be of practical benefit to Ceylonese fishermen to enable them to keep pace with the mechanization program. About a year ago, a team of Japanese experts visited Ceylon and drew up a report on the Potential development of a network of small fishery harbours in June 1960. Japanese interests own 45 per cent of a Ceylonese fishing company which catches tuna in northern waters for canning in Japan and export to the U.S.

In *Hong Kong*, training offered by the Fisheries Division consists of skipper classes, navigation classes, coxswain classes and engineering classes. The skipper class is

designed to train experienced skippers to obtain a certificate of competency which will permit them to take command of a British registered trawler. A navigation class was introduced in 1960 to meet the need of the rapidly developing middle and distant water section of the local mechanized junk fishing industry. The objective is to impart a working knowledge of navigation by dead reckoning. Each course lasts 6 months and successful graduates are presented with a diploma issued by the Department of Co-operative Development and Fisheries. The coxswain class is designed to enable fishermen to pass the Marine Department examination for both the "full" certificate for mechanized vessels of up to 60 tons nett and the "modified" certificate for fishing craft of under 1,000 piculs capacity. In 1961/62, 12 classes, which were attended by 237 fishermen, were organized. In all 1,483 fishermen have received coxswain certificates since the course started in 1961. Engineering classes are designed to assist fishermen to pass the Marine Department examination for engineers of fishing boats mechanized with diesel engines.

In *India*, the fisheries activities in the Indo-Norwegian Project were directed towards accelerating the programme of mechanized fishing by the introduction of improved types of fishing boats, experimental fishing and training. Under the TCM programme, two purse-seine technicians worked in the Offshore Fishing Station, Cochin, for experimental purse-seine fishing and for training Indian fishermen in this type of fishing. The recommendations of the Expert Committee on Fisheries Education are being implemented. A Central Institute of Fisheries Education has been established in Bombay with assistance from the U.N. Special Fund Project for training District Fishery Officers. Most of the maritime states have now introduced training courses for the fishermen in the introduction of improved types of fishing and handling of mechanized boats. There are two centers in Gujarat, one in Maharashtra, one in Mysore, three in Kerala, three in

Madras and one in Andhra Pradesh. The courses are now proposed to be modified to meet the requirements of certain rules and regulations. Besides training to fishermen in these centers, some advanced training is also given in the Government of India, Deep Sea Fishing Station, Bombay and Central Institute of Fisheries Technology to enable them to operate specialised types of gear and to qualify them to become fishing mates.

The Government of *Korea* held training courses on navigation and marine engine at important fishing ports in 1960. A total of 50 men received instruction. The project was discontinued in 1961, but will be started again in 1962. The training will be in two separate parts: one will be for the fishermen of the deep-sea fishery and the other is for general fishermen. A total of 200 are to be trained, 100 in each course. The scope of the deep-sea fishery training is intended to help develop the deep-sea tuna long line fishery, the deep-sea bottom towing fishery, and the other deep water or distant water fisheries. The general fishery training is to educate the coastal fishermen who are now engaged in or want to become engaged in the coastal fisheries. The training project is for the purpose of educating new fishing technicians and re-educating fishermen who are now engaging in fishing. The training courses will be held during the non-fishing season. The deep-sea fishery training will be for 3 months and the general fishery training for 1 month, study on land takes $\frac{2}{3}$ and marine practice $\frac{1}{3}$ of the total period. The Central Fisheries Cooperative Union will take charge of the training under the supervision of the Ministry of Agriculture and Forestry, and the CFCU will establish the training centre. The expenses for the training which include the teaching materials, meal service, and place of abode will be supported by the Government.

In the *Federation of Malaya*, the first batch of fishermen trainees since the opening of the Marine Fisheries School, Glugor, completed their course on 9 June 1961. The results of the examination held were:—

	No. Sat	No. Passed
Engine care & maintenance	24	23
Engine driver 3rd Class	23	19
Helmanship of fishing boat	19	18

The new term began on 19 June and is being attended by 32 fishermen trainees from all parts of the Federation. A new fisheries school was started on 28 April in Kuala Trengganu. It was officially opened on 2 May 1961. The Second 5 months Course at the Marine Fisheries School, Penang, ended on the 29th December 1961, while the School in Kuala Trengganu ended its second 3 months' course on the 8th December 1961. For the first time, the trainees in the Marine Fisheries School, Penang, recorded a 100% pass in the Helmanship of a Fishing Boat Examination conducted by the Marine Department and the 3rd Class Engine Drivers' Examination. In the Engine Care and Maintenance Examination, 29 out of 30 trainees passed the examination. A Japanese Colombo Plan Expert attached to this Division, left for Japan in December 1961 after completing his term of duty in Malaya. While in Penang, he taught the Fishermen trainees in the operation of various types of fishing gears.

In *New Guinea and Papua* (Australian administered), eight fishery assistants from the Territory are being trained by the Fisheries Division. Training covers a minimum period of three years and involves a study of fish and shell species together with the problems of river, estuary and reef fishing, the construction and repair of different types of fishing gear, seamanship and fishing operations. Those who pass their examinations are given the opportunity to proceed to more complex training leading to qualifications which will enable them to give instruction in villages on fishing methods and the preparation of fish for market, to take charge of station and field work, to design and operate new gear and to manage fisheries vessels up to 18.3 m. in length. Depending on the qualifications they obtain the assistants will be stationed at various places in the Territory where they can best assist local fishermen, or will be attached to technical

personnel for survey work. The fishery assistants have recently qualified for the position of fishery field-worker and carrying out fisheries work on the coast between Wewak and Lae.

To date, fishermen in *Netherlands New Guinea* have been given practical training. This method is applied within the scope of the fisheries extension service and with direct aid from the group of the population that is interested in fisheries. In 1961 four students from this Territory attended the 3 months' fisheries training course at Tulagi, British Solomons Islands, which was organized by the S.P.C.

In *Pakistan*, general lectures on different nets were delivered i.e. gill net, purse-seine net, longline and lampara net. Practical training in the operation of trawl net and longline has been completed. Different nets or Ibrahim Hyderi and Kathi Bunder were shown and explained to the trainees. Important "Rules of the Road" i.e. article 15 to 31 were taught. Chart reading and finding out the course was taught. Practical training in handling of vessel was imparted. Lectures on net making and mending and training of nets were delivered. Practical training in net making has been taught. A Vocational Training Institute has been set up at Karachi in 1961 to impart training in mechanized fishing. The duration of the training is six months and the curriculum includes theoretical and practical training in gear; operation and maintenance of diesel engine, winches; echo sounders; chart and compass reading; elementary navigation and seamanship and handling of fish, etc. The practical training is given on board the Department exploratory vessels. A batch of twenty trainees have been admitted for the second course which started from 1st July 1962. The trainees are given a monthly stipend of Rs. 50/4 each for the duration of the training. A Colombo Plan Japanese expert is associated with this Institute. We are, however, trying to procure a suitably qualified principal for the Institute from abroad in order to set it up on a firmer footing and to expand the scope of

the training. Besides this, Provincial Governments have also set up two training centers, one in either wings of the country (Dacca, East Pakistan; Sheikhpura, West Pakistan) for training in inland fisheries. Two persons selected from amongst the fish processing plants, were sent to Japan in 1960 under the Colombo Plan for seven months training in "marine products processing". Another six persons selected from amongst the fishermen were sent to Japan in 1961, under the Colombo Plan for one year training in "fishing methods". They have since returned and are usefully employed on the fishing boats.

Two fisheries training courses for young people, mainly the children of fishermen, residing at fishing villages were started in *Singapore* during the year. The students were taught, inter alia, (a) the rule of the road at sea, (b) maintenance and repair of fishing boat engines, (c) construction and use of fishing gears, (d) elementary fisheries technology including icing and freezing of fish as well as canning of fish.

The U.S. Bureau of Commercial Fisheries, Department of the Interior, provides technical assistance and advice to any interested fishermen. The Department of the Interior is authorized to provide an extension service for training fishermen in the technological aspects of production and vessel operation, but as yet no program has been initiated. Several New England area high schools are conducting extension school training programs.

In *Vietnam*, permanent National Training Centers for training fishermen in modern methods of fishing and navigation are being established with assistance from FAO/EPTA program. One such training center was initiated during 1961 at Vung Tau (Cap St. Jacques) with the assistance of two FAO experts. This was a four month training course on fishing techniques and methods and was organized for young fishermen those who already have certain experience in fishing and have some education in primary school. From th

training course, it is stated that a certain number of fishermen of the category mentioned above were trained well and became master fishermen for boats of 40-50 GRT. As for the training of fishermen on the operation and maintenance of diesel engines, mobile teachers with necessary equipment have been sent to fishing villages to train fishermen right on the spot. These courses, of three weeks duration, were organized during the off-season time.

RESEARCH ACTIVITIES

Institutions

There has been an expansion of activities in the field of research on fishing gear in the Region during the intersession period. Only three countries in the Region have research institutions engaged full time in research on fishing gear, i.e. India, Japan and Korea. In *India*, the research activities are being carried out at the Gear Wing of the Central Institute of Fisheries Technology, Cochin. In *Japan*, the main institution is the Gear Division of the Tokai Regional Fisheries Laboratory, Tokyo. In addition, research on fishing gear is also carried out by some of the prefectural fisheries laboratories, and universities. In *Korea*, the Gear Division of the Central Fisheries Experimental Station is responsible for research on fishing gear.

The U.S. Bureau of Commercial Fisheries has research stations engaged in work on fishing gear as follows:

1. Base Director
Exploratory Fishing Base
Bureau of Commercial Fisheries
239 Frederick Street
Pascagoula, Mississippi
2. Base Director
Exploratory Fishing Base
Bureau of Commercial Fisheries
2725 Montlake Boulevard
Seattle 2, Washington
3. Base Director
Exploratory Fishing Base
Bureau of Commercial Fisheries
State Fish Pier
Gloucester, Massachusetts

4. Base Director
Exploratory Fishing Base
Bureau of Commercial Fisheries
5 Research Drive
Ann Arbor, Michigan
5. Base Director
Exploratory Fishing Base
Bureau of Commercial Fisheries
Dairies Bldg., P.O. Box 2481
Juneau, Alaska
6. Station Director
Exploratory Fishing Station
Bureau of Commercial Fisheries
1231 Bay Street
Brunswick, Georgia

In *North Borneo*, it is proposed to staff the Fisheries Division with a Gear Technologist who is to be trained in Japan under the Colombo Plan.

In *Pakistan*, a Marine Research Laboratory has been built at the Karachi Fish Harbor. The research activities are confined mainly to exploratory fishing.

Research Programs

Information on the researches carried out and research programs underway is available from India, Korea and U.S.A. and is given below:

In *India*, the following are summaries of some of the papers published during 1961-1962.

- (1) A paper on "The comparative catch efficiency of hand operated trawls" in *Ind. J. Fish.* 7(2): 458-70, gives the following data: based on the results of observations made during the course of studies, the following have been noted to be the decided advantages of the mechanically operated modern gear: (i) The number of crew engaged while fishing is less in case of nets operated by winch. (ii) The hand-operated vessel could not operate a bigger net than the one operated by her as more hands are necessary for hauling-in a bigger net. (iii) Though the time required for shooting the net is same in case of 'TARPON' and 'SAGARKUMARI', the hauling-in of warps by hand required more time.

Moreover, the vessel 'SAGARKUMARI' had to be stopped from going ahead while heaving the net which resulted in escape of some of the fishes from the net. (iv) The number and duration of hauls were more in case of 'SAGARKUMARI' as prolonged trawling results in additional labour and time for taking the increased catches onboard. (v) While comparing the opening of the nets, it can be deduced that the opening is more in case of fully mechanized craft. One of the factors responsible for getting less spread in the net operated by 'SAGARKUMARI' is the size of the warp (0.75 in. Manila rope) which offers more water resistance while being towed. (vi) Comparing the catch efficiency per unit effort, it can be concluded that the catch is more in case of 'TARPON'. The catch per hour comes to 274 lb. and 140 lb. in respect of winch and hand-operated trawl net.

Both the methods of operation are being practised in India and the opinion is that, if trawling is to be conducted commercially, powered operations would increase efficiency.

(2) Another paper on "The fishing experiments conducted with a 10 ft. beam trawl net". *Ind. J. Fish.* 7(1): 174-186, gives the following data: The experiment was conducted in the sea off Cochin, where shrimps contribute to a fishery of economic importance and both indigenous and to a certain extent modern gear are in use for their exploitation. To facilitate comparison of the catches, experimental fishing with the beam-trawl was done in close association with a few of the mechanized boats and country craft. The depth of the fishing ground ranged from 8.23 to 23.77 m. fathoms. The bottom was muddy (soft mud) for most part interrupted by a conical area of shell ooze admixed with mud. The webbed portions, using the reef-knot, were fabricated with the aid of a hand-driven net-making machine. Russian cotton twines specifications 32/6/3 (Count No. 32; 3 strands; 18 threads) were chosen as the material for the webbing. The size of the stretched mesh was 25 mm. throughout. The coir head rope was 12.5 mm. diameter, 5.79

m. long and carried 10 oblong thermocole floats each having a buoyancy of 0.25 kg. The foot rope also of coir, was 8.23 m. long and 18.75 mm. diameter. Thirty lead sinkers, each weighing 0.024 kg., were attached to this rope. The overhang of the head rope in advance of the foot rope was a little less than 1.9 m. The beam was 3.46 m. long and the height of the beam leg at either ends being 0.61 m. To the lower legs of the short bridles lead weights weighing 7.47 kg. were attached to compensate the loss of weight caused by the absence of trawl-heads or shoes usually present in the conventional types of beam-trawl. The bridles proper were sisal ropes of diameter 18.75 mm. and length of each bridle-leg being 14.63 m. The single warp (or tow line) was shackled to the union where the bridles of either side were joined together. To this shackle, a cement weight of 29.8 kg. was also attached. The Research vessel FISHTECH I attached to the station was used for the experiments. The specifications of the boat are length 9.14 m., engine 40 h.p., semi-diesel. Comparing the catch efficiency of beam-trawl and local seine nets, it is evident that catch per hand per day in the case of beam-trawl is three times the catch of the local gear. The volume of water filtered by different trawl nets per hour is related to the size of the net. Since, the beam-trawl used for experiment was very small having an opening of 3 m. x 0.61 m. the volume of water filtered per hour was less when compared with the volume of water filtered by other trawls. Assuming 2,832 m³ of water filtered as a unit for all the nets, the catch per unit volume of water filtered per hour calculated in respect of different vessels determines the catch efficiency of each net. There is very little difference in the catching power of beam and otter-trawl nets on the basis of the volume of water filtered through each. The beam-trawl net could be used successfully on small low powered fishing crafts and unlike an otter-trawl can be operated in waters as deep as 183 m. The beam-trawl could be conveniently operated from a sailing vessel as similar type of fishing is in vogue in East Asian countries like Philippines and Japan.

Fishing with 3 to 5 beam-trawls operated from a single boat having 2 to 3 sails is a characteristic feature of the Japanese fishing industry. Beam-trawl fishing in inshore waters of British Islands is being practised by small inshore fishing crafts and beam-trawls are also used to a certain extent in the West European and Mediterranean coastal waters from medium size motorized vessels. Good results can be obtained from this net in brackish water lakes and freshwater reservoirs, where the bottom is free from rocks and other obstructions, so far as capture of bottom fishes are concerned. Trial fishing with this net in areas where there is a strong tidal current will be quite interesting since a set of 5 to 10 nets could be conveniently anchored as a stream net. In case of non-availability of fish in inshore areas during a particular period, same can be shifted to any depth which in turn would be helpful in exploring new grounds or in knowing the migratory habits of fishes in deeper waters.

(3) Another paper "A preliminary account of the experimental rock-lobster fishing conducted along the south-west coast of India with bottom-set gill nets". *Ind. J. Fish.* 7(2): 407-422, gives the following results: considering the vast resources for lobsters in India, their fishery can be organized in a better way than at present. The demand for Indian lobsters in the foreign markets has given a new status for the lobster fishing industry in India. There exists an important fishery for lobsters along the South-West coast of India. Traps, anchor hooks and scoop nets are the existing fishing gears employed for lobster fishing in this area. The present fishing is restricted to limited areas only. With a view to improving the existing lobster fishing and to extend the present area of operation, simple yet efficient fishing gear was designed at the Central Fisheries Technological Research Station at Cochin. In order to assess the working efficiency of the new design, preliminary experimental fishing were conducted at Muttam and Manakudi, two important centres for lobster fishing along the South-west coast

of India. The gear employed was bottom set gill nets of cotton or nylon with 152 mm. stretch mesh. Each piece was 250 meshes long and 15 meshes deep. 23 wooden floats (*Bombax* sp.) spaced 0.91 m. and 10 to 15 cement sinkers each weighing 283.5 g. and spaced 1.5 to 1.84 m. apart were used. The lobster catch was not much different between nylon and cotton nets though nylon nets caught 7-8 times as much fish as cotton nets. The average catch of lobster was 0.011-0.047 kg. per 9.281 m² of net surface set overnight.

(4) A paper on "Design of bottom set gill nets for rock lobsters" (1962). *Fish. Tech. Newslet.* III(1): 3-6, summarizes as follows: Describes further trials with nylon or terylene bottom set gill nets of the about same design as above. The fishing was carried out at a number of places on the west, south-west and south-east coasts of India at depths ranging from 2.74 m. to 24.69 m. The number of units of nets used in each set ranged from 165 to 324. The maximum number of lobsters caught was 336 at Quilon at 3.65 m.—7.31 m. depth on a rocky and sandy bottom within 15 days of fishing.

(5) "Trawling for prawns during south-west monsoon season (1961). *Fish. Tech. Newslet.* II(3): 9-11.

Prawns constitute the principal catch of seine nets during the south-west monsoon period on the Kerala Coast and the fishing ground during the season is limited to a few hundred metres from the shore. Although some mechanized trawlers have attempted prawn trawling during this season in past years, they had to suspend operations as bottom trawls did not yield practically any catch of prawns. The possibility of shrimp trawling with mechanized boats during the monsoon is, therefore, a major problem, which has not been tackled so far. The problem, for an effective solution, will have to be approached from two different angles namely (1) the prevailing sea conditions, and (2) the behaviour of the prawns during this particular period. The existence of prawns in the area during the monsoon period has been demonstrated by the local fishermen using in-

igenous gear and it is also well known that prawns in the area come up to the surface layers during this season possibly due to the upheaval of the mud banks. The investigations were undertaken off Cochin for a few days in the month of July when the sea conditions were favourable. The net an ordinary 25 ft. bottom trawl. The net was operated between 4 and 9 fathoms, the usual depth range of the prawns beds in the area. In all the operations not even a single prawn was caught in the net. It is, therefore, reasonable to assume that prawns do not settle down on the sea bed during this period. If the ordinary bottom trawl is towed with short warps and at rather high speed, the net does not reach the bottom and is towed in column region. Therefore, by adjusting the length of warp and towing speed, the bottom trawl net was used as mid-water trawl following the abovementioned method and the results were as under :—

(i) No prawns were available beyond 6 fathoms depth

(ii) Three hauls were tried at the depth range from 3 to 4 fathoms and the catches obtained/hr. were 32.7 kg., 151.5 kg., and 56.2 kg. respectively.

When the net was used in the above fashion, the floats attached to the head-line were visible near the surface and prawns were also observed jumping over the water surface. The results tabulated above appear encouraging particularly taking into consideration the size of net used during trials. The observations made, it is hoped, will be of great benefit to all mechanized shrimp trawlers working in the area for they are forced to stop fishing from June till the end of September. This apparent "Off season" contributes to a great loss of fishing time and income of these vessels. Upon receiving the information, a few private agencies have already commenced monsoon fishing for catching prawns adopting the same method and getting a good harvest. It is, therefore, expected that the other trawlers will also adopt a similar method for capturing prawns

during southwest monsoon at least from the next year. Special mid-water trawls are not necessary as the ordinary bottom trawl, by following the method described above, can be adopted as a mid-water trawl.

(6) Design of a 45 ft. nylon trawl net for 30 to 32 ft. boats with 30 to 36 h.p. engines (1962), *Fish. Tech. Newslet.* II(4): 1-2.

The design of a 13.72 m. four seam overhang nylon trawl net is described based on the actual net constructed and tried under field conditions. The stretch mesh size is 51 mm. for the main body and wings, 38 mm. for the throat and 25 mm. for the cod end. The otter boards, 1 m. x 0.51 m. in size and weighing 34 kg. each are used. The catches off Cochin with 10 m. boat and 36 h.p. diesel averaged 113 kg. per hour (54 voyages and nearly 150 hrs. of trawling) consisting of 23 kg. of prawns and 90 kg. of fish.

(7) Design of a 55 ft. trawl net for 32 ft. boat with 36 to 40 h.p. engine (1962). *Fish. Tech. Newslet.* III(1): 10-12.

Gives the design details of a 16.76 m. four seam overhang trawl net. The trawl boards each weigh 40.82 kg. plus 9.07 kg. detachable weights. Based on 51 days of operation and about 169 hrs. of trawling, the catch rates were 20 kg. of shrimp and 85 kg. of fish per hour.

(8) Effect of tickler chain on the catch of prawns and fishes landed by an otter trawl (1962). *Fish. Tech. Newslet.* III(1): 8-9.

In order to increase the catch efficiency of otter trawls for bottom fishes, certain experiments were made by attaching a thin iron chain (tickler chain) ahead of the foot rope of a 55 ft. four seam overhang shrimp trawl and paired drags with and without chain were made under similar fishing conditions. The tickler chain used was a thin galvanized iron link chain having 8.23 metres length, 5 mm. diameter and 3.26 kg. on the total weight. This chain was attached to the foot rope 2.34 metres away from the spliced ends of either side by means of a shackle. Thus it remained one foot ahead of the ground

rope at the bosom part. The catch of shrimp and fish landed by the net increased by about 71% and 25% respectively due to the attachment of a tickler chain. Further, it was observed that the attachment of a thin tickler chain had no great adverse effect on the opening of the net in action.

(9) A comparative study of certain characteristics of the common vegetable fiber twines for fishing nets. *Ind. J. Fish.* VII(2): 448-457, 1960.

(10) The common characteristics of cotton fishing twines—Experiment Series II. *Ind. J. Fish.* VII(2): 471-482, 1960.

(11) Preliminary studies of certain characteristics of spherical fishing floats. *Ind. J. Fish.* VII(2): 483-495, 1960.

(12) Cotton twine as a fishing net material—Part III (1961). *Fish. Tech. Newslet.* II (3): 6-9.

(13) Cotton twine as a fishing gear material—Part IV (1962). *Fish. Tech. Newslet.* IV(4): 5-7.

(14) A general account of the wooden floating materials used for fishing nets in India. *J. Timber Dryer's and Pres. Assoc. of India* VII(4): 13-26, 1961.

(15) Amilan—A synthetic fiber as a netting twine material. Fisheries of Gujarat, Nov. 1961, pp. 64-69, 1961.

(16) A comparative account of the rotting resistance of netting fibers of vegetable. Origin. *Bull. Jap. Soc. Sci. Fish.* 28(7): 655-663, 1962.

In Korea, the research programs concerning fishing gear are as follows:

Previous Projects

(i) Exploratory Shrimp Trawl Fishing and Gear Development

It had long been thought that the coastal waters of Korea contained suitable areas for commercial stocks of shrimp, and in 1958, an exploratory fishing and gear demonstration program was started to determine the extent and availability of these shrimp and to develop the best fishing methods. The first

part of this program was carried on off the south and west coasts, using two of the Experiment Stations' research vessels. Four cruises were made in this area using Gulf of Mexico type flat trawls of 40 and 74 ft. spread with considerable success. A summary of these operations was presented to the 8th session of this organization. The exploratory shrimp program was further expanded in 1959-60 to include the east coast of Korea. Three research vessels and four chartered fishing boats carried out this most recent survey. In addition to the previously successful Gulf of Mexico flat type shrimp trawls, balloon type trawls were used. The comparative fishing efficiency of these trawls and the Danish seine was also carried out. The program was successful in learning the abundance distribution and taxonomy of the commercial abundant species as well as related ecological data. It was determined that the shrimp stocks were sufficiently abundant to support a commercial fishery and that was possible to fish commercially throughout the year. Three important fishing grounds were found during this survey at Chuk Byon (1.4 Km²), Kang Ku (0.6 Km²) and Ku Ryong Po (3.7 Km²). These areas are all located on the steep slopes of submarine canyons and produced from 498 to 2,000 lb. of shrimp per hour. The catch ratio of shrimp to total catch was more than 90%. In general the shrimp beds were located in a north to south direction. The beds were narrow and confined to the depths previously mentioned. The tests made to determine the fishing efficiency of the Gulf of Mexico and Danish trawls showed that the Gulf of Mexico type caught more than five times the amount of shrimp the Danish trawl caught.

(ii) Modernization of Purse Seine Fishery

With an annual production of more than 3,000 metric tons, the mackerel and horse mackerel are two of Korean most important food fishes. These two species found along the entire coast are taken mostly by means of two boat purse seine. Some 33 sets of vessels employing approximately 4,500 fishermen are engaged in this fishery from late

March or early April until late in December. Until 1957 most purse seining in Korea was carried on by means of two-boat seiners using a cotton twine purse seine. This two boat operation required sixty men to handle the net and took 2 hours and 15 minutes to complete a set. In 1957 the International Cooperation Administration, an agency of the United States Government, introduced the power block to facilitate the hauling of the net, and purse seines made from synthetic bifers which are lighter in weight and easier to handle than the old type of cotton nets. This modern fishing equipment was demonstrated to the fishing since that time four additional demonstration vessels have been equipped with synthetic nets and power equipment. The single vessel method of purse seining using mechanized equipment greatly increase the amount of catch per unit of efforts. The release of the second vessel of the two boat seining sets into productive fishing will greatly augment the production of these important species.

(iii) Young Fishermen Cooperative Boat Owners Demonstration

In an effort to encourage qualified young graduates of fisheries schools to enter the commercial fisheries of Korea, the government was sponsoring a program for financing fishing vessels, equipment and gear. Not only did this program encourage the entrance of young men into the industry, but as the same time, it tended to stimulate the growth of the industry along modern lines. Small groups of five qualified men who has agreed to pool their resources and to personally operate the vessel was selected from among the numerous applicants. Technical advice and financial assistance in the form of loans was available. Each group decided on which of the two designs they wish to have built. The first type was a 50 to 70 ton combination boat equipped for purse seining and stern set otter trawling, the second type of vessel was a 20 ton boat adapted for long-line, gill-netting and lampara net fishing. They are now operating with various fishing gears.

(iv) Lampara Seine Net Demonstration Fishing

The commercial fishery for the Anchovy is one of the most important fishing operations in Korea, particularly in reference to the manufacture of fish meal. The present fishing method employing the Kun Hyun net (concert net) is costly and highly inefficient. Seven vessels, 3 powered and four non-powered, are employed in setting the net which also requires 40 men to control the operations. The high production costs and inefficient use of man-power has raised the cost of the product above the level where most people cannot afford to buy this product. In order to overcome this difficulty two experimental nets were ordered from Japan in 1957 through the ICA program. The mesh size was found not suitable for anchovy fishing, and no matter how modified, they would not fish well. The Central Fisheries Experiment Station discarded these first two nets as unsuitable since for some reason the nets would not function properly. In 1960 ICA purchased two nylon lampara nets to demonstrate the method and techniques of their use. This work was carried out by two twenty ton combination boats each operated by a 5 men group of young, educated fishermen, and the result has been successfully good.

Present and Future Projects

(1) High Seas Otter Trawling

The west and south seas of Korea from a vast continental shelf which is well known to be productive in bottom fishes. In the past this fish has been exploited by the Danish seine and bull trawl methods. Under certain conditions the catch rate per unit of effort makes these operations marginal and it is our purpose to develop operation methods that are less costly and more efficient to reduce capital risk. We are now operating two otter trawlers, the *Jin Yang* and the *Kae Rim*, on these fishing grounds with the objects of establishing the method as being more economical and therefore more profitable than present methods used.

(ii) Mid Water Trawl

Two staff members have had training in this method while on FAO Fellowships in Europe. It is our opinion that the method has possibilities in solving some of our problems in the anchovy, pike mackerel, choggi, pollock and other fisheries. A net and equipment has been prepared by station personnel and preliminary trials are in progress.

(iii) Shrimp Trawl Fishing

The shrimp trawl fishing project has been continuing for several years from 1958, and the shrimp bed of East Sea of Korea has been successfully developed. Hereby the commercial fishing of shrimp in East Sea is now in progress. The Station is now encouraging the shrimp trawling by participants vessels to develop the shrimp beds of South and West Sea. Participants are cooperating well in this project.

(iv) Fish Attraction Lamp System, Blanket Net Fishing

Though most of the pike-mackerel which is one of the most important marine products in East Sea of Korea are caught by gill net, an advanced fishing method in this field is to use the blanket net utilizing light-attracting character of pike-mackerel. The scattered fishes are gathered into a limited area by light and caught by lift net. This method can decrease the fishing expense in comparison with the present gill-netting. This new method was tried in last years project in the Station, but the result was not so good with technical unpreparedness and losing the suitable fishing season. The Station has made a wide basis investigation on this fishing, and an exploratory vessel, CHANG PA, is now operating with suitable gear and equipment.

(v) Improvement of Fishing Gear and Method, and Testing of Fishing Gear Material

For the establishment of reasonable fisheries management, the Station puts in operation of physical, chemical and biological test of fishing gear material, and of improvement of fishing gear which is one of the most important elements in fishing. The necessary

tools and equipments for the testing have been installed in conjunction with a new machine shop constructed by ICA funds and this work is in progress.

The following is a list of programs under direction of the U.S. Bureau of Commercial Fisheries bases :

1. Pelagic Explorations and Gear Research—Seattle, Washington
2. Bottomfish Explorations and Gear Research—Seattle, Washington
3. Shellfish Explorations and Gear Research—Seattle, Washington
4. Fishing Gear Research and Development—Pascagoula, Mississippi
5. North Atlantic Fishing Gear Research—Gloucester, Massachusetts
6. Maine Herring Gear Research—Gloucester, Massachusetts
7. Great Lakes Gear Research—Ann Arbor, Michigan
8. Inland Waters Gear Research—Ann Arbor, Michigan

Below is a list of publications which have originated as a result of Exploratory Fishing and Gear Research Activities since 1961.

1961

Alverson, Dayton L. (1961): Pacific coast ground fish. *Western Fisheries*, June 1961, pp. 1-6.

_____ Fishing vessels around the world. *U.S. Naval Institute Proceedings*. 87(1): 98-109.

_____ Un Grand Petit Bateau (A grand little boat) *France Peche*, Vol. 2, 50 NF No. 47.

_____ Ocean temperature and albacore distribution. *Journal of the Research Board of Canada*. 18(6): 1145-52.

- Alverson, Dayton L., and Sigurd J. Westrheim (1961): A review of the taxonomy and biology of the Pacific Ocean perch and its fishery. *Extrait, Rapp. et Proc. Ver., Cons. Internat. Explor. de la Mer.*, pp. 12-27.
- Bullis, Harvey R., Jr. (1961): A progress report on experimental fishing for sardine-like fishes in the Gulf of Mexico. *Proceedings of the Gulf and Caribbean Fisheries Institute*, 13th Annual session, Nov. 1960, pp. 94-97 Miami.
- Bullis, Harvey R., Jr. and Robert Cummins, Jr. (1961): An interim report of the Cape Canaveral calico scallop bed. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(10): 1-8 (Also as Separate No. 630).
- Butler, Jonny, A. (1961): Development of a thread-herring fishery in the Gulf of Mexico. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(9): 12-17. (Also as Separate No. 628).
- Gordon, William G. and Keith D. Brouillard (1961): Great Lakes trawler conversion. *U.S. Fish and Wildlife Service, Fishery Leaflet* 510, 15 p.
- Greenwood, M.R. (1961): Improvements . . . efficiency . . . keynote 1960 vessel construction. *Fishing Gazette Yearbook*, 1960, pp. 94-100.
- Hitz, C.R., H.C. Johnson and A.T. Pruter (1961): Bottom trawling explorations off the Washington and British Columbia coasts, May-August 1960. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(6): 1-11. (Also as Separate No. 620).
- Holt, John K. (1961): Equipment Note No. 10. A sea sled to towing vessel communication method. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(9): 18-19. (Also as Separate No. 629).
- Johnson, H.C. (1961): Improvements . . . efficiency . . . keynote 1960 vessel construction. *Pacific Coast. Fishing Gazette Yearbook*, 1960, pp. 100-101, 104.
- Johnson, Harold C. (1961): Equipment Note No. 8. New hydraulically-driven block speeds hauling crab-pot warps. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(1): 15-16.
- Juhl, Rolf (1961): A study of vessel and gear usage in the shrimp fishery of the southeastern United States. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(8): 1-8 (Also as Separate No. 624).
- Lerch, D.W., and Dayton L. Alverson (1961): Considerations influencing and design and operation of a fisheries gear research vessel. In *Research vessel design*, LER-1-17, FAO, Rome, Nov. 1961.
- McNeely, Richard L. (1961): Experiments utilizing electrical trawl cables—a progress report. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(4): 1-7. (Also as Separate No. 616).
- _____ (1961): The purse seine revolution in tuna fishing. *Pacific Fisherman*, 59(7): 27-58.
- Rathjen, Warren F., and Peter C. Wilson (1961): Russian gill-netter docks in Boston, Mass. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(9): 41-43.
- Ruggiero, Michael (1961): Equipment Note No. 9. The surf-clam fishery of New Jersey. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(9): 41-43.
- Schultz, Leonard P., Perry W. Gilbert and Stewart Springer (1961): Shark attacks. *Science*, 134(3472): 87-88.
- Smith, Keith A. (1961): Air-curtain fishing for Maine sardines. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*, 23(3): 1-14.
- _____ (1961): Air-bubble and electrical field carriers as aids to fishing. *Proceedings of the Gulf and Caribbean Fisheries Institute*, 13th annual session, November 1960, pp. 73-86. Miami.

Squire, James L. (1961): Aerial fish spotting in the United States commercial fisheries. *Commercial Fisheries Review*. 23(12): 1-7. (Also as Separate No. 633).

Thompson, J.R. and Stewart Springer (1961): Sharks, skates, rays and chimaeras. *U.S. Fish and Wildlife Service, Fish and Wildlife Circular* 119, 19 p.

Wathne, Fred and Harold C. Johnson (1961): Shrimp exploration in central Alaskan waters by the M/V *John N. Cobb*, October-November 1959. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*. 23(1): 1-8. (Also as Separate No. 609).

1962

Alverson, Dayton L. (1962): Northeast Pacific explorations. *World Fishing*, April. 11(4): 28-30.

(1962): Gear Research in the U.S.A.—a progress report. *World Fishing*. 11(7): 36-38.

Cummins, Robert, Jr., and Joaquim B. Rivers (1962): Georgia crab trawl fishery. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*. 24(3): 1-6.

Cummins, Robert, Jr., Joaquim Rivers and Paul J. Struhsaker (1962): Snapper trawling explorations along the south Atlantic coast of the United States. *Fish. Boat*, May 1962, pp. 18-19.

Gordon, William (1962): Equipment Note No. 11. A Great Lakes stern ramp trawler. *U.S. Fish and Wildlife Service, Commercial Fisheries Review*. 24(4): 33-36.

Greenwood, M.R. (1962): Trends and developments in vessels and gear in 1961. *Fishing Gazette Yearbook*, 1961, 79(13): 78-80, 82-86.

Springer, Stewart (1962): How 'rules of the road' make your vessel safer at sea. *Proceedings of the Gulf and Caribbean Fisheries Institute*, 14th annual session, Nov. 1961, pp. 47-51. Miami.

DOCUMENTATION

There has been no IPFC documentation in the field of fishing gear during the intersession period. However, the following FAO publications are listed below for information.

FAO/EPTA Reports

No. 1305 Fisheries of the Amazon Region by A. Meschkat.

No. 1328 Fishermen's training centers by R. Ruppin.

No. 1342 Improvements of fishing techniques in inland reservoirs of India by G.S. Gulbadamov.

No. 1345 Training Center for master-fishermen conducted by UAR and FAO at Suez, 1 Sept.-17 Oct. 1960 by P. Lusyne.

No. 1466 Experimental and exploratory fishing in Bay of Bengal, by N.I. Borisov.

No. 1494 Organization and operation of a training center for fishermen (Vietnam) by P.A. Lusyne.

No. 1499 Supplement to report on improvement of fishing techniques in inland reservoirs of India by S.B. Gulbadamov.

Studies and Reviews of the GFCM

No. 14 Mediterranean trawling Fifth Report, by J. Scharfe.

No. 15 The Sicilian tuna trap, by Vito Fodera.

No. 17 Improvement of techniques for fishing with lights, by F. Bourgois and L. Farina.

FAO TECHNICAL ASSISTANCE ACTIVITIES

During the intersession, the following FAO technical assistance programs were concluded or were in operation.

Ceylon

Two master fishermen were operating during the intersession period, one of whom concluded his assignment and the other is continuing his operations. Terms of reference are to test and introduce suitable equipment and methods of fishing for use with small mechanised boats and train local fishermen.

India

One naval architect, and one harbor engineer completed their assignment. The naval architect's assignment was to design improved types of boats to replace local catamarans and also assist in organizing the research program of the Craft Wing of the Central Institute of Fisheries Technology. The harbor engineer continued the work of earlier experts in surveying suitable sites for new fish harbors.

Two gear technologists (freshwater) were assigned, one of whom concluded his operations and other has taken over. The program of work has been to introduce new methods of fishing in large impounded inland waters of India.

One gear technologist (marine) is continuing his assignment which is to introduce non-traditional methods of fishing, and train local fishermen.

One marine engineer has been assigned for a year to organize the Engine Section of the Craft Wing of the Central Institute of Fisheries Research. One gear technologist is continuing his assignment since the last five years to organize the gear wing of the Central Institute of Fisheries Research, Cochin, and develop research programs and train local people.

Pakistan

One master fisherman has been appointed to introduce non-traditional methods of fishing in Bay of Bengal and train local fishermen.

Philippines

One master fisherman who was assigned for more than five years to introduce tuna fishing concluded his assignment.

Vietnam

Two gear technologists were assigned and concluded their operations to set up a national training center for fishermen.

During the intersession period, one fellowship was awarded to a fishing operation technician (Korea) to study trawl fishing and purse seining.

Assistance was also given in the organization and operation of the SPC fishermen's training center at Tulagi, British Solomons.

PERSONNEL OF THE FAO REGIONAL OFFICE FOR ASIA AND THE FAR EAST

There has been no change during the intersession period in the existing fisheries staff at the FAO Regional Office for Asia and the Far East. It has not yet been possible to appoint a permanent Craft and Gear Specialist at the Regional Office due to budgetary restrictions but where possible assistance has been provided through the EPTA programs to individual requests (See Section on FAO Technical Assistance Activities).

SUMMING UP

The highlights of intersession developments in the field of fishing gear in the Region are as follows:

(1) While motorization of traditional fishing craft has made progress, the mechanization of fishing gear handling on traditional craft has been slow though in certain instances, mechanical aids have been installed on craft which have adopted non-traditional methods of fishing such as trawling. However, a large proportion of newly designed craft are being fitted with mechanical aids for fishing gear handling.

(2) Use of synthetic fibres and other artificial materials for fishing gear has in-

creased and in many countries it has largely displaced natural materials. A new trend has been the use of monofilament nylon gill nets. Among the synthetic fibres, nylon (and chemically related fibres) and kuralon seem to be favored while others such as terylene and also fibres from polyvinyl compounds are also used. The use of synthetic fibres which has been confined to gill nets generally has now spread to other types of fishing gear, such as purse seine and traps. In a number of countries, imports of fishing gear materials is free of customs duty.

(3) A number of non-traditional methods of fishing are becoming popular, e.g. beam trawling, otter trawling, tuna fishing, etc. In certain countries, notably North Borneo and India, otter trawling with small stern trawlers are being introduced. In Thailand, large numbers of purse seiners are switching over to otter trawling in the Gulf of Thailand. There is a trend in certain areas

to switch over to purse seining for tuna from traditional live-bait pole-and-line fishing.

(4) The use of echo sounders for detection of fish has not made much headway in the whole of the Region. Their use is extensively in some countries.

(5) In some countries, mechanical production of fishing gear has started but most of countries still have to import fishing gear (particularly synthetic materials).

(6) New permanent fishermen's training establishments training centers are being established in many countries in addition to *ad hoc* lecture and practical courses for fishermen.

(7) There has been encouraging developments in research activities in fishing gear technology and there has been an increase, during the intersession period, of the number of papers published in this field.

C. SESSION REPORT

Fishing Craft

The Council has reviewed the improvements in the design of fishing craft in the Region. The experience gained in India with mechanized beach landing boats capable of negotiating heavy surf has been noted. Little interest in this type of craft has been evinced in a majority of the countries of the Region, and having regard to the fact that it is essential that boats be designed to meet local conditions, and that in all member countries, the type of craft referred to would not be entirely suitable, the Council considers that no useful purpose will be served by further pursuing the matter as a Council activity. It suggests, however, that any Member Governments who may be interested communicate direct with FAO.

The Council having considered various types of fishing craft designed in the Region, recommends Member Governments with assistance from FAO to undertake a study of

the economics of different designs in relation to the gear and fishing methods to serve as a guide to adopt the most suitable and economical designs.

After noting that fiberglass-plastic boats have been tested in other areas, the Council requests both FAO and the Member Governments to study the possibility of obtaining a fishing boat constructed of this material for testing under tropical conditions in this region.

The Council notes with interest that in India fuel oil for fishing purposes was being subsidized by the government to the extent of about 10%. The Council however wishes to reiterate its recommendation made at its 9th Session, that Member Governments may consider the feasibility of reducing the prices of fuel oil for fishing purposes either by abolishing import taxes or by granting subsidies.

After reviewing the general trends of motorization of fishing craft in the region,

the Council considers that it is desirable for the Member Governments to make an assessment of the economics of outboard and inboard engines for fishing purposes.

The Council notes with satisfaction that in certain member countries of the region facilities for fishing craft, such as ports, landing facilities of harbors, are being provided.

The Council learnt with interest of a series of booklets dealing with fishing boat designs evolved in India with FAO assistance and wishes to bring them to the notice of interested Member Governments.

Fishing Gear

Regarding the expansion of the staff of the FAO Regional Office for Asia and the Far East with the appointment of a craft and gear technician, the Council heard a statement from Dr. Finn, that due to budgetary restrictions earlier recommendations regarding this could not yet be implemented. The Council reiterates the earlier request to FAO to appoint as soon as possible a full time Craft and Gear Technician to be stationed at its Regional Office for Asia and the Far East.

The Council notes that there has been an expansion of research activities in relation to craft as well as gear in some member countries and strongly recommends that such research activities including use of lights for fishing be tested and promoted also in other countries of the region. The Council also recommends that ways and means of ex-

changing research data and findings be explored.

After discussing the different aspects of fish detection by echo sounding and echo ranging, the Council emphasizes that Member Governments should give high priority to testing the feasibility of using this method to increase fishing efficiency. Particular attention should be paid to the economic aspects in the choice of the type of equipment for a particular purpose.

In view of the proven superiority of synthetic material for most fishing gear, the Council recommends that Member Governments should facilitate its introduction by grants of subsidies or exemption from import duties, sales taxes, etc. Where considered necessary or desirable, Member Governments could perhaps establish facilities for testing synthetic fibers and advise the industry of the results of such tests. The Council also urges Member Governments to take up indigenous production of synthetic fishing gear materials. After considerable discussion the Council recommends to Member Governments that monofilament synthetic fiber nets be introduced on a trial scale.

While noting the existence of weather forecasting services for the fisheries in some member countries, the Council strongly recommends that similar services be developed in those countries where they do not exist at present. For instance, weather forecasts could be broadcast at certain periods of the day and received by the fishing craft by means of inexpensive radio receivers.

CHAPTER IV

FISH PROCESSING TECHNOLOGY

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A. STATUS OF THE INDUSTRY

FRESH FISH

Handling and Icing

Use of ice in the short term preservation of fish has been increasing in the Region. The fresh fish aboard larger boats are generally iced immediately after catch but not on traditional craft which are not equipped with proper holds. The fish are not generally gutted or cleaned aboard. Most of the icing is done ashore. The developments during the intersession period are as follows:

While there are problems in *Australia* associated with handling of fish, particularly in connection with transport from outlying ports to capital city markets during the summer months, those responsible for this transport are making generally successful efforts to ensure that wet fish is properly handled and preserved. Ice is widely available. Rail, road, and air transport of perishables is generally rapid and reliable.

In *North Borneo*, there are small ice factories in Tawau, Sandakan, Jesselton and Labuan owned by private enterprises. In Sandakan, in connection with a shrimp freezing unit, there is a flake ice machine of about a ton an hour capacity. In the Si-Amil Island off the coast of North Borneo, where skipjack fishing industry exists, there is a flake ice plant about 15 tons/day capacity. The price of ice is generally high, M\$0.11 per kg. or US\$37 per ton.

In *Brunei*, the use of ice in fish is not wide spread due to the high cost of ice. Most of the fishing boats do not carry any ice and fish may be iced at the market and when it is transported to Brunei City market.

In *Burma*, as fish have to be transported over considerable distances to the urban markets ice is used generally for packing of fish. Except on the large trawlers and purse seiners, ice is not carried aboard and fish are iced only ashore. Icing is done in the proportion of 1:1. The fish after catch do not usually remain in un-iced condition for more than 6 hours. The price of ice is generally

high (about US\$22 per ton) but the apex fisheries cooperative at Rangoon operates a 50 ton/day block ice plant and supplies ice to the fishing industry at a little less than US\$10 per ton.

In *Cambodia*, ice is expensive (US\$14 to 85 per ton according 1961 prices), and consumers prefer live fish. Freshwater fish are generally "fattened" in bamboo cages along the Tonle Sap and other rivers and transported to urban centers as and when required.

In *Ceylon*, all unmechanized boats return within 12 hours and supply whole un-iced fish to auction halls and markets. Small mechanized boats may stay out at sea up to two days, occasionally carrying ice and removing the guts of bigger fish on board. Trawlers stay out up to 12 days and carry ice and have refrigerated holds. Trawlers use ice equal to half the weight of the fish. Tuna long liners stay out 15 days and have freezing equipment and refrigerated holds. Trawlers and tuna boats also remove the guts of bigger fish. The time during which fish is stored on board and the time the gear is in the water are given in Table below.

Auction halls are usually close enough to the landing places for the fish to be carried from boat to hall by the fishermen in their hands or in baskets or nets within an hour. At the hall, ice is used (in a maximum proportion of 1:1) to pack the fish into wooden boxes for transport by rail or motor truck to markets. Packing takes one or two hours and transport up to 12 hours. Fish intended for local sale may be carried away from auction halls without ice by itinerant vendors for sale within a few hours. At markets fish may be re-iced while awaiting sale which is usually within 24 hours of arrival. Cold storage plants receive fish direct from boats or auction halls. Unloading from trawlers takes upto 3 days while transport from halls upto 12 hours. At the main plant in Mutwal, Colombo fish for short storage of up to 10 days are kept in chilled brine tanks maintained at

Method	Time taken in hours			Maximum time in hours-Fish kept	
	For trip	To ground	For fishing	In water	On board
Trolling and hand lining	12	2	8	—	10
Gill netting	12	3	6	6	3
Bottom lining	9	2	5	5	2
Float lining	12 to 24	4	4 to 16	4	4 to 20
Trap fishing	12	1	10	10	1
Beach seining	4	—	4	4	—
Tuna fishing	24 to 15	24	24 to 13	4	24 to 14
Trawling	24 to 12	24	24 to 10	3 to 4	24 to 11

32°F. For longer storage the fish are blast frozen -30°F for 4 hours and stored at -10°F. From the cold rooms to the markets (within 12 hours) the fish are sent by rail or motor truck in wooden boxes with flaked or crushed ice. The curing yards receive fish for curing from boats and auction halls. If the yard is close to the hall, no ice is used during the few hours of transport. Ice is expensive in Ceylon and the Government operated factory which produces flake ice sells ice at US\$24 per ton while private producers sell at US\$37 per ton.

There has not been much change in fresh fish handling practices in *India* during the intercession period excepting that more ice plants have been set up to supply ice to fishing industry. During most parts of the year ice is reasonably cheap but for a short period during summer, prices increase due to a heavy demand for ice for other purposes such as air conditioning, beverage industry, etc. The current fresh fish handling largely depends on the type of craft, the size of the fishing village and amenities available, as well as existence of ice plants. The fishermen of the southeastern coast use the *catamaran* (lografts) boats, which have neither fishholds nor adequate space on board for proper handling of the fish. Small canoes ranging from 15 to 40 feet in length and up to 3 feet in width are used for inshore fishing all along the Indian coast. These canoes also have no

proper fish holds, the catches being generally flung at the bottom of boats and directly exposed to the sun and trampling by human feet. The catamarans and the canoes do not carry any ice. The sailboats are the most important type of boats used in the country and they contribute the major portion of the landings. An average sized sailboat is 40 feet long and 12 feet wide. The boats are equipped with a deck made of removable wooden planks. Fish is placed in baskets which are mainly made of split bamboos and hold up to 40 kg. of fish each. These baskets can be stored under the planks so as to protect them from direct sunlight. The sailboats do not take ice on fishing trips and return ashore within six hours after fishing. Immediately after hauling, the fish is washed in sea water and stored in the sheltered space under the deck in baskets or in some cases simply heaped in the space. During the past decade a small proportion of the sailboats has been mechanised by installation of marine diesel engines. Beach-landing and Pablo type (25 to 30 ft. plank-built boats filled with 10 to 20 h.p. engines) power boats have been introduced wherever the indigenous design of the craft does not permit direct mechanisation. The size of and the gear on these mechanised boats are similar to those of the sailboats. The handling and the storage of the catches on board therefore continue to be done manually. Most of the power boats stay at sea for 2 or 3 days and carry enough ice.

No definite proportion of ice: fish is maintained. The State Governments and the Central Government have recently put into service a few fully mechanised boats for the purpose of demonstration to the fishermen. These boats mainly operate small trawl nets which are paid out and hauled by winches and gurdies. The boats are equipped with fish holds under the decks. Ice is used in the proportion of 1:1. Commercially operated trawlers with a capacity to hold 40 tons of fish are a recent addition to the Indian fishing fleet. The trawlers have refrigerated holds in which the fish are stored in ice at 1:1 proportion. They carry ice and stay at sea for 8 to 12 days. In India, most of the fish is captured in nets although the hook and line method and trolling are practiced by some fishermen. The nets can be broadly classified into stake-nets, drift-nets, drag-nets, shore-seine nets and cast-nets. As the size of majority of the boats is small they anchor very near the shore. The transfer of wet fish from the boats to the landing place is done manually in baskets. Landing jetties are provided in a few large fishing ports. Ice-making plants catering to the fishing industry are mainly located in towns and fishing harbours with relatively large landings. The plants produce block ice and range from 2 tons to 50 tons of ice making capacity each per day. Ice sells at Rs. 1.50 to Rs. 10.00 (US\$0.30 to US\$2.00) per 100 kgs. depending on season and location of the plant. As stated earlier it is not a general practice to carry ice on fishing trips. As such, most of the ice is used after fish is brought ashore for further transport. Ice is also used during cold storage of fish in the city cold storage. With the exception of the few mechanised boats and trawlers no ice is carried on board any of the fishing boats, because of (i) non-availability of ice (ii) lack of communication facilities for the transport of ice to the fishing villages and (iii) the design of the indigenous craft operating in some parts of the country does not permit the carrying on board adequate quantities of ice. The fishermen are ignorant of the proper methods of handling fish with special reference to the hygiene

and improving the keeping quality of the fish. The consumer prefers fresh fish in the round; hence no beheading or gutting of the fish is practised on board. The delay caused during the transport and marketing of fish affects the quality of the fish reaching the consumers. The aforesaid problems may be tackled on the following lines: By immediately providing better communication facilities for all the fishing villages. Concurrent with better communication above as many small ice-plants as possible may be installed for a village or group of interconnected villages. The fishermen may be persuaded and helped to build and use better fishing crafts with adequate facilities for storage of fish. Necessary extension services may be organized to educate the fishermen in the proper methods of handling fish so as to improve its keeping quality. The consumer may be educated through propaganda on the need for gutting of fish on board and to make him quality conscious in general. Steps may be taken to introduce suitable insulated vans or containers where practicable for transport of iced fish. Lastly, standards of quality may be evolved for fresh fish and may then be enforced through adequate legislative measures.

In *Indonesia*, most of the fishing operations are carried out very near the shore the duration of the trips not exceeding 12 hours. No ice is carried aboard in such cases. Motorized fishing vessels carry out fishing operations of longer duration and carry ice in insulated fish boxes. Generally one ton of ice is carried for every ton of fish expected to be caught on a four days round trip. Ice is carried as block and crushed manually on-board as and when required. Ashore, the fish are seldom re-iced before selling to consumers. Apart from washing fish aboard, they are not gutted.

In *Japan*, practically all the boats carry ice onboard when going out fishing and carry back their iced catches. The recent trend has been the use of freezing equipment on-board. There are already more than 700

large boats equipped with quick freezers. Most of the other craft carry ice, the quantities of which vary with the fishing ground,

size of the boat, season, etc. The table below gives an idea of the amount of ice carried onboard Japanese fishing craft.

Type of Fishery	Type of Boat	Duration of Trip, Days	Ice Carried, Tons
Medium trawling in the Japan sea	20 to 30 tons two boat trawler	7 to 10 days	15 tons
Purse seining in Japan sea	medium sized	1 to 3 days	15 tons
Skipjack hook and line off the Pacific coast of Japan	100 tons	7 to 15 days	25 tons
Tuna longline off the Pacific coast of Japan	80 tons	30 to 40 days	50 tons
Saury stick held dipnet	50 tons	5 to 7 days	10 tons
Small boats in South-west Japan areas	10 tons	2 to 3 days	4 to 5 tons
—do—	1-5 tons	1 days	20 Kilograms

There are approximately 2,000 ice factories with a daily capacity of about 25,000 tons per day. The fish handling practices are very similar to those in the more technologically developed countries of the world but particular care is taken of the fish which is to be consumed raw.

In *Korea*, fish are generally cleaned in sea water and iced immediately after catch. The proportion of ice used is 1:2 in summer and 1:3 or 1:4 in winter. There are some 79 ice factories with a total capacity 1,900 tons per day supplying ice to the fishing industry. Some of ice machines are of the flake-ice type and this type of ice is prepared by many fishermen.

In the *Federation of Malaya*, use of ice in the fishing industry is extensive but ice prices are generally high. However, on the East coast a Government sponsored fisheries

cooperative supplies the fishing industry with ice at US\$3.75 per ton. Under the Canadian Colombo Plan Assistance Scheme for the East Coast Marketing Project, equipments for eight ice and fish depots are being provided. These depots are to be set up in Tumpat, Bachok, Kuala Besut, Kuala Trengganu, Kuala Dungun, Kijal, Kemaman and Kuantan. The machinery for these depots have been delivered and it is hoped that these depots will be functioning by March 1963. So far the buildings in Kuala Dungun, Kujal, Kemaman and Kuantan have been completed and are awaiting the installation of the machinery. The building for the depot in Kuala Trengganu is under construction and the one for Kuala Besut will begin soon. As regards the depots in Tumpat and Bachok, foundation work for the buildings are expected to begin towards the end of October this year.

In *Pakistan*, fresh fish is preserved in ice and packed in bamboo baskets and transported by rail or motor trucks to small distances both in the country and outside the country i.e. India. In East Pakistan the fish is preserved in ice and exported to Calcutta by steamers and rails. Buildings to house an ice plant and a cold storage have been completed at Pasni on the Mekran Coast and steps are now being taken to transport the machinery there.

In the *Philippines*, there are no statistics available on the number, capacity and facilities of ice making plants for the fishing industry. However, fish carriers or fishing boats generally use crushed ice without mechanical refrigeration facilities. One fishing boat of 100 tons gross carry 550 blocks of ice on its way to the fishing ground. One block (300lbs.) of ice cost ₱2.10-₱2.20 from the ice-plants. In the Manila area the Ice and Cold Storage Corporation, operated by the San Miguel Brewery is the leading supplier of ice to the fishing boats. There are, however, no available data as regards the volume of ice sold to fishing boats. Refrigerated trucks are not used in the Philippines. Generally fish coming from places transported by land are packed in big boxes insulated with rice husks or lined with fresh banana leaves with crushed ice mixed with the fish.

Manila: Prices of ice sold in different areas in the Philippines :

	Per 300 lbs. block	Per lb.	Per kilo
At the Plant	₱2.10	₱.007	₱.0154
Delivered	2.40	.008	.0176

Cagayan:

At the Plant	— ₱0.12 per kilo
Delivered	— 0.14 „

Malacbalac, Albay:

At the Plant	— ₱.04 per kilo
Delivered	— .05 „

Misamis Oriental:

For sale of 100 kilos or more — ₱.08 per kilo
For sale of less than 100 kilos— ₱.10 per kilo

Opon, Cebu:

At the plant and delivered— ₱.066 per kilo
" " — .03 „
" " — .50 per 50 lbs.

In *Philippines*, trawlers and fish carriers carry crushed ice on their holds for use in the chilling of fish to be transported to the shores. Boat holds are divided into compartments or pens where fish are dumped on fish holds or first placed in a circular G.I. trays with crushed ice. With the use of spade, a thin layer of crushed ice is first sprinkled on the bottom of the tray, then also with the use of spade a layer of fish is placed, then alternately putting ice and fish up to the brim of the iron tray. Filled trays are then arranged in the boat hold, each layer of which are separated by planks or wooden beams to separate the bottom layer from the upper layers. This arrangement provides air circulation as well as protection against abrasions of exposed fish. Ice bought by operators from private plant operators are mechanically crushed before being loaded by trawlers or fish carriers in the boat holds prior to departure to the fishing grounds. In the fishing ground and immediately after catch fish are packed in the circular trays with a calculated proportion of 3 parts ice to 7 parts fish. There is no definite criteria as regards proportion of ice and fish and basis of mixture is done only in a haphazard manner. As regards fish carriers, as soon as they reach the fishing ground, fish from the fishing outfits are immediately transferred to the carrier, placed in trays with crushed ice added. If the catch is good for one boat load, it takes them 24 hours to load the carriers. The average number of hours of storage from fishing ground to the shore i.e., Palawan-Manila is 32 hours. The approximate storage time for those boats coming from the Visayan waters is 40 to 59 hours. Depending upon the rate in which the boat hold is filled by fish, the fishing boats have to stay fishing for an undetermined number of days. In which case, fish caught at the early stage of the fishing trip stays longer in the boat hold, till

the fishing boat reaches the landing place. As there are no fishing boats or fish carriers that have mechanical refrigeration facilities, all fishing boats are provided with holds or pens that occupies 50% of the boat space. Pens are insulated with cotton or palay husk and crushed ice is merely dumped in.

In *Singapore*, all the fish caught by local fishermen are sold in the fresh iced condition. A small proportion, mainly anchovies and sprats, are sold as cooked fish to satisfy the demands of consumers' preference. Ice supply is adequate and prices are reasonable.

In *Thailand*, fish caught in stationary traps and nets as well as by small gill netters are not iced aboard as the duration of the trips is about six hours. However the purse seiners, two boat trawls and the recently growing otter trawl fleet always carry ice and the fish are immediately packed with ice after catch but are not gutted. Ice is used liberally as ice is plentiful and reasonably priced in most areas. There are approximately 50 ice plants with a total production of about 1,300 tons per day in Thailand.

Icing procedures in the *U.S.A.* have changed very little over the years. Some research has been conducted recently using antibiotic ice (chlortetracycline). Several commercial firms have tested this means of preservation. However, very few plants have installed this preservation method in routine handling procedures. The reason for this is reported to be the relatively small shelf life extension achieved in relation to costs.

In *Vietnam*, most of the fish are carried without ice by sailing vessels from the fishing grounds to the landing place when the duration is less than 5 hours. However for longer duration ice is generally carried aboard and the catch is iced onboard in the ratio of 1:1. In all cases, the fish are iced ashore for transport to urban markets such as Saigon. A number of block ice plants together with ice storage rooms have been built at selected fishing centers and supply of ice to the fishing industry has appreciably increased. The price of ice is reasonably cheap.

The attached table gives an idea of the prices of ice prevailing in the countries of the IPFC Region.

*Price of Ice in the IPFC Region in 1961**

Country	Minimum Price US\$/ton	Maximum Price US\$/ton	Converted from local currency costs at Exchange Rate
Australia (Papua and New Guinea)	12	16	1 US\$ - A.Sh 8/6
North Borneo	—	37	1 US\$ - 3 M\$
Brunei	—	32	1 US\$ - 3 M\$
Burma	10	22	1 US\$ - 4.76 Kyats
Cambodia	14	85	1 US\$ - 35 Riels
Ceylon	24	36	1 US\$ - 4.76 Rupees
Hong Kong	6	—	1 US\$ - 5.714 HK\$
Indian (based on prices in New Delhi)	2.50	14	1 US\$ - 4.76 Rupees
Indonesia	11	22	1 US\$ - 45 Rupiahs

* These prices are mainly based on a report prepared for the FAO/EPTA Training Center on Fish Processing Technology, 6 March-17 April 1961 as well as on observations made by the Technical Secretary during his periodical visits to member countries.

Price of Ice in the IPFC Region in 1961 (Contd.)

Country	Minimum Price US\$/ton	Maximum Price US\$/ton	Converted from local currency costs at Exchange Rate
Japan	3	4	1 US\$ - 360 Yen
Korea	3	4	1 US\$ - 130 Won
Federation of Malaya	10	20	1 US\$ - 3 M\$
Pakistan	12	20	1 US\$ - 4.76 Rupees
Philippines	7	12	1 US\$ - 3.90 Pesos
Sarawak	13	—	1 US\$ - 3 M\$
Singapore	5	7	1 US\$ - 3 M\$
Thailand	4.5	5.5	1 US\$ - 20 Bahts
Vietnam	5	8	1 US\$ - 75 Piasters

Distribution, Packaging and Transport

The limited facilities of transport and distribution of fish has been one of the bottlenecks in the modernization of the fishing industry in the Region. During the last few years, increased facilities have become available for distribution and transport of fish from production areas to distant consuming centers.

In *Australia*, refrigerated road transport is becoming increasingly popular and a considerable proportion of them are mechanically refrigerated. Principally, they are of the semi-trailer type.

In *North Borneo*, a cheap insulated fish box has been designed for fishermen and fish dealers by the Government fisheries section. The North Borneo Railways provided special insulated boxes for transport of perishable foods including fish. The boxes measure 0.76 m. x 0.46 m. and a hire fee of MS\$1.00 per day is charged. Due to lack of road communications, water transport is used to a considerable extent.

In *Cambodia*, the transport of freshwater fish is no problem as the fishing areas are quite near the urban consuming centers. Sea fish is transported by road in baskets in an iced condition over distances of some 150 Km. A considerable amount of sea fish, especially

Rastrelliger is also boiled and transported to Phnom Penh and other urban centers.

In *Ceylon*, efforts are being made to improve the existing marketing and distribution facilities. At present, there are no refrigerated trucks or railway wagons and no fish is transported by air. However, there is one insulated railway wagon and three insulated motor trucks in operation. Ice is not available in sufficient quantities at all landing places and even markets occasionally run short of ice. At landing places and markets there are no cold storage or insulated rooms for holding fish. Transport from the landing place to railway stations or markets is often inadequate for the catch, while the majority of rail-cars and motor trucks are not insulated. Taboos play a very small part in marketing but consumer preferences contribute largely to widely different values being placed on equally edible fish. Current problems are inadequate icing which contributes to the deterioration of fish sent to markets by rail and motor truck. Fish for sale in or outside markets are exposed on open counters or at most in the boxes used for their transport. Further developments are to include cheaper and more readily available ice which is one of the chief requirements in the field of fish utilization. Ice making plants are required to be established round the coast to avoid

transport of ice and its consequent expense. Cold storage rooms are needed at all important landing places and every market. In its simplest form these can be merely insulated rooms to hold fish with ice. At the markets refrigerated show cases (or even insulated containers) should be introduced for holding fish prior to sale. Insulated rail cars and motor trucks will assist in bringing good quality fish to market and reduce wastage of ice. On a larger scale, freezing facilities and cold rooms should be provided at the principal fishing centres of the Island.

In *Hong Kong*, the use of aluminium fish baskets has been tested and found satisfactory in every respect. This new type of container will be cheaper and cleaner to use and will eliminate the need for the present large areas used for the storage of bamboo baskets which have a much shorter life.

In *India*, a major portion of the catches is dried or salted. This is more so in fishing villages lacking communication facilities. The fish intended to be dried or salted is directly taken to the fish curing yards in head-loads. The relatively small quantity of fish intended to be sold as fresh fish in nearby villages or areas is transported on head-loads, bicycles, cycle-rickshaws, bullock-carts and trucks, depending upon the distance and availability of the transport. No ice is generally used during the transport of the fish from such villages. The fish is not auctioned on the shore since the sale is effected through the members of the family of the fishermen. A different pattern of disposal is obtained in fishing villages easily accessible by road or sea. A major portion of the catch landed at these villages is sold as fresh fish. In Madras State the catches are sometimes sold immediately on landing by public auction. However, in other places the auction is replaced by annual contracts with the fish merchants (middlemen). The co-operatives organized by the fishermen are slowly replacing the fish merchants. No gutting or beheading of the fish is done until the fish reaches the retail market, as the consumer prefers his fish in the round. Icing is resorted to in the case

of fish intended to be transported to the nearby cities. The proportion of fish: ice is not definite although an approximate ratio of 1:1 is common. Ice is purchased in the factories situated in the cities and is transported to the fishing villages. The transport is provided by trucks, railways, diesel powered launches or sailboats. The trucks are open-type and not refrigerated. The fish and ice are arranged and packed in bamboo baskets or wooden boxes. The amount of ice used being indefinite, the quality of fish at the destination varies from day to day and lot to lot. The trucks operated by some co-operatives carry the fishermen as well, together with their baskets of fish and also on their return trip with the empty baskets after disposal of the catch. The railways carry fish parcels to towns in gunny wrapped baskets and boxes. Till of late, the railways had no refrigerated vans especially built for fresh transport. Recently however, a few vans of this type have been put into service. Each of the vans has 3 compartments, the middle one being used for housing the refrigeration unit comprising a compressor, a 12 h.p. motor and a generator. The two end compartments are capable of holding $7\frac{1}{2}$ tons of fish each. Fish is pre-cooled by ice (2 fish: 1 ice). A temperature of 30° F is obtained in the two compartments by cold air drafts. The refrigerant used is Freon 12. The train journey lasts for 4 to 12 hours. The ice: fish proportion is approximately 1:1 except in case of transport by refrigerated wagon when it is approximately 1:2. Diesel-powered launches have earned a special significance in transport of mackerel and sardine from southern parts of the Bombay State to Bombay City. Their use is now being extended to transport of iced fish to Bombay City from the northern regions as well. The launches averaging 20 tons loading capacity carry ice from Bombay. Icing is done at 1:1 proportion. The mackerel is heaped in the holds while the costlier varieties of fish coming from north are packed in old tea-chests which are stacked in the holds. The launches take 24 to 36 hours to reach Bombay. Transport of fresh fish in ice on sailboats is similar to

that on the launches. The boats take about 30 hours to reach Bombay. The fish landed at small and remote villages reaches the consumer generally in un-iced condition as stated earlier. The transport time (usually by headloads, cycles, etc.) varies from an hour to four hours. The consumer in big cities purchases his fish from the local fish markets. The retailing is done by fisherwomen who bring basket-loads of fish from either (a) the nearby fish landing places (b) the wholesale market or (c) the cold storage. The transport is provided by trucks but handcarts are also used if the distance is short. The fish is usually re-iced during the transport although the quantity of ice used is rather meagre. During retailing, the fish is exposed and exhibited on wooden boards in small lots. Large sized fish is usually sold in pieces by weight while small fish is sold in small lots. No quality control is enforced by the Government. However, the Municipal Health staff periodically checks the stalls for maintenance of proper hygiene. As stated earlier it is not a general practice to carry ice on fishing trips. As such, most of the ice is used after fish is brought ashore for further transport. Ice is also used during cold storage of fish in the city cold storage. In the North West sector, majority of fish is transported by fish carrier boats, and insulated road vans. In the South Western Coast, fresh fish is transported by rail and road, as also in the East Coast. The Government of India have recently introduced refrigerator rail cars in certain selected routes, viz. Waltair to Calcutta, Calicut to Madras and Ahmedabad to Delhi. It is proposed to increase the number of refrigerator rail cars and also to run them on new routes.

In *Korea*, the following is an account of distribution of fishery products (contributed by Mr. Han Shin Wook): Fresh fish are shipped to consumer centers either by train or truck. At present, *Korea* has only four refrigeration trucks, all owned and operated by exporters of frozen marine products. The number of refrigeration freight-cars in operation are as shown in the following table.

There are only seven refrigeration freight-cars in use at the major fishing ports of *Korea*, such as Pusan, Yosu, Mokpo, Changhang and Pohang.

- (1) For use of U.N. Forces in *Korea* :
 - 133 mechanized refrigeration freight-cars.
 - 10 converted refrigeration freight-car.
- (2) For General Consumer :
 - 44 Converted refrigeration freight-cars (26 working, while 18 are inoperative).

In most of the inland regions of *Korea*, there are no or only inadequate cold-storage facilities for fresh fish, and ice is used for the cold-storage transportation of fresh fish. Therefore, the Government has begun issuing loans to facilitate the installation of cold-storage facilities in the major consumer centers. Three new fresh fish cold-storage plants will be built this year. Studies are under way for a more effective utilization of cold-storage freight-cars and also for the introduction of refrigerator trucks. *Korea* has used each year more than 8,000,000 wooden box containers for the transportation and distribution of fresh fish, but following the Military Revolution in May last year, the illegal felling of trees has been put under strict control, making the supply of lumber for box containers scarce. To make up the shortage, the Government has released 10 million won in loans to the Fisheries Associations to facilitate the substitution of light-metal box containers, which would be cheaper in the long run and more sanitary. The use of rubber tyre fish containers and brush-wood containers is also encouraged.

In the *Federation of Malaya*, most of the iced fresh fish is transported by road. Most of the ice factories are situated in the west coast and only about 15% of the total ice production is contributed by the East coast. The total ice production is about 1,100 tons/day. There are two refrigerated trucks which transport fresh and boiled fish to Kuala Lumpur and Singapore markets. Plans are afoot to procure under Canadian Colombo Plan one

refrigerated 5-ton lorry, and 2 insulated 3-ton vans for fish transport. In addition it is anticipated that facilities for ice, fresh fish, dry fish, and frozen fish storage will be provided at various producing as well as consuming centers under the above Plan. Preparations for starting field observations on icing in transportation of fresh fish have been completed and work on the temperature history of iced fish is to be started very soon. Two spear thermometers of the Torry type have been acquired for this purpose.

In *Pakistan*, under the Mekran Coast Fisheries Development Scheme, two fish carriers have been constructed for transportation of fresh fish from the Mekran Coast ports to Karachi. Fishermen Cooperatives will operate these carriers. On the recommendations of the Fisheries Department the Pakistan Western Railways now provide mechanically refrigerated wagons on their main routes for transportation of fish to upcountry. Work is in progress on designing of a suitable container for boxing the fish prior to their despatch to upcountry in these refrigerated wagons. In the private sector also, a number of carrier boats have been built by the freezing plant owners, for quick transport of shrimps and fish from the Mekran Coast ports. These carriers are only insulated and carry ice for preservation of shrimp etc.

In the *Philippines*, transport and distribution of fish is done by road, water as well as by air for certain special items such as shrimp and milkfish (*Chanos*). There have been no significant changes during the inter-session period.

In *Sarawak*, due to lack of road communication between producing centers and consuming centers, the distribution of fish to inland people is not sufficient. Small quantities of fish are transported by water along coastal towns and creeks.

In *Singapore*, locally caught fish are generally transported by ordinary trucks to the markets. Considerable amount fresh fish is also imported from abroad which

arrive by boats and if it is from Thailand, by truck.

In *Thailand*, at present time, ice is available at almost all the major fishing centers. If it is a small fishing boats such as bamboo trap boats or gill net boats, the fish must be brought to ashore first before packing in ice but for bigger boats, e.g. purse seine boats, trawl boats or fish carriers which carry crushed ice, the fish are packed immediately after catch in ice and stored in the insulated fish hold. Mode of packing fish in the fish hold are as following: All sizes of fish are not eviscerated before packing, fishes from purse seine, bamboo trap and gill net are mostly packed in heaps while trawled fish are packed more carefully in boxes with ice and stored in the hold. The proportion of ice to fish depends on the duration of the fishing trip, but this averages 1:1. On arrival at Bangkok, most of the fish is consumed fresh while a part is processed and rest is sent to further inland consuming centers in the North and North East. In view of improvements in roads, transport of fish by trucks has become very popular from the fishing centers on both East and West coasts. For transport, fish are packed with ice in wooden boxes which are lined with woven nipa palm leaves as insulation, while fish for inland market is packed in G.I. boxes which are placed in a larger wooden box, the metal box closely fitting into the wooden box. Bamboo baskets are also commonly used with banana leaf insulation. For North and Northeastern parts, fish are packed with $1\frac{1}{2}$ times their own weight of ice. Because of inadequate staff in the Technology Laboratory of the Fisheries Department, it was possible to initiate only preliminary investigations on quality control of fresh fish such as temperature history of fish from the moment of its catch until the consumer, icing techniques and quality assessment. It is hoped that a systematic study of spoilage, icing techniques, as well as quality assessment of fresh fish will be undertaken when the staff of laboratory who have gone abroad for higher studies will be returning soon. Results of

the temperature studies on fish are described in Technical Paper IPFC/C62/TECH 41.

In *U.S.A.*, plastic impregnated cardboard boxes have recently been used in the transportation of iced fillets. These boxes contain 50 to 100 pounds of iced fillets. The smaller sizes usually are covered. Companies using these plastic impregnated boxes indicate that the ice remains for longer periods without melting and that there is a savings in weight over the traditional wooden boxes.

In *Vietnam*, the project for regulation of fish marketing is going to be approved together with the organization of the managers of fish markets.

Exportation of fresh fish amounted:

To Singapore :	2,103,453 Kg. at
	38,205,222 VN\$
To Thailand :	185,913 Kg. at
	1,696,512 VN\$

TRADITIONAL METHODS OF PROCESSING

Salted, Dried and Smoked Fish

No new developments have been reported in the salted and dried fish industry during the intersession period. One reason for this is perhaps, provision of increased facilities for handling, transport, marketing and distribution of fresh fish from production areas to consuming centers. There has not been any reports of any new introduction of artificial dryers on a commercial scale for drying of fish. This does not mean that the demand for this product is less. The production as well as demand for salted and dried fish remains high as before.

The salting, smoking, or drying of fish in Australia is the exception rather than the rule. Specialised fish products and fish pastes (non-fermented) are produced by a few plants using modern hygienic processes.

In *India*, improvements have been effected in fish curing yards and method of fish curing by salting and drying. With the better offer of prices for better quality, the producers themselves have considerably im-

proved the processing methods. Efforts are being made to introduce quality control and preservation standards for different commodities. The traditional methods of packing and storage continue, but improvements are made to the extent of improving quality of products, especially in the case of Prawns, Bombay ducks, Mackerels, Sharks and Sardines. The results on experiments on the use of artificial driers have encouraged a few processors also in Gujarat, Kerala, Mysore, Madras and Orissa to initiate programmes on mechanised drying for fish and prawns.

In the *Federation of Malaya*, the problem of insect infestation and mold growth on dried fish, has been solved by storing the dried salted in cold rooms. Normally storage of salted-dried fish in cold rooms would not be economical but the cold store lockers are available at reasonable rentals in Malaya. The monthly rental for a 60 ton cold store locker is about M\$500 and even assuming that only half the space is utilized it can be estimated that the storage of 30 tons of salted-dried fish in a cold room (25° to 38°F.) for a period of six months increases the price of the salted-dried fish to the consumer by not more than 10%. Among the advantages of storing salted-dried fish in cold rooms are: no moisture absorption and resulting microbiological spoilage, no insect infestation, and no expensive packaging materials are needed.

In *Pakistan*, model curing yards have been constructed at Pasni and Gwadar on the Makran Coast of West Pakistan. Similar yards will also be built at other fishing ports on the Makran Coast and in East Pakistan. Arrangements have also been completed to supply duty free white salt to the curers for curing of fish. In Chittagong (East Pakistan), the local fishery cooperatives, under advise of Fisheries Department, have constructed specially designed warehouse for storing of cured fish. These warehouses are properly ventilated and provide proper racks for storage of fish. They also fumigate the fish against pests etc., with the result that the stored fish retains its good quality for a

much longer period. Similar warehouses are being built in other places in East Pakistan. In Karachi, the M/s. Engineering Trading Corporation have started curing the fish on the Burmese style, which is different from the traditional local cure. The firm employed Burmese women cutters in the initial stage and cured sea as well as fresh water fish. Their entire trade is with the Burmese Government. A large quantity of fish is salted and dried for export to Ceylon and Burma. Smoking is not prevalent in West Pakistan. Only a small quantity of fish is smoked in East Pakistan. There is no separate fishery salt production. Out of the quantity of white salt available in the country, a certain quantity is allocated for the use of fish curing and processing by the Government at cheaper rate free of tax.

In *Thailand*, since large scale development of trawl fishing in the Gulf of Thailand is taking place, there has been considerable increase in landing of trawled fish with which the consumer is not familiar. By means of various audio-visual aids such as radio, T.V. etc., the consumer is being educated to utilize trawl fish in the same way as other traditional fish. The Technology Laboratory of the Fisheries Department has developed processes for the utilization of trawl fish, such as salting, smoking, fish protein concentrate in the form of a flour, fish crackers (Khao Khrieb), etc. Some of these processes are adopted by the industry. Particularly this is the case with fish smoking industry which was formerly using only fresh water fish as raw material.

In U.S.A., there has been no significant changes in these processing methods. Packaging, shipping and storage of cured fish—some interest exists in the public health aspects of botulism in smoked fish packed in plastic bags. Limited research in this matter is under way. Extracts from a relevant paper "Construction and operation of an inexpensive smoke house". *Comm. Fish. Rev.*, 22(8): 8-12, 1960 on this subject is given below:

A project was undertaken to build a fish smokehouse that could (1) be easily constructed by unskilled labor at minimum cost and (2) produce a uniform product having good taste acceptance. The smokehouse consists of two major parts: (1) a firebox and (2) a 4-foot x 4-foot x 4-foot plywood smoker. The separate units are necessary to prevent fire hazards and permit control of smoke temperatures. The equipment can be constructed in 16 hrs. The firebox is constructed from a 55-gallon drum having a removable clampon lid. A 8-inch x 10-inch door is cut near the bottom rim of the drum, using a cold chisel and hand hacksaw. The cutout piece is refitted as a door by attaching it with a pair of brass butt hinges. On the opposite side of the drum and near the top, a hole 6 inches in diameter is made to fit in a piece of stovepipe. Furnace cement should be used to seal the cracks between the pipe and drum. Eight feet of six-inch galvanized stovepipe is attached at the top rear of the firebox and at the bottom center of the smoker. The simplest procedure is to set up the smokehouse on a bank of steep slope with the firebox on the lower grade. Otherwise the smoker must be raised on blocks, or a blower used to gain circulation of the smoke. Fire is started in the firebox about one hour prior to hanging the fish. Charcoal briquets are used to start the fire and *green or wet* hardwood is added to provide the smoke. Approximately 150 pounds (240 mullet) were smoked in one operation in this smokehouse, producing a product acceptable to a taste panel of local citizens. The plans may be expanded to construct a larger smokehouse, but it is desirable first to gain experience with a smaller smokehouse such as this one.

Boiled Fish

A draft Report on Boiling of Fish as a short term method of preservation under tropical conditions was prepared during 1959 and distributed to Member Governments. Subsequently revised report was discussed during the 9th Session, at Karachi, 6-23 January 1961 as well as at the FAO/EPTA Fish Processing Training Center, at Quezon

City, Philippines, 6 March-17 April 1961. To ensure publication of this Report without delay, the final report is submitted to the current sessions as a technical paper.

There have been no reports of any further developments in the member countries in this method of processing.

Fermented Fish

There have been no reports of any further developments in this field excepting that technologist studies have resulted in the development of a method for reducing nuocnam, a fermented fish sauce into a solid form in *Vietnam*. In *India*, at present, fermented fisheries product, fish sauces and fish pastes are not popular but some of the Fisheries Departments like Gujarat, Maharashtra, Kerala, Madras and Orissa are developing recipes for fish paste.

Other Traditional Products

Nothing to report.

NON-TRADITIONAL METHODS OF PROCESSING

During recent years non-traditional methods of processing have become more and more popular. Among these methods are freezing and canning. Some new products have appeared in the market such as fish sausage.

Frozen Fish

In *Australia*, the traditional methods of fish processing are the cold process or canning. There is ample freezing and cold storage available at main distribution points. Much of the crayfish production and much of the prawn production is frozen, while the production of frozen fillets is increasing. Freezing techniques are well-established, comprising brine, air-blast and plate contact freezing. Packaging, shipping and storage of frozen foods is well established also.

In *North Borneo*, investigation into the prawning grounds in North Borneo waters in 1960 and early part of 1961 showed that the ground between Sandakan and Tambisan

Island in the East Coast was rather promising, but the extent of the prawn stock has yet to be determined. A modern prawn processing factory equipped with a flake ice making machine, plate freezer and cold storage was completed in November 1961 by the Sabah Fishing Company in Sandakan. This Company operates a prawn trawling fleet consisting of one 44 ft. and five 45 ft. boats designed and built in Hong Kong. A joint Japanese and local enterprise named the Borneo Fishing Company has set up an ice factory and built a 68 ft. American type prawn trawler (the largest fishing boat ever built in North Borneo). The prawns are quick-frozen by plate freezers. The headless frozen prawns are packaged in 2.3 and 4.5 kg. cartons which are lined with plastic sheet. The frozen prawns prior to export are stored at -5°F ., while awaiting refrigerated boats. The product is exported to Japan and U.S.A.

In *Ceylon*, non-traditional methods of processing and preservation have made some headway. Freezing facilities available include three airblast freezers at Mutwal each with a capacity of 3 tons per batch. The fish are frozen at -30°F ., and frozen fish are stored at -10°F . after glazing. The frozen fish has found wide consumer acceptance in Ceylon. Prime fish such as *Cybius* are frozen, cut into steaks with mechanical saws, and packaged in polyethylene bags. The packaged frozen fish steaks are marketed by the Cooperative Fish Sales Union which has established a number of retail shops with deep freezers which store the frozen fish for sale. Frozen shark is also treated in a similar way and sold as "white steaks". The frozen fish are generally held for not more than 15 days before they are disposed off. One of the problems in the cutting of large sized frozen fish into steaks has been the loss of fish in the form of "sawdust". The loss may amount to as much as 2 to 5%. The cold stores in Colombo have capacity of 500 tons maintained at -10°F .

In *India*, during recent years, in addition to the important frozen shrimp export trade, frogs are also being frozen and exported mainly to France and U.S.A. The shrimp are

generally cleaned at the plant, packed in cartons of 2.2 kg. frozen in plate freezers and stored at -30°F. Frozen packages meant for U.S.A., employ cartons which are imported from U.S.A. and the Indian exporting firm gets a draw-back on the customs duty when the cartons containing frozen shrimp are exported. The cartons meant for the European markets are produced in India. The shrimp freezing industry is concentrated mainly in the west coast. It is estimated that the value of exports of frozen peeled headless shrimp is about US\$2 million (more than 1,200 tons) during 1960. The frog legs industry has developed into an enterprise of some importance. Also concentrated on the west coast, the industry processes about 2 tons of frog legs per day which are frozen in 2.2 kg. retail or 22 kg. wholesale cartons. The main market is in France and U.S.A. The frogs are usually brought to the plant in butchered condition, i.e. only the legs are bought though a few plants actually have a butchering line added to the factory. Each pair of legs is thoroughly cleaned, washed and carefully packaged in individual polyethylene bags before freezing. The bags containing the frog legs are put into the cartons and frozen. There is no frog culture industry and the frogs are captured in the wild state by the fishing community as a side line activity. A small industry has also developed in the freezing of spiny or rock lobster (*Panulirus* sp.) tails the main market for this being in Europe. The supply of raw material has to be increased to meet foreign demands, for this product. The frozen shrimp and frog industry provides employment for more than 1,000 persons. Non-traditional methods of processing of fish is now being adopted in the states of Gujarat, Maharashtra, Mysore, Kerala and Andhra Pradesh. Most of the prawns, lobsters and frog legs are processed for export purposes in Kerala, Mysore and Andhra Pradesh. Pomfrets, Indian salmon and jew fish are processed in Gujarat—Maharashtra sector. Plans are already finalised for establishing processing plants for fish in the Gulf of Kutch, Madras and Orissa. There has been considerable increase in the frozen shrimp industry.

Additional producers have been licensed in Kerala, Madras, Andhra Pradesh and Mysore.

In *Korea*, freezing of fish such as horse mackerel has become popular in order to level out the price of fish during the year. The price fluctuates considerably during the year as the fish catch is very large during a short season. Freezing of dressed fish and fillets has developed for supply to armed forces. Most of the freezing equipment consists of sharp freezers with single stage compressors and industry is being advised to change over to two stages compressors to improve the freezing efficiency and economy. Shrimp freezing is done on a small scale and in 1959, 102 tons of frozen shrimp were exported to U.S.A. During 1961, the exports frozen shrimp increased to 706 tons. Shrimp is generally frozen into 2.2 kg. (5 lb.) blocks or peeled and frozen individually.

In the *Federation of Malaya*, two commercial enterprises have set up fish freezing plants, one in Penang and the other in Ipoh. These two plants have a freezing capacity of seven tons and two tons of fish per 24 hours respectively. There are a large number of cold store rooms for storage of frozen fish in various parts of the country and many of these rooms have been used also for freezing fish meant for disposal within a short time.

In *Pakistan*, three more freezing plants in Karachi have since started production, bringing the total to six. Besides this two more freezing plants, and one canning-cum-freezing plant are under construction and are expected to start production this year. In Khulna, East Pakistan, one freezing plant has started production this year. Another freezing-cum-canning plant is nearing completion in Khulna and is expected to start production by the end of this year. One more freezing plant is being constructed at Chittagong and a few more are in the planning stage. Altogether there are six plants producing frozen shrimp for export, in West Pakistan and one in Khulna (East Pakistan). Both airblast and plate freezing techniques are used. There is no frog leg freezing industry in Pakistan.

In *Thailand*, during the last years, there has been a marked increase in the number of chilled fish as well as frozen fish storage rooms of all sizes. The existing storage capacity for frozen fish is 2,860 tons and a new cold store of 500 tons capacity is under construction at Chumporn. Provision of storage facilities at distant consuming centers in the North and Northeast is under consideration by the Government. Frozen fillets was introduced into the market by the Bangkok Cold Storage Organization under technical guidance of the Technology Laboratory. A small export trade in frozen shrimp has also developed. Experimental trials with production, storage and common acceptance of fish sausage are going on and it is hoped that this product will be put on the market very soon.

In *U.S.A.*, there are several small research studies underway investigating freeze-drying methods for processing various fishery products. One U.S. company has been commercially freeze-drying cooked peeled shrimp for several years. Another new development in the frozen fish industry is the use of microwave oven for thawing frozen products such as fish blocks. Research has been initiated in this field, but the findings are not as yet available in the literature. The U.S. industry is using plastic bags in the packaging of frozen fishery products. These bags may be impervious to gases and are often evacuated to preserve moisture and quality. In this field, the following papers were published:

- (1) Technical Note No. 42—Keeping quality and rate of freezing of cooked deepsea lobster meat frozen in cans. *Comm. Fish. Rev.*, 20(1): 22-27, 1958.

The discovery of large quantities of deep sea lobsters off the Coast of New England has led to the development of a new lobster fishery. Because of the large size of deep sea lobsters (2.2 to 6.7 kg.), the market for live lobsters are limited. Since a successful method of preserving them would greatly these lobsters. A small-scale preliminary test was conducted with cooked

lobster meat frozen in cans to determine (1) the effect of (a) the amount of vacuum in the can, (b) the storage temperature, and (c) the addition of brine and (2) the rate of freezing of the canned lobster in a blast freezer. The findings were as follows: 1. Cooked lobster meat stored in cans for 18 weeks at -20 °F. kept well and was apparently of better quality than was cooked lobster meat stored in cans for the same time at 0 °F. The amount of vacuum in the can did not appear to affect the keeping quality appreciably. Samples of cooked lobster meat containing 2.5 percent salt brine, packed at 680 mm. of vacuum, frozen, and stored for 18 weeks at -20 °F. were at about the same level of quality as those not containing brine, but otherwise packed under the same conditions. 2. With lobster meat packed 1 pound per No. 2 can, 100 minutes was required to cool the cooked meat from 45° to -20° F. in an air blast having a temperature of -10° to -35° F. and a velocity of 457 m. per minute over the cans.

- (2) On storage of frozen shrimp show that proper packaging "pays off". *Comm. Fish. Rev.*, 20(1): 27-28, 1958.

Frozen shrimp must be adequately protected, through the use of packaging or glazing techniques, or both, in order to minimize quality changes during frozen storage and marketing. Many investigators have found that poorly-packaged commercial samples of shrimp deteriorate rapidly during normal frozen storage at 0° F. Information on the storage life of frozen shrimp afforded maximum protection through commercial packaging and glazing techniques would enable industry to take advantage of glut periods, level off production costs, and still market a high-quality product. Realizing this, the Bureau of Commercial Fisheries Technological Laboratory at East Boston, Mass., is conducting studies to determine the frozen storage life of peeled and deveined and raw headless shrimp. These samples of shrimp were either (1) frozen individually glazed and packaged in a 1.1 kg. carton, which was overwrapped with micro-crystalline waxed paper or (2) packed wet into a 1.1 kg.

carton, the carton overwrapped as above, and the shrimp frozen in the form of a block. After six months of frozen storage at tem-

peratures of 0° to -5°F., all samples are reported to be of very good to excellent quality.

Summary of Taste-Panel Scores on Frozen Shrimp Stored at 0° to -5°F.

Description of Samples of Frozen Shrimp	Product Score*					
	Months of Storage at 0° to -5°F.					
	1	2	3	4	5	6
Peeled, deveined, block frozen (packed wet)	8.7	8.6	8.7	8.6	7.8	7.7
Peeled, deveined, individually frozen (glazed)	8.7	8.4	8.7	8.1	8.0	8.0
Headed, not-peeled, block-frozen (packed wet)	8.8	8.7	8.7	8.6	8.3	8.3
Headed, not peeled, individually frozen (glazed)	8.6	8.6	8.5	8.4	8.1	8.1

* Product score was the average value for odor, flavor, appearance, and texture of the cooked product as rated by the taste panel. The taste panel consisted of 8 to 10 people. Score based on nine-point system of: 9, excellent; 8, very good; 7, good; 6, fair; 5, borderline; 4, slightly poor; 3, poor; 2, very poor; and 1, inedible.

There are no significant technical changes in the frozen shrimp and frog industry except as reported above for free-drying shrimp.

In *Vietnam*, there is a shrimp freezing plant which was started some two years ago and the production is exported.

Canned Fish

There are six major fish canneries in Australia, handling tuna, Australian "salmon" and barracouta. One of these canneries is also equipped to can sardines when these are available.

In *India*, canned and frozen fish exports to U.S.A. and West European countries have registered an increase. Tin plate subsidy scheme has been introduced to serve as an incentive to the fish canning industry. A special Export Promotion Scheme for supply of packing materials to the fish processing industry is in operation. The total exports of net amount of fish (dressed) was about 350 tons valued at approximately US\$500,000. The major exports were canned shrimp to U.S.A. which accounted for some 270 tons

valued at about US\$300,000. Canning of fish is now restricted to prawns, sardines, mackerels, promfrets and Indian salmon. Canning of shrimps is now being done in Gujarat, Mysore and Kerala. Canned sardines are produced in Kerala and Mysore and canned mackerels in Mysore and Maharashtra and canned promfrets in Gujarat, Maharashtra and Kerala.

In *Japan*, a large fishing firm begun to export 5,000 cases of canned shrimp to the U.S.A. for the first time in July 1961 and completed the entire shipment by mid-August 1961. In August, some 10,000 cases were expected to arrive from the North Pacific shrimp factoryship and the company intends to export them all the U.S.A. and Europe. The company which operated the world's first shrimp-canning factoryship in the Bering Sea this year, will handle more than half of the export quantity and the remainder through 2 or 3 large exporters. Three other large fishing firms are pushing their plans to also fish and can shrimp in the Bering Sea next year with newly-acquired machinery. With the canned shrimp, frozen shrimp will also be

exported to the U.S.A. through San Francisco and to Australia. Up to the present time, the firm operating this year's factoryship has been exporting annually some 1,000 metric tons of frozen shrimp produced in the Seto Inland Sea and Kyushu to the U.S.A. Poor shrimp fishing in Japan this year has made it necessary for the firm to export the shrimp caught in the North Pacific. The shrimp-canning factoryship (EIJIN MARU) production target is 50,000 to 60,000 cases of canned and 3,500 tons of frozen shrimp.

In *Korea*, canned fish produced by the 41 canneries accounts for about 15% of the total output of the processed fish. The canned fish is mostly supplied to the armed forces and about 15% of the production is exported. The total production is about 4 million cases (containing 32 cans of 0.45 kg. each) per year. During 1960, horse mackerel and saury-pike accounted for more than 90% of the canned fish. The Korean Canning Industry employs some 3,600 men, most of them part time during the fishing season.

In *Federation of Malaya*, the joint Japanese-Malaya fishery products company in Penang, Malaya, is using tuna from the Indian Ocean in its canned tuna pack. Three types of tuna are caught in the Indian Ocean: albacore or white-meat tuna; and yellowfin and big-eye, both of which are called light-meat tuna. In addition, a number of spearfish, including swordfish, are caught, but there has been no demand for their meat on the local market, and they are not canned. The tuna canned by the company is packed in cottonseed oil or soyabean oil. A small quantity for the Danish market has been packed in tomato sauce. The size used is the 7-oz. can. About 7,000 cases (48 7-oz. cans) per month are packed. Until recently most of the canned tuna was shipped to West Germany, with smaller quantities to Denmark, Holland, Belgium, and the U.K. However, in July Canada received a shipment. There is still no market for tuna in Malaya itself. The factory is planning expansion during 1962. A tuna by-products plant is in operation

producing meal and oil from the heads of trimmings.

In *Pakistan*, two fish canning plants and one canning-cum-freezing plant is under construction. In addition, there is already one cannery operating in Karachi.

In *U.S.A.*, there have been no significant changes in the canned fish industry. The fish canning industry in the United States endeavors to produce canned food not only acceptable to the widest circle of consumers, but which may be chosen in preference to other competing protein food. Principal species of fish canned in the United States include mackerel, tuna, herring, salmon, oysters, clams, shrimp and crab.

In *Vietnam*, the only cannery is in Phan Thiet which cans *Dorosoma* in tomato sauce in 375 g., 170 g., and 120 g. cans the total production being 600,000 cases. In addition two other canneries in Saigon occasionally can fish.

Other Non-Traditional Products

In *North Borneo*, a Japanese fishing company started live-bait and line fishing for skipjack and yellow-fin tuna in May 1959, based at Si-Amil Island near Tawau, North Borneo. The shore base is capable of handling 15 tons of fresh fish per day. The fish (mainly skipjack) is processed into dried smoked skipjack meat (dried bonito) and exported mainly to Ceylon. The offal is cooked and dried, and exported mainly to Hong Kong as raw material for fish meal. A total of 2,075 metric tons of fresh fish was landed at the base in year 1961. The skipjack is dressed in the same way as for katsuobushi and cooked in about 6% brine. It is allowed to cool overnight and then smoked at 85°C. for several hours. The product is kept in an insect-free store room before export.

In *Japan*, production of fish (tuna and tuna-like fish are generally the principal ingredients) ham and sausages in Japan for the first six months of 1961 was estimated at 36,200 metric tons. This represents an increase of about 30% over the same period

last year, when production totaled 27,700 metric tons. Production of fish hams show the greatest increase, from 5,300 tons in January-June 1960 to 7,500 tons in the same period of 1961, or about a 42% increase. Fish sausage production this year totaled 28,700 tons, as compared to 22,400 tons last year, an increase of about 28%. Hopes were held of producing over 100,000 tons of fish sausages and fish hams in 1961 (1960 production was 85,500 tons), but it seems that this target was somewhat difficult to achieve. Production was down in February and March (tuna-like fishes which are used extensively in the production of fish sausages and hams were in very short supply at that time) but picked up in April. Production for June 1961 exceeded by 60% that of June 1960. The increase in 1961 production is attributed primarily to the establishment of a number of large new fish sausage-ham plants. One of the largest Japanese fishing companies has completed the construction of a three-story fish sausage-ham plant and a four-story cold-storage plant (capacity 4,000 metric tons), including a freezing plant capable of freezing 30 metric tons of fish in eight hours, at Kurihama. Facilities include a research laboratory and quarters for company personnel. Total construction cost was one billion yen (US\$ 2,777,777). The new fish sausage-ham plant is capable of producing 600,000 pieces of fish sausage and hams per day. The firm has other fish sausage plants, one in Sapporo, Hokkaido (daily capacity 50,000 pieces), one in Ishinomaki, Miyagi Prefecture (daily capacity 30,000 pieces), another in Hiroshima (daily capacity 30,000 pieces). The daily productive capacity of all four fish sausage plants now totals about 700,000 pieces.

In U.S.A., certain new techniques such as irradiation are being studied to preserve fish. Initial studies on the pasteurization by radiation of selected fishery products indicate that shelf-life of irradiated fresh haddock and clams can be increased by 10 or more days. This process must be used with refrigeration.

FISH PROTEIN CONCENTRATES

There have been no further developments reported on these products (for human consumption) in the Region. Recommendations arising out of the FAO International Meeting on Fish in Nutrition, held at Washington, D.C., during 19-27 September 1961 as well as at the FAO International Emergency Meeting on Fish Meal held at Rome during 20-29 March 1961 are given elsewhere.

An account of researches carried out in India is given below:

The following is a summary of seven papers published in *Food Science*, Feb. 1962.

(1) Preparation of edible flour from oil sardine (*Clupea longiceps*), pp. 37-39.

A process for the preparation of edible fish flour of good quality, with a low bacterial count, from oil-sardine has been described. The process consisted of four steps: (i) dressing, cooking and pressing of oil and water (ii) drying and coarse-grinding, (iii) extraction with ethanol and drying in vacuo of 80°C and (iv) powdering and packaging. The fish flour had a protein content of over 80 per cent, calcium content of 3.8 per cent and fat content of less than 0.5 per cent. It was free from *B. coli*, *Salmonella* and pathogenic anaerobes and the total count varied from 10,000 to 15,000 in 2 batches of the product.

(2) Chemical composition and shelflife of a protein food based on low fat groundnut flour, Bengalgram flour and fish flour, pp. 39-41.

A process for the preparation of a protein food consisting of a 2:1:1 blend of low-fat groundnut flour, Bengalgram flour and fish flour and fortified with essential vitamins and calcium has been standardised. The protein food is available in two forms (1) seasoned, for use in soups and savoury preparations and (2) unseasoned, for use in puddings and sweet preparations. It contains about 50 per cent protein and provides nearly the same amounts of calcium and riboflavin as skim milk powder when compared

on the same protein basis and also substantial amounts of vitamins A and D. Both the seasoned and unseasoned products kept well at 37°C in sealed containers for a period of 8 months. The loss of vitamin A was about 25 per cent and that of thiamine was about 14 per cent in samples stored as 37°C for 8 months.

(3) Supplementary value of proteins of fish flour to those of groundnut flour and the protein efficiency ratio of a protein food containing groundnut, Bengalgram and fish flour, pp. 42-44.

The Protein Efficiency Ratio of fish Flour from oil sardine (2.92) was nearly of the same order as that of the proteins of skim milk powder (3.04) at 10 per cent level of protein intake over a period of 4 weeks. The Protein Efficiency Ratio of blends of groundnut flour and fish flour proteins in the ratio of 3:1 and 1:1 were 2.08 and 2.48 respectively as compared with a value of 1.5 obtained for groundnut flour. The Protein Efficiency Ratio of the proteins of a 2:1:1 blend of groundnut flour, Bengalgram flour and fish flour (2.56) was significantly higher than that (1.79) of a 3:1 blend of low-fat groundnut flour and Bengalgram flour (Indian multi-purpose food).

(4) Supplementary value of fish flour and a protein food containing low fat groundnut flour, Bengalgram flour and fish flour to poor rice diet, pp. 45-48.

Supplementation of a poor Indian rice diet with fish flour, or a protein food based on 2:1:1 blend of groundnut flour, Bengalgram flour and fish flour to provide about 5 per cent extra protein in the diet resulted in a highly significant ($P < 0.001$) increase in the growth of rats. There were no significant differences in the mean weekly growth rates between the two protein supplemented diets. The mean fat content of the livers of rats fed on the control rice diet was significantly higher and the mean protein content significantly lower than the corresponding values for the rats receiving diets containing the protein sup-

plements. Livers of animals fed on the rice diet showed mild to moderate degree of parenchymal damage of the protein deficiency type, while those of rats receiving the protein supplements were quite normal. No significant differences were observed in the mean retentions of protein per 100 g. increase in body weight of rats fed on the rice diet or the same supplemented with protein foods.

(5) Supplementary value of fish flour fortified with vitamins to poor Indian diets based on different cereals and millets, pp. 49-51.

Supplementation of poor Indian diets based on rice, wheat, jowar (*Sorghum vulgare*) and ragi (*Eleusine coracana*) with fortified fish flour at 3 per cent level or skim milk powder (fortified with vitamins A and D) at 7 per cent level (so as to provide 2.5 per cent extra protein and about 100 mg. per cent extra calcium to the diets) caused a highly significant increase in the growth of rats. Fish flour promoted slightly better growth than skim milk powder. The mean haemoglobin and red blood cell contents in the blood of rats receiving supplements of fish flour or skim milk powder were slightly greater than those of control groups fed on the poor Indian diets. There were no significant differences in the mean fat contents of the livers of rats fed on the different diets. The mean protein contents of livers of rats receiving supplements of fish flour or skim milk powder were significantly greater than those of the livers of control groups not receiving the supplements.

(6) Supplementary value of fish flour and a protein food containing low fat groundnut flour, Bengalgram flour and fish flour to a maize-tapioca diet, pp. 52-56.

A diet based on 1:1 blend of maize and tapioca contained only about 5 per cent protein and promoted very little growth (1.8 g./week) in albino rats. Supplementation of the diet with fish flour, a protein food based on 2:1:1 blend of groundnut flour, Bengalgram flour and fish flour or skim milk powder to

provide 10 per cent extra protein in the diet, resulted in a highly significant ($P < 0.001$) increase in the growth of rats. There were no significant differences in the mean weekly growth rates (19.3-19.7 g./week) on the different protein supplemented diets. The mean fat content of the livers of rats fed on the maize-tapioca diet was significantly higher ($P < 0.001$) and protein content significantly lower ($P < 0.000$) than those of rats receiving the protein supplements. The livers of rats fed on the control maize-tapioca diet showed moderate degree of parenchymal damage of the protein deficiency type and severe periportal fatty infiltration. On the other hand, the livers of animals receiving the different protein foods were quite normal indicating that when providing 10 per cent extra protein to the diet, the protein food consisting of 2:1:1 blend of groundnut flour, Bengalgram flour and fish flour was as effective as fish flour or skim milk powder in correcting the protein deficiency in the diet. No significant differences were observed in the mean retentions of protein (17.1-17.4 g.) per 100 g. increase in body weight of rats receiving the different protein foods.

(7) Relative value of a protein food containing fish flour, groundnut flour, and Bengalgram flour as compared with skim milk powder in meeting the protein requirements of depleted rats, pp. 57-61.

Male albino rats weighing about 100-110 g., when fed on a nitrogen-free synthetic diet for a period of 25 days, lost on an average about 40 per cent of body weight, 42 per cent of total body nitrogen, 50 per cent of liver weight and 55 per cent of total liver nitrogen. The xanthine-oxidase activity of liver was completely lost. There was a significant reduction in the total serum proteins, haemoglobin and red blood cell count of the blood. When the protein depleted animals were rehabilitated by feeding for 21 days on diets containing 20 per cent protein from a protein food based on 2:1:1 blend of low fat groundnut flour, Bengalgram flour and fish flour or skim milk powder, the serum protein levels and haemoglobin and red blood

cell counts were restored to normal levels. The xanthine-oxidase activity of the liver was also restored to normal level. The mean gains in body weights per gram of protein intake were 1.94 and 2.08 and the mean gains in body weight per gram of protein retained were 6.05 and 6.15 respectively. The mean protein retentions expressed as percentage of the intakes were 32.06 and 33.92 respectively on the two diets. No significant differences were observed in any of the above constituents between the two groups of rats fed on diets containing protein food or skim milk powder.

In U.S.A., fish protein concentrate processed from whole fish is not being produced. At least two plants have or are developing solvent extraction methods for this product for animal feeding use. A survey of the world's fish protein concentrate processing methods has been accomplished by the U.S. Government. This survey is the basis for a U.S. research program to develop a completely adequate and economical process for fish protein concentrate manufacture.

In view of the keen interest evinced in fish protein concentrates, a paper prepared by FAO with particular reference to Peru, is reproduced below for the information.

EXTRACT FROM A NOTE ON A PROPOSAL TO MANUFACTURE FISH PROTEIN CONCENTRATES IN PERU

Prepared by FAO Fisheries Division

Fish Protein Concentrates—Characteristics and Specifications

In considering the manufacture of fish protein concentrates in powdered form, it is essential to recognise the typical characteristics of these products and what bearing these have on the equipment and processes to be used. For the purpose of these and similar projects, where the production of fish protein concentrates, as described in the tentative specifications, is envisaged as supplementary to the manufacture of fish meal, three types of product have been specified. These tentative specifications for fish protein

concentrates as adopted by the Panel of Experts convened by FAO in Washington in September 1961 are appended. The specifications give the minimum requirements for each type. Type A is completely, or almost completely, deodorized and defatted, Type B is partly deodorized and defatted and Type C is non-deodorized and non-defatted.

Existing Equipment and Processes for the Manufacture of Fish Protein Concentrates

The following is a summary of what is known to FAO concerning available equipment and processes used for the manufacture of fish protein concentrates in different countries. In this connection, it must be emphasized that the manufacture of Types A and B products from a Type C product has so far been restricted to batch production on a small scale and that continuous type extraction plants have not yet been tested on fish.

(a) Types A and B Products

Two groups of processes can be distinguished:

(i) Production of Types A and B in *one stage*, directly from raw fish by azeotropic dehydration and lipid extraction with partial or complete deodorization. Fish protein concentrates of Type C cannot be manufactured by this method. (Examples of this process are: VioBin process, Vogel process, process developed at the Herring Industry Board Reduction Factory in Great Yarmouth, England, process developed at the Fisheries Research Board of Canada, Halifax, process developed at the Norwegian Fisheries Research Institute, Bergen).

(ii) Production of fish protein concentrates in *two stages*, the first of which consists in producing a concentrate of Type C. The second stage is a solvent extraction of Type C, leading to a concentrate of Types A and B. (Examples of this process are: that developed by Societe Azote Union, Safi, Morocco, South African Fish Meal Producer's Association, Capetown, and Astra International, Södertälje, Sweden).

The Solvents used in the various processes for making fish protein concentrate of Types A and B are ethanol, isopropanol, hexane, ethylacetate, acetone and ethylene dichloride. The solvents used may affect the wholesomeness of the product. They must be eliminated from the final product because of undesirable effects on taste and flavour. No toxic residues must be allowed to remain in the final product. Good experiences are recorded with ethanol and isopropanol. In most of the equipment to be used for manufacturing concentrates of Types A and B, various solvents can be utilized but trials have to be carried out before switching from one solvent to another.

The apparent merits and demerits of the various processes in relation to requirements in Peru are discussed below. The conclusion is that the information available is sufficient for the Peruvian Government and industry to come to a decision about the manufacture of Types A and B in Peru now, but that the selection of a specific process might be made dependent on further investigations and trials. If the decision is positive, these investigations and trials could take place concurrently with the first phase of the campaign for the introduction of fish protein concentrates into the diet of protein-deficient people in Peru, namely the development of suitable vehicles including testing for palatability. Meanwhile, FAO is now conducting widespread enquiries in order to supplement the analytical and operational information available at present.

(b) Type C Products

Subject to certain precautions and control with regard to the quality of the raw material and standards of hygiene during processing, these products can be manufactured in conventional fish meal equipment. The methods can again be divided into two groups:

(i) Those where the raw material is dehydrated by direct heat (flame driers);

(ii) Those where the raw material is dehydrated by indirect heat (indirect steam driers).

It is fully realized that satisfactory products might be produced by all the methods involved. In order to decide what type of process should be selected for Peru, it appears that the following points ought to be taken into account:

(i) The process should be easily controllable and not need highly skilled operation.

(ii) The equipment should be easily serviced and cleaned in order to meet the requirements necessary for food processing equipment.

Investigations Concerning the Manufacture of Fish Protein Concentrates

There is widespread interest on the part of the fishery industry, food technologists and nutritionists in the development of equipment and processes for the manufacture of fish protein concentrates suitable for human consumption, and certain investigations now proceeding offer hope of success at a fairly early date. Among these, FAO has assembled information from the following:

Schlotterhose and Company
Maschinenfabrik, Postfach 329
Bremerhaven-Fischereihafen 4
Western Germany

Stord Marin Industry A.S.
Stord, Norway

Rose, Downs and Thompson Ltd.
Old Foundry, Hull, England

Edw. Renneburg and Sons Co.
2369 Boston Street, Baltimore 24
M.D., U.S.A.

De Smet
38 Avenue de France
Anvers, Belgium

Lurgi Gesellschaft für Wärmetechnik
MBH

Frankfurt-am-Main
Western Germany

Fisheries Research Board of Canada
5 Terminal Road, Halifax, N.S.
Canada

Herring Industry Board Reduction
Factory
Yarmouth, United Kingdom

Norwegian Fisheries Research Institute
Fisheries Department
Lars Hillesgate 26, Bergen, Norway

Bureau of Commercial Fisheries
U.S. Fish and Wildlife Service
College Park, Maryland, U.S.A.

Societe Azote Union
Safi, Morocco

South African Fish Meal Producers'
Association
Capetown, South Africa

VioBin Corporation
Monticello, Illinois, U.S.A.

UNICEF Fish Flour Plant
c/o ISESA
Quintero, Chile

Astra International
Södertälje, Sweden

Considerations Affecting the Proposed Project in Peru

During discussions between FAO and the fish meal manufacturers in Peru, the latter indicated their interest in an installation capable of producing 1,500 tons annually of fish protein concentrates of Types A, B and C, without restriction below this limit of the capacity to produce any one of these types.

It will be evident that in the circumstances described above, the manufacturers are faced with a number of alternatives which must be evaluated in terms of the commercial risks involved and the prospects for a profitable return on investments. These alternatives are described below, together with FAO's comments on the apparent advantages and disadvantages from the standpoint of technical, economic and organizational considerations:

(a) It is recognized that an annual production of 1,500 tons, such as is visualized by

the fish meal manufacturers in Peru, is considerably in excess of the requirements of the projected campaign and that the surplus will be marketed together with fish meal for animal feeding. In view of this, and also since some Type C product will probably be required in any case (for the purpose of the campaign), it is assumed that the project in Peru will be based on the manufacture of a Type C product. The manufacture of Types A and B products will be based on processes involving the manufacture of a Type C product as a first stage (production in two stages).

(b) With regard to the manufacture of a Type C product, it has been mentioned above that conventional fish meal equipment can be used for this purpose. It is a matter for the manufacturers to decide whether to install a new plant or to make available an existing plant for this purpose. In this connection, it is strongly recommended that whatever equipment is used, whether new or existing, the installation should be used exclusively for the manufacture of a Type C product and should be operated quite separately from other installations manufacturing products below the standards required for human consumption, with due regard for the control of raw material and standards of hygiene as mentioned above. The manufacture of the fish protein concentrate should be carried out in a closed building.

(c) With regard to the manufacture of fish protein concentrates of Types A and B, continuous production processes have been used so far only for products other than fish, and on a scale much larger than that envisaged in Peru.

(d) For the manufacture of Types A and B products, therefore, the manufacturers could adopt one of the following alternatives:

(i) A rotary drum batch process using a plant to be purchased and installed by the fish meal manufacturers.

Comment:

The advantage would be that a Type B and perhaps A product could quickly be

produced in sufficient quantities for the promotion campaign. During the period, it would be hoped that the results of various experiments and pilot operations would be available, on the basis of which the manufacturers could then be further advised. If, at a later stage, the manufacturers decided to replace the rotary drum process by a continuous process, this might be done without changing the solvent recovery unit which accounts for the greater part of the cost of the equipment.

(ii) A pilot plant for continuous extraction set up and operated by interested manufacturers of equipments.

Comment:

Manufacturers of equipment have already indicated interest in making pilot plants available in Peru or to make trials with anchoveta in their own countries. Production would be on a small scale, but would be adequate for gaining experience with the process and for supplying material for the early stages of the promotion campaign.

(iii) An existing continuous extraction plant now being used in Peru for products other than fish.

Comment:

The capacity would undoubtedly be much greater than that required for the manufacture of fish protein concentrates in Peru. The arrangement would depend on the willingness of a firm in Peru already operating a continuous extraction plant to make the plant available and to operate it under appropriate conditions, including the use of specified solvents and the exclusive use of the plants at given periods for the manufacture of fish protein concentrates.

(iv) A full-scale continuous extraction plant purchased and installed to the specifications of the fish meal manufacturers.

Comment :

FAO could not recommend the outright purchase of any particular full-scale continuous extraction plant and considers further trials and investigations essential. However, interested suppliers of equipment may be willing to make such a plant available in attractive terms. This would be subject to negotiation once it has been decided to proceed with the project.

(e) In general, for a plant in which fish protein concentrates of Types A, B and C should be manufactured, the following characteristics should be given :

(i) Operate only with fresh, wet fish of good quality.

(ii) Be equipped in a fully sanitary manner, so as to qualify as a food processing installation.

(iii) Store the fish protein concentrates in such a way that no spontaneous heating can occur (storage of the concentrates in bags of suitable material).

Conclusions

It is necessary first to decide, in principle, whether in the light of the information now available, the campaign outlined in the draft plan of operation should be undertaken. If this decision is positive, the fish meal manufacturers could go ahead with setting up a new, or using an available, plant for the production of fish protein concentrate of Type C. The manufacturers could either choose one of the alternatives listed under 5 (d) above or, if on closer examination there is not one which appears sufficiently attractive at once, defer for the moment the final decision concerning the process and equipment to be used in the manufacture of fish protein concentrates of Types A and B (see above p. 220). Supplies of these products could be obtained from other countries for the purpose of the early stages of the promotion campaign. This procedure would probably be effective in determining the requirements of the market.

As part of the project, FAO would make available the services of a suitably qualified food processing technologist, who would be ready to advise the industry on the choice of methods and equipment. He will have at his disposal a good deal of additional information on existing processes and equipment which FAO and other agencies are now assembling. Moreover, a number of pilot operations untaken both by suppliers of equipment and by research institutes are at present in progress and well advanced. The FAO expert will keep in close touch with these pilot operations. By the time preparations for the acceptability trials are complete, vehicles for the introduction of fish protein concentrates into the diet of protein-deficient people have been developed and palatability trials have been carried out, it is likely that considerably more will be known about the various processes for the manufacture of Types A and B, so that, if the decision of the choice of equipment is deferred, it could then probably be taken with a good deal of confidence.

**Tentative Specifications for Fish
Protein Concentrates**

(Edible Fish Flour and Fish Meal)

The following criteria are considered important to guarantee the quality of fish protein concentrates (edible fish flour and fish meal) for human consumption.

1. *Raw Materials* : The various types of fish protein concentrates (A, B and C) may be prepared from the same material. This material need not be confined to fish flesh, but could include whole fish, headed and gutted fish, or trimmings of suitable type. In all cases, it should be in a condition fit for human consumption.

2. *Processing* : The processing methods which could be used to produce Types A, B and C of fish protein concentrates need not be specified in detail. However, sanitary precautions ordinarily applied in producing human food must be observed in the handling of the fish from catch to end of processing.

3. *Production Specifications :*

	<u>Type A</u>	<u>Type B</u>	<u>Type C</u>
a) Protein Nx6.25			
Protein content (at 10% moisture content)	minimum 67.5%	minimum 65%	minimum 60%
Pepsin digestibility	minimum 92%	minimum 92%	minimum 92%
Available lysine	minimum 6.5% of the protein	minimum 6.5% of the protein	minimum 6.5% of the protein
b) Moisture	maximum 10%	maximum 10%	maximum 10%
c) Fat content	maximum 0.75%	maximum 3%	maximum 10%
d) Chloride	maximum 1.5%	maximum 1.5%	maximum 2%
e) Silica	maximum 0.5%	maximum 0.5%	maximum 0.5%

4. *Odor and Taste :* Type A should have no more than a faint odor and taste when wetted with boiling water in a closed container.

No specifications can be made for types B and C since they will show a wide range of odors and flavors.

5. *Storage Stability :* Type A, after six months storage at 80°F (27°C); and when packed in a hermetically-sealed container, should exhibit no significant deterioration as judged by the development of off-flavors or by loss in protein quality as shown by digestibility and available lysine values appreciably below the specific minima.

In types B and C the requirements are the same for protein quality, but no specification is possible for the development of off-flavors.

6. *Bacteriology :* Type A should be free from *Enterococci*, *Salmonella/Shigella*, Coagulase-positive *Staphylococci* and *Clostridia* and have a total bacterial plate count at 37° of not more than 10,000 per gram.

For types B and C the same requirements would apply for *Enterococci*, *Salmonella/Shigella*, Coagulase-positive *Staphylococci* and pathogenic anaerobes.

7. *Safety :* No additives, preservatives or harmful solvent residues should be present in type A. Safety tests on at least one species of animal should be done according to the requirements of the appropriate official

agency of the country where the product is to be used.

Types B and C should contain no solvent residues and no substances such as anti-oxidants, or flavorings should be added unless permitted by the consuming country. Safe test with animals are required as with product A.

8. *Methods of Analysis :*

- (a) The fat content of Types A and B should be determined by extraction for six hours with boiling ethanol or chloroform-methanol (2:1). The fat content of Type C should be determined by extraction with ethyl ether for six hours in a Soxhlet apparatus.
- (b) Available lysine should be determined by the method of Carpenter.
- (d) Prior to large scale testing and, if accepted for mass feeding trials, at reasonable intervals thereafter, biological evaluation of protein quality would be required. The level should be specified.

Other problems remain to be dealt with when the necessary information is available. Thus there are problems of dispersability, grittiness and volatility, particularly for products of Type A. There are problem of packaging. The suggestions above

have been made in an effort to combine technological feasibility with adequate nutritional and palatability requirements. It is recognized that the existing methods of analysis are, in many cases, inadequate and diverse procedures are employed in different countries for products of these types. It is to be hoped that studies currently underway on methods of analysis will soon be completed in order that they may be used for the necessary determinations as outlined in these specifications. The first draft of the above specifications was prepared by a Working Party at the FAO International Meeting on Fish Meal, Rome, March 1961. In June 1961, the specifications were reviewed and slightly amended by the WHO/FAO/UNICEF Protein Advisory Group. The specifications were further discussed by the Interim Panel of Experts on Fish Meal and Fish Flour for Human Consumption which was convened by the Director-General of FAO at the end of the FAO Conference on Fish in Nutrition, Washington, September 1961. The tentative specifications given above are a composite of the views expressed at the above meetings.

BY-PRODUCTS FROM FISH

Fish Meal

In *Australia*, fish meal is produced on a very small scale, using waste from canneries of other processing plants. There is no industrial fishery in Australia to supply a fish-meal industry. Australia produced about 3,500 tons p.a. of whale meal and 2,000 tons p.a. of dried whale solubles in 1961.

In *North Borneo*, the fish bones and other waste obtained as a by-product in the dried smoked skipjack industry, are dried in the sun and exported to Hong Kong for conversion into meal for animal feeding or fertilizer.

In *Ceylon*, the modern fish meal plant set up at Mutwal under the Canadian Colombo Plan aid operates on the dry rendering principle and has a capacity of 3 tons of raw material per batch. The raw material is directly fed into a vacuum drier and dried to

a moisture content of 40% or less. A vacuum of 510 mm. (i.e. a pressure 250 mm.) is maintained in the drier by means of steam and water pumps. The partially dried material is then pressed in a powerful hydraulic press under a pressure of 211 Kg./cm² (3,000 lb./sq. in.) squeezing out as much moisture and oil as possible. The resulting cake has a moisture content of less than 10% and oil content of about 5 to 6% and is milled into meal. The meal is locally used for animal feeding.

In *India*, a fish meal plant (dry rendering process) with a capacity of 10 tons of raw material per batch has been installed at Bombay. It proposes to utilize small-sized scianid fish for which there is not much demand and which form a considerable proportion of trawlers' catches. About 10,000 tons of fish meal per year are produced of which about 3,000 tons are exported. Another fish meal plant of similar capacity has just been completed. Experiments have been successfully carried out to initiate pilot plant operations for proper utilisation in Maharashtra, Kerala and Madras and Andhra Pradesh. Fish meal is produced on a large scale for export purposes in Gujarat, Maharashtra, Mysore, Kerala and Madras and fish liver oil and manure on increasing scale in all the maritime states.

In *Japan*, about 660,000 tons of fish including waste from canneries, etc. were converted into fish meal.

In *Korea*, the fish meal industry employs some 300 people. The raw materials include saury-pike, hairtail, etc., and waste from canneries. The material is boiled for a short time by soaking in boiling water (10 to 20 minutes), pressed to separate oil and water, sun-dried and pulverized. The meal has generally 10.5 to 13% moisture, fat 8.5 to 13.6%, and protein 39 to 44%. Yield of the product is 25 to 35%. The fish meal is used for animal feeding. Two mechanized fish meal plants are under construction, are with a capacity 1,000 tons/year and the other 4,000 tons/year.

In the *Federation of Malaya*, the waste products of the tuna cannery such as heads,

trimming, etc., are converted into meal. The heads and trimmings are separately processed. The trimmings are directly dried in sun resulting in a meal containing 15% moisture, 4 to 5% oil, 78 to 89% protein and price is 160 US\$ per ton. About 5 tons are processed every month. About 20 tons of heads are processed every month. The heads are split, boiled in water in a cauldron for an hour, oil decanted, pressed and sun-dried. Up to 45 liters of oil are obtained from 450 Kg. of raw material. The meal made from cooked heads contains 15% moisture, 43 to 45% protein, 8% oil and is priced at US\$80 per ton.

In *Pakistan*, four fish meal plants are in operation. Raw fish is used but home-made fish meal or dried fish are also used as raw material for preparing a more "refined" meal.

In *Philippines*, there is a modern fish meal plant with a capacity of 2 tons of raw material per day.

There are two modern fish meal factories operating in *Thailand* at Chumporn and Ranong in addition to numerous small scale home "factories" for making fish meal.

In *U.S.A.*, there are no significant recent changes in the processing of fish meal and solubles. Research in this field has been primarily conducted in the feeding of poultry. The following publication may be of interest.

The nutritive value of fish meal protein: A comparison of chemical measurements with a chick feeding test. *J. Assoc. Off. Agr. Chem.*, 43: 760-762.

A study was made of the possible relationships between the results obtained from (a) the first action AOAC method for determining pepsin digestibility of animal protein feed stuffs, (b) the growth of chicks fed the meals, and (c) other chemical analyses, using six herring and four tuna meals prepared in the laboratory under a wide variety of carefully controlled conditions. The six herring meals averaged 6% gain in weight

per day per chick and 96% digestible protein. Deviations from these averages were moderate for growth effect and slight for digestibility. When a meal was produced under extreme processing conditions, as was the case with one tuna meal, both pepsin digestibility and the chick growth possible with the meal were drastically lowered. Crude fiber content of a fish meal higher than one per cent may be caused by overheating during processing and may indicate a lowered nutritive value. There was apparently no consistent relationship between the protein or ash content of the meals tested and their nutritive value as measured either by pepsin digestibility or chick growth.

The rapid expansion of the world fish meal production during recent years has created new problems of utilization and an extract of the proceedings of an FAO meeting in which some IPFC Member Governments took part is given below.

FAO International Meeting on Fish Meal, Rome, 20-29 March 1961

The International Meeting of Fish Meal was convened by the Director-General of FAO at the request of certain Member Governments. The Meeting was called as a result of a rapid increase in the world's productive capacity for fish meal occurring without the use being made of the product keeping pace with this expansion and stocks of meal accumulated, prices fell substantially and production had to be reduced in a number of countries. Less than full use was being made of this valuable material which goes directly or indirectly into animal and human food and the incomes of fishermen and others involved in its production were being seriously lowered. The purpose of the meeting was to assess the world demand for fish meal, both short and long term, in relation to resources and productive capacity; to consider ways and means of increasing the effective demand for fish meal by action on the part of governments and of the industry individually or in concert; and to explore

possibilities of ensuring stable conditions in the international market for fish meal. The Meeting was attended by participants from 27 nations and observers from a number of international organizations. An extract from the report of this meeting is given below

The use of fish protein concentrates (fish flour and fish meal) for human consumption

The Meeting received much information from member countries, delegations, and representatives of FAO, UNICEF and WHO, resulting from their several and joint activities over recent years which bore on the need for protein concentrate in the diets of the human population of the world. This information presented may be summarized in the following manner:

Terminology: A considerable amount of discussion was given to the proper terminology to be applied to the wide range of fish protein concentrates which are available or could be produced for human consumption. For the purposes of the Meeting the term "fish flour" was used to cover the very finely milled, defatted and deodorized types of dried fish materials that are used for the enrichment or supplementation of cereal products. The term "fish meal" was used to cover non-defatted and non-deodorized dried fish materials for use as human foods, having a wide range of texture of texture, particle size, fat content, flavor, color, etc.

Needs:

1. The human body requires for healthy growth and maintenance a certain proportion of protein in the diet and in this protein proportion of the diet there must be a wide range of amino acids, several of which are essential for the body's growth and health.

2. Such of the essential amino acids as methionine and lysine can be practicably synthesized commercially and added to the diet to remedy these deficiencies. It is expected that the progress of organic chemistry will make such syntheses possible eventually for all or any essential amino acid. However,

it does not appear likely that this can be accomplished economically or practically on the volume and cost basis required for the world human diet for a period of some decades and for some products perhaps never.

3. Fish proteins contain all of the essential amino acids in combinations well balanced for the needs of the human diet; they are particularly suitable for the enhancement of the biological value of cereal proteins. In addition, fish protein concentrates are rich in calcium, phosphorus, and trace elements required by the human body as well as containing notable amounts of vitamins in the B complex. Other animal protein also contain all these amino acids, but are not so readily available in adequate amount.

4. There appears now to be a challenge to the fish meal industries to elevate the status of this commodity still further to make it suitable for human consumption. The availability of resources is well established, technological know-how for development of suitable processing techniques and equipments can be found for the development of suitable products, and the deliberations of this Meeting have clearly spelled out the need that exists for the products. There remains only the problem of the fish meal industry to meet this challenge for the elevation of their products to the higher level of utilization, that of direct consumption by humans.

5. Fish can be processed to provide for man a high quality, easily digested and complete animal protein source by exercising good practices in the preparation, packaging and storage of such a product as fish protein concentrate. The product should have a minimum protein content of 65 per cent and this protein should have a biological value of not less than 80 per cent. This product would then be well suited for use, e.g. at the rate of 10 to 15 grams per day for each child, in the many areas suffering from protein deficiency.

6. Calculated very roughly, it may be said that about one million tons of such fish

concentrate will satisfy the annual dietary requirements of about 100,000,000 people in a population having a normal spread of age.

7. Lack of adequate protein in a child's diet results in failure of growth, muscular wasting and oedema of varying degrees—the so-called "kwashiorkor" of West Africa—or in "marasmus", failure of growth and wasting of tissues. The mortality rate in both instances, if untreated, is high. The addition of foods rich in protein of high quality is the only method of treatment. In adults, protein deficiency leads to lack of full physical vigor and lowered resistance to disease. There was attempted in the Meeting the estimation of how many human beings in the world now suffer from protein deficiency. A conservative estimate of at least 500 million was arrived at, made up of perhaps four-fifths pre-school age children and most of the remainder pregnant and lactating mothers.

8. Protein production can be expanded only with great difficulty in several areas of the world, in some instances because the land cannot be spared from production of other needed human foodstuffs, and in other instances because endemic animal diseases make the raising of livestock impracticable. Ultimately, despite any and all land-produced protein supplies, the resources of the sea must be more fully utilized.

9. Large populations of fish occur in the world oceans, often in reasonable adjacency to large human populations suffering from protein deficiency. However, for technical and economic reasons, such supplies of fish often cannot be fully marketed and used for human consumption in industrial form.

10. For these reasons it would appear certain that the need for fish protein concentrate in the world's human diet is great, urgent and should be capable of fulfilment. What value to give to the quantity needed is uncertain, except to say that it is to be expressed in terms of millions of tons of fish meal and fish flour per year.

Acceptability :

Numerous trials on rather broad scales have been conducted by competent nutritionists to determine the acceptability of fish protein concentrates to humans in such different conditions as are found in Sweden, Senegal or other territories of the French Community, Morocco, Ghana, Union of South Africa, Chile and Mexico, among others. The conclusions from these field tests can be summarized as follow :

1. Products which are highly acceptable to human wants as well as needs can be made available, and in large quantities, through the manufacture of protein fish concentrates.

2. These are divisible into two sorts :

a) *Fish Flour* : Where the taste, odor, and characteristics of fish meal should be absent. In such instances the defatted and deodorized product provides a material which can be added to cereal or other foods in quantities adequate for nutritional needs without being detectable.

b) *Fish Meal* : Where the taste, odor, and characteristics of fish meal are acceptable. This condition applies to broad areas of human population and can be readily met by the preparation of products with whatever degree of fat and odor removal is required for a particular population.

3. Separate human societies tend to be highly conservative, as well as being broadly and sharply varied, in respect of their food habits. For the most part, they will accept food only in the forms to which they are accustomed unless this attitude is changed through an educational program. This conservatism increases usually, in any particular society, with decrease in economic level in that society. It is frequently, if not normally, the case that the people who most urgently require protein supplements in their diets

are the least amenable to taking them unless they are in a form reasonably indistinguishable from foods they normally eat.

Present Use: Despite the demonstrable need and acceptability of fish protein concentrates by the human community, little use is presently being made of them in the world and no use is being made of them on what might be termed a fully commercial scale. In the Union of South Africa a thousand tons, more or less, of fish flour has been produced and eaten but this has been a subsidized experiment which has been temporarily, at least, terminated. Experimentation within the laboratory on better methods of preparation, etc., continues, however. In Sweden, since August 1960, a few hundred tons of fish flour have been produced by a private pilot plant and successfully utilized on an experimental scale. In Ghana, fish meal suitable for human consumption has been produced and successfully used, but the product is not yet in ordinary trade. Similar experiences have been had in other countries. A successful project of this kind appeared to be that going on in Morocco where fish concentrates are being currently produced, sold in normal commercial outlets, and enjoying a steadily increasing sale. For 1960 that country expects to increase production to approximately 2,500 tons. In the Federal Republic of Germany a pure, or nearly pure, fish protein concentrate called "Wiking Eiweiss" has been developed and is used for pharmaceutical purposes.

A number of conditions appear to be delaying the desirable expansion of the use of fish concentrates in human diets to the desired commercial scale or even the scale required for large sized emergency or trial work by international agencies or member governments. Among these conditions are the following:

Quality: Fish concentrates, in the form of fish meal, presently being manufactured on a large scale in many countries of the world have been developed for the primary purpose of feeding animals. Accordingly, the

standards of quality and sanitation under which they are presently being produced in large-scale ventures are not designed for human needs, and generally they are not suitable therefore in their present condition.

To foster the development of fish protein concentrates suitable for use in human dietary needs in protein-deficient areas, UNICEF and FAO have been financing acceptability and evaluation tests on a number of the products. They are willing to test such products in future. The principal problem, to date, has been to find a product which was sufficiently consistent from sample to sample. This is despite general agreement that satisfactory progress has been made both in laboratory and pilot plant scales toward the understanding and solution of nutritional, chemical, microbiological and toxicological aspects of the problem.

Cost of production: It was generally concluded that the cost of manufacture of a fish protein concentrate suitable for human consumption on a commercial or big test scale was high. To meet the above noted standards of quality, plant equipment may have to be re-designed, problems of sanitation control solved, and processing procedures suitably modified. The capital cost of doing this would be high. The operating cost, at least initially, would be substantially higher than in the production of such concentrates for animal consumption. Under present conditions of demand as differentiated from need, there did not appear to be the immediate market volume at price level which would be required to cover these added costs. Accordingly, in view of known factors, plus numerous uncertainties, money from the private sector of the economy had not yet ventured into the field of manufacture on a really commercial or a big test scale. There was general agreement that until these factors and uncertainties were substantially removed, no such private venture capital would be forthcoming.

Cost of marketing: The added costs that would be required to market these fish concentrates in normal channels of trade were

felt to be formidable. Accurate surveys would have to be made in each market where further information is needed to determine the type of product which that market would accept and normally but for food. The product would then have to be tailored especially for that market. The specifications in different markets were considered to be so different as to require several types of manufacturing plants. The cost of advertizing or use of demonstration programs to encourage the human population in the market area to buy or even accept gratuitously the product was unknown but probably large, at least for the first few years after introduction.

Specifications: There was considerable discussion during the Meeting on the need for agreement on specifications for fish meal and fish flour types of products. A Working Party of Committee B developed such specifications for the consideration of the Meeting. The Meeting agreed to accept these specifications as guide lines for interested governments, specialized agencies, and the fishing industry, to facilitate early submission of products qualifying for use in the contemplated feeding tests in protein-deficient areas. In order that continuing review and improvement of this report might be accomplished, the report will first be reviewed at the June 1961 session of the FAO/UNICEF/WHO Protein Advisory Group, and secondly at the FAO Fish in Nutrition Meeting, in September 1961. Out of these reviews it is expected that specifications for these products will be developed that can be accepted as recognized international standards.

The findings of the Working Party are annexed to this report.

It was generally agreed that, because of the above factors and others, private industry could not, by itself, be expected to invest the large sums of money necessary for the development and promotion of these products, nor did it seem feasible to expect under-privileged populations immediately and without any educational effort to appreciate the nutritional value of these products.

Accordingly, it was concluded that it would be necessary in many areas for individual governments, with the assistance and advice of nutritionists and home economists, to take the load in investigating ways and means of incorporating these products into the foods of their populations and in educating their people in the benefits to be derived from these first-class protein sources with a view to developing food habits which, in turn, would lead to the commercial establishment of these products. Money to get these processes started must come, at least in part, from the public sector of the world's economy.

It was further felt that FAO and other specialized agencies could render invaluable aid to these governments in the planning and implementation of this necessary work.

It was the general belief among the delegates participating in the Meeting that collaborative efforts between governments, industry, and international organizations should lead in the direction of mitigating the protein deficiency now affecting perhaps a billion of the world's present peoples and providing means for adequately feeding the new hundreds of millions which seem sure to come into the world within the next decade.

These collaborative efforts can be expected to provide tangible benefits to governments, to producing industries, to consumers, and, in short, to mankind.

In view of these considerations, the Meeting adopted the following recommendations:

Recommendations:

The Meeting, in considering the problem of increasing the demand for fish meal and fish flour for human consumption, took into account the serious protein deficiency in a large proportion of the world population, the suitability of fish flour and fish meal of appropriate quality to satisfy this deficiency, the availability of raw material for these products, and the present limitations on their use caused by problems of cost, production

and marketing, and lack of sources of finance.

The Meeting agreed that if expeditious progress is to be achieved in making use of fish flour and fish meal to fill the world protein food needs, an immediate and concentrated effort must be initiated to overcome these problems.

The Meeting considered the following proposals appropriate for this purpose:

(i) that the Director-General of FAO should set up, in consultation with other specialized agencies of the United Nations, a Working Group of experts to ascertain, as far as possible in qualitative and quantitative terms, the requirements of potential consuming countries for fish flour and fish meal for human consumption, and to advise FAO and, through it, the interested governments and specialized agencies of such requirements and the best ways and means to promote the consumption and marketing of these products;

(ii) that the producing countries should indicate in advance of this survey by the Working Group the extent to which they could, with existing production facilities, contribute suitable fish meal and fish flour, taking into account such standards and specifications of these products as may be generally acceptable in the consuming countries;

(iii) that the Director-General of FAO should invite the Governments of producing countries to contribute, free or at moderate cost, with the cooperation of their industries, such quantities of these products as are required for the necessary large-scale acceptability tests and promotion campaigns to be conducted under the auspices of FAO and other specialized agencies of the United Nations as envisaged under (i) above;

(iv) that the Director-General of FAO, in consultation with the other specialized agencies and the Working Group, should review progress of the work envisaged in the program. Should he consider, after the first

year's operation of the program, that useful progress had not been made owing to lack of suitable fish meal or fish flour, he should formulate proposals for the purpose of including the production of suitable fish meal or fish flour in the program in order to attain its objectives.

The Meeting considered the probable cost of such a program and, while not coming to a definite conclusion, thought it might well be in the order of one million U.S. dollars, spread over a period of the three years, if sufficient quantities of suitable fish meal and fish flour were made available gratis or at nominal cost. The cost would perhaps be in the order of one and a half million U.S. dollars if the development of production processes and the supply of suitable fish meal and fish flour were to be included in the program.

The participants of the Meeting, while not able to commit their Governments, agreed that these proposals were worth of urgent consideration. The Meeting therefore invited the Director-General of FAO to prepare more detailed estimates of the cost of implementing this program than those contained in Document S/3 Rev., and on the basis of these estimates, to consult the Member Countries of FAO and the specialized agencies and other interested organizations to decide what immediate action can be taken in the light of these proposals, possibly as part of FAO's Freedom from Hunger Campaign.

Fish Oils and Liver Oils

Recently *Australian* purchasers of shark liver oil announced that they no longer required this product, as synthetic Vitamin A was readily available. Alternative uses are being sought for this oil.

In *Ceylon*, there is a fully equipped fish liver oil plant in Mutwal near Colombo which has a maximum capacity of about 1 ton of liver per week. This plant is operated by the Government. In addition there is some very small scale extraction done by fishermen in a few coastal areas. Fish liver oil in the Government plant is prepared in a well equipped

factory and is sent out in sealed bottles and tins and so presents no processing or storage problems. The fish liver oil plant uses a steam rendering process to extract oil from shark and other big fish livers caught throughout the year. The oil is purified and blended with groundnut oil to an uniform vitamin potency. A labour staff of nine work this plant to produce about 35 tons of oil/year. This Government fish liver oil plant sells medicinal and veterinary oil both wholesale and retail and is also under contract to the Government Medical Stores for supplies of medicinal oil for hospitals and schools. This oil is standardized to 3,000 I.U. of Vitamin A/ml. The liver oil is packed in 4.5 litre tins and 240 ml. bottles.

In *Korea*, there are 46 plants making pollock liver oil and two plants making shark liver oil. Also viscera and livers of cuttle fish as well as saury-pike are used. The industry provides employment for 200 men. The product is exported to U.S.A. and Japan in sealed drums holding 220 to 300 liters each. The oil is exported as crude oil but a large scale liver oil concentrating and refining unit is under construction which when completed can produce 700 tons of refined fish liver oil. The present total production is about 900 tons per year and exports are valued at about US\$400,000.

In *U.S.A.*, there have been no significant changes in the processing of fish oils. Research studies are primarily aimed at developing new markets for this product. Extract from a pertinent publication concerning this program are given below:

Progress on studies in utilization of fish oil derivatives in ore flotation. *Comm. Fish. Rev.* 20(1): 14-19, 1958.

An empirical relationship exists between the iodine value of a number of fatty acids and the corresponding selectivity indices for an iron ore wash tailing, using 227 g. of collector per ton of ore, a pH of 6, and floating at room temperature. All of the unsaturated acids prepared by the Hormel

Institute from menhaden and tuna oils, and a number of other acids have been tested under similar conditions; the relationship is of general application. Maximum selectivity index occurs between pH 6 and 7 for all except one or two nonfish-oil acids. Frothability, froth stability, bubble size, and wetness of froth differ with the degree of unsaturation of the fatty acid. All of these factors markedly influence the selectivity index, but not always detrimentally. For optimum flotation, there must be a proper balance between collecting and frothing. Synthetic mixtures of stearic, oleic, linoleic, and linolenic acids, with iodine values averaging about 105, have been used for flotation at 227 g. per ton of ore, pH 6, and room temperature. It is significant that mixtures containing more than a certain proportion of either linoleic or linolenic acid give poor selectivity and excessive froths. Spot flotation tests have been made on a scheelite ore containing 1 per cent W_3O_8 . 227 g. of pure oleic acid per ton of ore gave a poor froth and a low recovery. The same quantity of bulk menhaden fatty acid (I.V.-217) at pH 10 gave excessive froth. Decreasing the level of addition of the acid to 133 g. per ton of ore and floating at pH 9 gave good frothing characteristics and good flotation of the scheelite. In the case of iron ore, decrease in the level of addition of unsaturated fatty acid from 227 g. through 112 g. to 67 g. per ton of ore decreased the froth volume, gave a higher selectivity between the iron oxides and the quartz, but lowered the selectivity index owing to a sharp decrease in the weight of concentrate. A general conclusion to be drawn from the work to date is that, at room temperature, the highly unsaturated fatty acids are potent frothers, and when present in moderate concentration in a mixture of fish-oil acids, they necessarily contribute to the excellence of a separation. The over-all effect of excessive concentration of such acids is detrimental. This statement should not be taken to mean that fish-oil fatty acids are precluded as flotation reagents, for in any use of fish oils for other purposes in which the highly unsaturated acids are required, the

fatty acids of intermediate value would remain, and could be used for flotation. A few spot tests were made on iron ore, using 227 g. of oleic acid and of the relatively saturated fraction (I.V. = 116) of a menhaden oil bulk fatty acid, at higher temperatures. The results were so excellent that similar tests were made using linoleic and linolenic acids, and several of the fish-oil fatty acids with iodine values greater than 190. The weights and remarkable cleanness of the products indicate extremely effective separations. Froths, with a given acid, are markedly different at elevated temperatures from those obtained at room temperature; flotation rates are greatly enhanced; and slime interference is reduced. Although the economics of high-temperature flotation has not been investigated, it is known that one industrial plant is competitively floating fluorite using steam injection. As far as the flotation of iron ore is concerned, a new and promising field of investigation is open not only with regard to utilization of highly unsaturated acids, but also with respect to excellence of the separation *per se*. An unexpected result of an investigation of a number of pure fatty acids is that the trans-isomers are more effective collectors than are the corresponding cis-isomers.

SEAWEED INDUSTRY

Resulting from the recommendation made at the 9th Session of the Council, a revised report on the use of seaweeds as human food has been presented as a Technical Paper in order to have this document published as soon as possible.

Australia has beds of the seaweed *Macrocystis pyrifera* but it has been found uneconomical to work them on present prices for alginates. Small beds of *Gracilaria confervoides* exist and these are harvested to supply seaweed for export.

In *India*, seaweed industry has not yet been developed fully, though even local people in the coastal areas of Madras and Gujarat have been using them as food and as fertilizers. A survey is being conducted on seaweed research for human utilisation.

In *Korea*, seaweeds are used for both edible as well as for industrial purposes, e.g. agar production and the total production is about 29,000 tons/year of which edible seaweeds accounted for about 16,000 tons. Processed products such as agar-agar, and dried laver (*Prophyra tenera*) are exported and amount to about 270 tons, and 200 tons, respectively.

There is no seaweed industry in *Pakistan*.

In the *U.S.A.* seaweeds are used for manufacturing a number of products used in the food industry. The use of seaweeds directly as human food is not extensive. Much of the seaweeds are still gathered manually but some of the firms employ mechanical devices such as underwater mowers and chain conveyors to harvest seaweeds. Among the industrial products manufactured in U.S.A., from seaweeds are alginic acid and its various derivatives from brown seaweeds, carageenin and derivatives from Irish moss (*Chondrus crispus*) and agar-agar. The total value of the production is approximately US \$12 million of which US\$5.25 million accounts for alginates, US\$4½ million for carrageenin, and US\$500,000 for agar-agar.

RESEARCH ACTIVITIES

Institutions

In *Australia*, research in fish handling and processing continue to be handled by the CSIRO Division of Food Preservation. Members of the staff of this Division have given lectures on fish handling and preservation at two training schools for fisheries operatives organized by C.S.I.R.O. Division of Fisheries and Oceanography, Cronulla, N.S.W.

In *Burma*, there is no separate institution for carrying out research in fish processing but some of the projects relating to fish processing technology are investigated at the Applied Chemistry Division of the Union of Burma Applied Research Institute at Rangoon, which has a food technology Division.

In *India*, the fish processing research is carried out in a number research institutes

and universities. In addition to a number of institutes run by State Governments there is a Central Institute of Fisheries Technology, Cochin, which has a Processing Wing. Fisheries research is also carried out at the Fish and Meat Division of the Central Food Technological Research Institute, Mysore.

In *Indonesia*, there is a technology section in the Sea Fisheries Research Institute, Djakarta, where research in fish processing is carried out.

In *Japan*, fish processing research is carried out in a large number of State as well as prefectural institutes, university as well as private industry. The main Government Institution is the Tokai Regional Fisheries Research Laboratory, Tokyo, which has a division of fish processing.

In *Korea*, the main research is carried out the Central Fisheries Experimental Station, Pusan, which has a number of regional laboratories. There is also a Central Fish Inspection Station at Seoul which does some research the main accent being on inspection fisheries products meant for export.

In the *Federation of Malaya*, the Fisheries Research Laboratory at Glugor, Penang, has a Technology Section.

In *West Pakistan*, fish processing research is carried out at the CSIR laboratories. In the East Pakistan, there is a Fishery Technology Laboratory at Comilla.

In the *Philippines*, the Bureau of Fisheries has a technology laboratory at Dagat-Dagatan, near Manila. Research is also carried out at the Universities.

The Technology Laboratory of the Department of Fisheries, *Thailand*, is mainly responsible for research in this field in Thailand. It is situated very close to the fish market and fish processing industry in Bangkok.

The *United States* Government Fisheries Technological Laboratories are located in the following cities: Gloucester, Massachusetts; College Park, Maryland; Seattle, Washington; Ketchikan, Alaska; Pascagoula,

Mississippi; and Ann Arbor, Michigan (Technological Station). Many universities and fish processing firms also conduct fisheries technological research.

The department of fisheries has a technology laboratory in Saigon, *Vietnam*. Research is carried out at the Pasteur Institute, Saigon.

Research Programs

In *Australia*, a conference of Federal and State fisheries officers in 1961 recommended that the handling, transport and preservation of fish and fish products should be studied in order to define problems needing urgent research. This survey has been started in the Port Lincoln area of South Australia. Research work on fish preservation was discontinued late in 1960. It is expected that it will be resumed early in 1963. The following papers were published during recent years.

Correlation of taste panel gradings with salt-extractable protein of frozen fish fillets. *Food Res.*, 25: 263-269, 1960.

The isolation and properties of fish myosin. *Biochimica et Biophysica Acta*. 40: 141-149, 1960.

Fish handling and preservation. VI. Preparation of fish for canning. *Food Pres. Quart.*, 20: 8-12, 1960.

Fish handling and preservation. VII. Fish canning. *Food Pres. Quart.*, 21: 22-31, 1961.

In *India*, the research activities on processing of fish relating to various factors in preventing spoilage of fish in iced, frozen and dry condition and also remedial measures to be adopted for increasing the life of stored fish and methods for utilisation of fish and fishery products are being undertaken.

The research programs underway in *Korea* are described below in a communication "Report on Food Technology" by Hee Un Chang.

Dried-Fisheries Products

In *Korea*, dried products are classified as dried only, salted and dried, boiled and dried, roasted and dried, frozen and dried, seasoned and dried, etc.

At present, the traditional process must be improved and the deterioration of nutritive value prevented during process and storage.

In regard to these defects, studies are pointed toward:

1. Demonstrations of improving the existing processing method of boiled and dried anchovies.

As the result of field surveys, the main facts bearing conditions, quality of salt, boiling conditions, drying racks, selecting and packaging methods, damage to fish during the process—cooking, draining, transportation, drying and packaging, etc.

The results of experiments on the above are as follows:

(1) The bamboo mat is considerably quicker for drying than the traditional straw mat. But the height of drying racks have no relation to speed of drying in case of small size fish.

(2) By using bamboo mats instead of straw mats damage to fish can be reduced nearly 8 times; consequently, product yield could be increased much more.

(3) Repeated cooking more than 10 times in the same brine solution without adding fresh brine influences the deterioration of quality.

(4) To keep raw materials fresher before cooking, soaking in brine up to 10° Be and keeping them in shade is desirable.

2. Studies of the protection from oxidation of boiled and dried anchovies treated with BHA (*Butylated hydroxyanisole*).

(1) The most adequate BHA concentration in curing solution for boiled-dried fish is 5/10,000 (for medium-size anchovies).

(2) Concentration of over 5/10,000 BHA did not increase efficiency.

(3) After 2 months' storage, 1/10,000 BHA solution was satisfactory; 5/10,000 BHA solution could preserve for 9 months without oxidation.

3. Research on the artificial drying of oysters.

To improve the quality of boiled-dried oysters, studies of artificial drying are being and/or will be practiced on the following points:

(1) Design of the dryer.

(2) Selection of fuel.

(3) Determination of the most adequate drying conditions (temperature, humidity and velocity of air).

(4) Determination of the most suitable moisture content for storage life.

(5) Use of antioxidants.

The results up to now are as follows:

(1) A better temperature for oyster drying in the first stage (3 to 4 hours) is 80°-85°C. and in the last stage 65°-70°C.

(2) Humidity of 30 to 40% is preferred.

(3) Proper velocity of air is 2-3 m/sec.

(4) Notable differences of drying speed (between 4 to 8 hours) were observed by the size of raw materials. Consequently, it is recommended that oyster should be graded by size before drying.

(5) Products kept at 20°C and sealed in polyethylene, the growth of mold is different depending on the moisture content of the product.

Moisture contents (%)	Days required for mold growth
37	9
35	10
32	11
29	16

It is expected that through further research and financial aid by the government, the artificial drying process will be extended to other valuable commodities such as oysters, mussel, scallops, shrimp, etc.

4. Drying facilities for cuttlefish

Cuttlefish, one of the main catches in Korea and exported to Southeast Asia as a sun-dried product, is landed in the rainy season in tremendous quantities. To find a proper way of preservation in the glut season is a very urgent problem. Often large catches deteriorate; it is hard to get good-quality dried products with the present sun-drying process. Therefore, much effort is being made to solve this problem by administrative and technical research. Suitable preservation methods using the artificial dryer in an economical way are being studied.

Salted Fisheries Products

Because salt curing is important in Korea, improvement of existing traditional methods and quality is a very serious problem to meet the requirement of consumers whose preferences are changing by their rising living standards. The conclusions of experiments on salted products are as follows:

1. Influence of the freshness of raw fish and the quality of salt on quality of product.

(1) The deterioration of salted fish caused by exposing raw fish outside for 24 hours before salting was of the same degree as deterioration caused by one month's storage of fish which was salted immediately without exposing outside.

(2) When the more fresh raw materials were used as samples, they showed less loss of nutrients.

(3) Regardless of the freshness of raw materials, the adding of potassium nitrate to salt increases penetration rate of salt into muscle.

(4) The order of quality grade of salt used on this experiment are:

- A. Formosan non-refined salt + 1% KNO_3
- B. Refined salt
- C. Formosan non-refined salt
- D. Mokpo non-refined salt (A Korea salt)

2. Effectiveness of chlorotetracycline and salting method for keeping quality of the salted products:

(1) The addition of antibiotics (chlorotetracycline) in brine salting could be made to decrease the volatile basic nitrogen during storage.

(2) The fat during salting is more oxidized in dry salting than in brine salting and the oxidation of products is not connected with the volatile basic nitrogen.

(3) Traditional dry salting with belly cutting brings the appearance of mold rapidly and causes loss of commercial value. Filleted products are superior.

(4) Generally brine salting is superior to dry salting and its storage life is nearly one year, if the brine is saturated.

3. Studies of salting methods on storage life are also being carried on at the present time to extend the knowledge to the industry to prevent deterioration of quality i.e. darkening, flavor, odor and nutritive value during storage for various periods e.g. 1,2,3,4,5 or 6 months.

Fermented Products

Pickled oysters, shrimp and anchovies are the most famous and important fermented products in Korea. These are preferred by the Korean people to normal soybean sauce in some areas. The results of efforts to improve quality can be summarized as follows:

A. Pickled oysters

1. Product cannot be preserved in less than 17% of salt content and

required saturated salt content to preserve for long periods.

2. It is hoped to study the close relationships between amino nitrogen and volatile basic nitrogen during fermentation.
3. To obtain good quality pickled oysters, the most important thing is to reduce the moisture content in the process.
4. For obtaining a better-quality product, raw material must be washed and drained thoroughly. If it is stirred during fermentation and placed in a cool place better quality product is obtained.

B. Pickled anchovies

1. Pickled anchovies contain considerable amounts of glutamic acid, lysine, leucine, isoleucine, proline, aspartic acid and histidine.
2. Anchovy sauce contains much more lysine, histidine and tyrosine than soybean sauce.
3. The most adequate conditions for maturation of pickled anchovies are longer than 2 months with a salt content of 20 to 25% under a temperature of 20° C.

C. Concerning pickled oysters, the study of the relationships between salt content and storage life, adding sugar and starch in pickling to improve flavor and packaging methods have been carried on to date.

Research Activities on the Processing of Fisheries Products

For the purpose of reasonable quality control and market development of marine products, all methods of improving existing products and developing new products are being studied. And new techniques are introduced to practical men in the fishing industry. Basic research on the preservation

of fish catches and biochemical research is also undertaken.

The summary of which is:

A. Improvement of the quality of fish catches.

In order to improve the quality of catches:

- i. Establishment of the inspection system of wet fish,
- ii. Improvement of facilities related to fish handling,
- iii. Technical training of inspectors,
- iv. Technical advice to fish handlers,

are urgently required now in Korea. In compliance with the above requirements, the following experiments are being studied:

(1) Systematizing "Taste panel test" of fresh fish.

(2) Survey of temperature distribution of fish during marketing and distribution.

(3) Improving the icing of wet fish.

(4) Purification of oysters from bacterial contamination.

B. Improving quality and market development of frozen and canned foods.

For the improvement of present processing methods and developing new types of fishery products, the following program of work is planned:

(1) Improving the quality and market development of frozen foods.

Freshness of raw material, freezing methods, cold storage conditions, washing conditions and effects and shrinkage of shrimp when cooked, etc.

(2) Experiments on fish canning, especially exportable products, i.e.: Shrimp, oysters, crab, anchovies, saury-pikes and other shellfish.

C. Studies on the improvement of the quality of dried cuttlefish and development of new cuttlefish products.

Semi-dried, smoked, and flavored products, etc.

D. Experiments on oyster products.

Studies on artificial dryers and drying conditions, stewed oysters, pickled, sauced and smoked. (And frozen products).

E. Demonstration of boiled-dried anchovies.

Improving existing processing facilities, boiling conditions, quality of salt to be used and applying of antioxidants.

F. Studies of Gul-Bi (Salted and dried yellow corvina).

Freshness of raw materials, brining methods, drying conditions, quality of salt to be used, and applying of antioxidants.

G. Demonstrations on fish sausage.

Selection of raw material, design of equipment and packaging problem.

H. Exploiting the raw materials of exportable products.

Raw materials for agar-agar and fish liver oil production.

I. Biochemical and bacteriological studies.

(a) Proximate chemical composition of shrimp, oysters, sea mussel, cuttlefish, crab, saury pickles and pollack.

(b) Research on discoloration in oyster products.

(c) Survey of the bacterial contamination of oyster growing areas. (Sea water, oyster meat and mud.)

The Central Fisheries Experimental Station, Pusan has also launched an extensive program of training and extension service in the field of fish processing technology during 1961. The training courses include the number of trainees were as follows:

Fish freezing and frozen products	27	men
Salt curing and extension work	82	„
Boiled dried anchovy preparation	52	„

Fish Canning	30	men
Fish liver oil	28	„
Agar-agar making	35	„
Ice making	52	„

The extension work included mechanical and natural agar-agar plants. The trainees were mostly people from the industry but some Government employees also took part.

Fishery technological research programs of the *United States* Government fall into the following categories: Preservation and processing of fish and shellfish; Fish protein concentrate; Chemical alteration of fish; Low dosage radiation processing of fishery products; Metabolism of nitrogen compounds in industrial fishery products; Rice fields and inland fisheries; Oxidative deterioration of fish and fishery products. Bibliographies of fisheries technological research are published in *Commercial Fisheries* TL30.

In *Vietnam*, research on the methods of preservation and processing of canned fish, fish meal, agar-agar, sausages, nuoc-mam powder, etc. is going on. Great help has also been brought to the canned sea-food industry which has produced more than 3,000,000 tins of various sizes. Certificates of quality have been delivered for the exportation of 293,000 Kg. of fresh frozen shrimps and 10,470 Kg. of boiled shrimps; 5 training courses are being organized.

During the Intersession period, a number of recommendations were made regarding research in utilization of fish and an extract from the proceedings of an FAO Meeting is given below for information.

FAO International Conference on Fish in Nutrition
Washington, D.C., 19-27 September, 1961

The FAO International Conference on Fish in Nutrition, held by courtesy of the Government of the United States of America in the new State Department building, Washington, D.C., from 19 to 26 September 1961, was attended by 304 participants from 35 countries and international organizations. The Conference was convened in response to

a recommendation of the 10th Session of the FAO Conference held in Rome in 1959. The main objectives of the Conference were to group together scientists in the field of human and animal nutrition, and food and fishery technology to evaluate the knowledge available in these three fields, and to point to future direction in the field of research as well as in regard to the practical application of existing information. Considerable research had been accomplished in the fields of nutrition and in the production of fisheries products in many countries. The Conference would afford the opportunity of bringing to the attention of researchers in the fields of nutrition and fisheries the widely-dispersed information in these fields.

With this basic idea in mind, the Conference was convened in plenary session only and organized in the following five main topics: Role of Fish in World Nutrition; Chemical Composition of Fish and Fishery Products; Contribution of Fish and Fish Products to National Diets; Fish and Fishery Products in Animal Nutrition; Demand for Fish as Human Food and Possibilities for Increased Consumption.

The survey of the present knowledge in these very different fields was accomplished by the presentation of 33 review papers, supported by 35 original scientific and technical contributions.

Conference Findings

I. General

Estimates of potential world fishery production, based on present fishing methods, range from twice to ten times the present yield of about 40 million metric tons. Intensive fishing for all species is practiced in few fishing regions, and in many potentially productive areas, fishing effort is negligible. Thus many scientists are optimistic that fishery harvests can be increased several fold.

Consideration of full utilization of the living resources of the sea should not be

confined to the harvest only—but to the processing and final utilization of fishery products. For maximum utilization by man it was suggested that the harvest of the sea be used directly for human consumption as far as possible. But because raw (unprocessed) fish is highly perishable and in most parts of the world limitations in transportation facilities limit the use of the products to areas adjacent to the shores of the oceans, lakes, and rivers, some means of preservation must be used if inhabitants of inland areas are to benefit by this nutritious food. Not only must the fishery products be prepared in an acceptable form, and in a form which will retain its desirable nutritive and palatable characteristics, but the cost must be at a level which makes the product available to people in all countries and in all walks of life.

Methods of preserving fish to make it available to all people range from simple salt curing or drying, canning, and freezing to the production of fish protein concentrate (fish flour). The method selected must be determined by climatic conditions, length of storage required, the food habits of the consumer, and his ability to pay for the product. The use of whole fish or the byproducts of fish processing will help to reduce the cost of fishery products.

Fish and fishery products have not received as much study as other main foodstuffs. There is much useful knowledge yet to be gained, particularly in view of the great number of individual and varied species involved.

Encouragement should everywhere be given to extending and intensifying (1) *basic scientific research* into chemistry and biochemistry, physics and biophysics, and bacteriology, as well as into the nutritive value of fresh and spoiling raw fish and of fishery products, from the raw materials used to the final processed commodity for human consumption—whether frozen, canned, dried, salted, smoked, fermented or the like—or byproduct (fish meal, oils, pharmaceuticals, etc.); and (2) *technological investigations* of how best to apply basic

knowledge and principles to minimize wastage of food, retain nutritive quality, and insure ready acceptance by consumers.

II. Basic Research

Scientific research will provide clearer conceptions of the composition, properties, and behavior of fish flesh and organs, from which the bases of nutritive value and quality (the main attributes of which are odor, flavor, texture, and appearance) will become more apparent and thus furnish a guide in technological work aimed at improving product quality and quality control.

Some fields of basic research require further attention, such as further study of the proteinaceous and lipid constituents of fish and their degradations by various biological as well as purely chemical agents. In the case of lipids, atmospheric oxidation and its catalysis and inhibition call for more special study having in mind nutritional as well as possibly toxicological implications. The biochemistry of phospholipids, present in all tissue cells of fish, is still imperfectly explored. It need hardly be said that ever growing resources in modern analytical techniques and equipment—well illustrated during the Conference—must provide a strong stimulus to new research.

III. Technology

The nutritive value of the final products can be considerably affected by the processing method. Before taking up the nutritional aspects, therefore, processing methods and their influence on nutritive value should be discussed.

(1) As regard technology, further investigations seem indicated on the storage of fish in chilled sea water and on the heat or radiation pasteurization of fish prior to chill storage. These methods could perhaps be applied with advantage at least with certain species.

(2) Studies are needed on the possibility of improving the storage life and variety

of fish sausages. The relatively new product should be examined more closely for it offers opportunity for diversifying presentation to the consumer. This type of commodity might well prove attractive in the more developed countries.

(3) The improvement in the developing countries of the processing of traditional and therefore already accepted products—such as dried, salted, smoked, and fermented fishes in various forms—is clearly an obvious avenue for investigation.

(4) In the more developed countries the production of fish products, whether fresh, frozen, salted, dehydrated, dried, smoked or half-conserved, and even canned still presents many problems of improving processes as well as products.

(5) The search for reliable objective indices of product quality should be continued. Further technological investigations must inevitably involve engineering investigations at various levels of complexity.

Application

(1) There is a great lack of relevant data, concerning the needs of the undernourished peoples, and thus there is a need for proper surveys of the procedures employed from catching to final marketing in producing and distributing traditional local fishery products and/or examination of the complication of existing knowledge, these procedures could be improved or mechanized so as to increase productivity and reduce wastage. Furthermore, there is need to do these things without recourse to very elaborate equipment and to improve product quality in the final analysis. Product standards and quality control would be required for any successful development that might follow. This project should have high priority.

To accomplish this as local fisheries are extended, people trained in fish technology will be required. This training should be undertaken in the very near future.

(2) In the developed countries such remains to be done in developing improved procedures, plants, equipment for treatment of fish at sea or on shore, and the processing, storage, transport, and distribution of fishery products of various types (chilled, frozen, smoked, canned, dehydrated, etc.), so that consumers get fish of uniformly high quality. As in less developed countries, much could be done to improve existing procedures if they were operated in conformity with already accepted standards.

(3) With special reference to the needs of developing countries for more high-grade protein, the production of cheap and acceptable deodorized or non-deodorized fish flours or protein concentrates suitable to local tastes and requirements needs further examination. Standards adopted should emphasize nutritive and keeping quality and acceptability as affected by the organic solvents used and the methods of drying, particularly in the light of the considerable variations in quality of products of this kind available at the present time. It would appear that, as a minimum, there is need to improve existing methods or develop new techniques to meet acceptable requirements listed in the main body of the report.

IV. Economics

Fundamental economic and social-political problems are involved in the efficient use of fish in nutrition. In developed countries fish and fishery products compete not only among themselves but also with meat and other protein foods. In the developing countries, on the other hand, the first requisite is to increase fish consumption, because in many cases this is potentially the cheapest and most easily available source of animal protein. Various general recommendations for increasing demand for fishery products are listed in the report.

V. Fish in Human Nutrition

Fish and fish products provide a valuable food in respect to high quality protein to

improve protein nutrition, and in respect to polyunsaturated fatty acids to keep down the level of cholesterol and other blood lipids.

The exciting possibility exists that increased consumption of fish products would reduce disability from heart diseases, which are the major killers in well-developed countries.

Increased consumption of fish and fish products is desirable particularly in high-cereal diets, since fish proteins have a definite supplementary nutritional value rich in lysine and methionine. The protein needs of children in the age group 1-4 must be particularly ensured.

Fish products produced either by traditional or by modern methods should be considered not competitively, but as suited to the tastes, needs, and economic levels of different segments of the population.

Campaigns of mass education should be started to promote increased fish consumption in the interest of better nutrition.

Introduction of a new product such as fish flour, to be produced locally or imported, calls for extensive experimental engineering. Such a product has to be reasonable cheap and enjoy common acceptance. Technically trained people obviously will be needed if this program is to be implemented.

FAO is requested to consider appropriate steps (including establishment of working parties) in respect to the recommendations listed above.

Research in Human Nutrition

More investigations are needed in the following areas:

(1) Processing and nutritive value of traditional fish products such as salted, dried, pickled, and fermented fish, and also of canned and frozen fish.

(2) Amino acid composition and biological value of protein of different species of fish, both marine and fresh-water.

(3) Value of fish protein as supplement to different cereals and tubers and to diets based on these vegetable products.

(4) Characterization of fish oils, their composition and development, and description of a uniform methodology.

(5) The influence of fish oils and fish and fish products on the level of blood cholesterol and other blood lipids as they relate to atherosclerosis. (The effect of tocopherols, other anti-oxidants, and also all other dietary components in this connection should be studied.)

(6) Contents of trace elements in fish, their physiological and nutritional role.

(7) The nutritive value of different kinds of fish flours, as well as their acceptability, and their possible toxicity with particular reference to residual chlorinated hydrocarbons in solvent-extracted fish flour.

(8) Specifications for the classification of different fish products, both traditional and modern, for human consumption.

(9) The potential influence of increased fish consumption on the health of population groups.

VI. Fish in Animal Nutrition

In addition to the direct use of fish for human consumption, they also play an important role in the nutrition of animals which provide man with a source of food. Fish meal is an excellent protein supplement for animals. This industrial product supplies unusually high amounts of the critical amino acids, lysine and methionine, and is rich in minerals and vitamins. Fish meal is also an economic and efficient source of total protein and energy. Probably the most serious detriment to the production of animal food products for man is the failure to apply fully the technical and scientific knowledge that is now available.

The history of agriculture and fishery technology has witnessed the upgrading of fish meals, originally only fit for fertilizer,

into products suitable for animal and human feeding. Animals can utilize fish meals otherwise unacceptable to man. Ruminants often can utilize efficiently fish meals which have been so damaged as to render them unsuitable for humans and non-ruminant livestock.

Fish meal may be used as the sole concentrate to supplement the nutritive value of low-grade hay and other roughages for cattle, and in rations of young ruminants may liberate the dam's milk for human consumption. Generally fish products are used to supplement vegetable proteins in feeds of livestock, in particular pigs and poultry. Of all farm animals, the ruminant is the least exacting as to the quality of protein required and the animal least competitive with man in nutrient requirements.

Research in Animal Nutrition

More investigations are needed in the following areas:

(1) Developing methods of assessing and defining the nutritive value of fish and fish products in animal nutrition. Attention should be given also to the bacteriological aspects and to the possible presence of all types of toxic substances, including antimetabolites.

(2) Finding rapid and cheap methods of establishing the quality of a fishery product, particularly with respect to its available amino acid content.

(3) Identifying characteristic properties of fish and fish products which may have a variable influence on the quality of the meat. A number of factors should be investigated such as "fishy" flavors, development of rancidity, instable fat-soluble vitamins, color of final product, deposition of unsaturated fatty acids, and carcass composition.

(4) Determining the effect of origin and processing of fish and fishery products on quality and nutritive properties, with respect to species differences, season and location of catch, processing, curing, and storage with particular reference to temperature and

moisture, preservatives and preparation of silage, fish solubles, and fish press water.

(5) Investigating the use of other marine sources of animal feed including shrimp and other crustacea.

(6) Determining the value of feeding fresh fish in some coastal areas to pigs and poultry where early experiments showed great promise.

Recommendation 1 (U.S. Delegator)

There is obviously a conflict of opinion as to the potential amount of aquatic foods that can be produced. Information now available on the distribution and abundance of the living aquatic resources of the world and on amounts produced in different regions indicates that the yield can be increased several fold using present techniques of harvest, culture, and processing. Much greater yields should result from improvement of present techniques and from the development of improved methods of harvest, processing and distribution, by increasing the capacity of the environment to yield in both fresh and salt waters, and by mitigating such factors as the effects of pollution, overfishing, and the political or economic deterrents which now reduce the productivity of the environment, the productive capacity of the resources, and the efficiency of harvesting. To realize the full potential of our living aquatic resources, the conference recommends to the Director-General of the Food and Agriculture Organization that there be established a Working Party, composed of internationally recognized experts in fishery biology, oceanography, technology, and economics, or by other means, to assess more accurately the world potential for fishery production and utilization and to examine methods necessary to reach this potential. It should consider more efficient use of present production and utilization techniques and the development of new techniques to increase production and utilization, and advise FAO and, through it, interested governments and specialized agencies as to the best means of attaining maxi-

imum sustainable use of the world's fishery resources.

Recommendation 2 (U.S. Delegation)

The U.S. Delegation is impressed by the information presented in Main Topic III and cognizant of its potential for world-wide improvement of man's health and well-being. It recommends that attention be given to meeting the urgent need for constant updating and expansion of information on the content of fish and fish products with respect to all the nutrients known to be involved in adequate human nutritive value are basic to the appraisal of the place and potentialities of fish and fish products in human diets, to evaluating processing and marketing techniques, and for developing educational material on preparation and use. The Delegation recognizes the well-documented effect of dietary polyunsaturated fatty acids in lowering cholesterol and other lipids in the blood. This emphasizes the potential contribution which fishery products may make as one of the animal components of the human diet. The mechanism of this effect is still not clear and its relationship to coronary heart disease and atherosclerosis is not understood. Therefore, a critical need exists for more intensive and comprehensive research because polyunsaturated fat is only one parameter in a complex nutritional health problem and that man himself appears to be the one research subject from which to draw definitive conclusions. Recognizing that fish protein supplements for human consumption will be developed primarily to overcome protein deficits, the U.S. Delegation recommends that: (1) FAO devise a series of minimal standards for classification of fish flours, meals, pastes, etc., for human consumption. (2) That minimal standards for classes of each of these products include nitrogen, fat, ash, moisture and standards of safety and stability. (3) That these standards take into account not only the nitrogen content but also its biological value as routinely determined by standard biological assays of the protein. (4) That these standards be devised for several classes of each fish product to

accommodate the needs of various parts of the world and as a service that FAO identify manufacturers and their products meeting these standards. Finally, it is the recommendation of the U.S. Delegation that FAO establish Working Party, consisting of nutritionists, technologists and food process engineers, to implement the recommendations as to engineering and large scale human testing of fish flour of the International Meeting on Fish Meal in Rome during March, 1961. This action is necessary because, at that meeting, there was no agreement as to practical methods for production of uniformly, high quality, stable and low cost fish protein concentrates on a commercial scale.

Recommendation 3 (U.S. Delegation)

The U.S. Delegation, after study and discussion of the review and original research papers presented under Topic IV, is impressed by the wide fields of animal nutrition in which the potential contributions of industrial fishery products have not yet been adequately assessed. The Delegation recommends to FAO (1) that it take the lead in encouraging such research among its member nations, and (2) that FAO act as the continuing source of information to all member nations on work undertaken by specific nations in response to this recommendation. The U.S. Delegation is concerned over the obvious lack of internationally standardized and agreed upon methods for determining the biological value of fishery products and their efficiency of utilization in animal feeding. The Delegation, cognizant of the widely varying economic factors that influence the degree of use of fishery products in the different areas of the world, nevertheless recommends that FAO and the member nations of FAO lend their fullest assistance to the program recently undertaken by the International Association of Fish Meal Manufacturers to develop such internationally accepted test methods. The U.S. Delegation, impressed by the wealth of information presented at this Conference, which attests to the high biological value of fish protein, both

as a food for human consumption and as a necessary ingredient in animal feeds, recommends to FAO that its scientific literature on the nutritive value of fish protein be re-evaluated on the basis of the presentations by Konosu and others at this Conference. The U.S. Delegation was struck by the fact that the use patterns for fish meal in animal feeds has been shown to vary considerably between countries. While, in many cases, such use patterns are undoubtedly influenced by regional economic considerations, the U.S. Delegation strongly supports the position of Dr. Combs that the most serious deterrent to the production of animal food products for man is the failure to apply fully all of the available technical and scientific knowledge on this subject. The U.S. Delegation is conscious of the fact that such programs will do much to insure continued advances not only in animal nutrition but in human nutrition as well. The U.S. Delegation, cognizant of the fact that no one product will fit the specific needs of all regions of the world, recommends strongly to FAO that it encourage research to develop fishery products of high biological value but which require little or no expensive mechanized equipment, highly skilled personnel, or involved processing methods.

Recommendation 4 (Mexico)

In the developing countries there is a lack of technicians trained in the field of marine product preparation. Due priority should be given to solving this shortage, which is one of the principal problems of those countries. Delegate (Mexico) recommends to FAO that permanent fishery technology training centers or institutes be established through Latin America and Africa. These centers will offer training in marine product technology so that the participants will gain sufficient knowledge to prepare dried or smoked products, meal, flour, etc. The participants, after completing the courses, will return to their developing countries and employ the techniques that they have learned.

Recommendation 5

An informal working group of the conference, consisting of a number of interested delegates of various countries, developed the following recommendations: It has been emphasized repeatedly that the immediate problem in developing areas is the application of existing technological knowledge. The group considered that an essential requirement was an integrated scheme of fisheries technological education on a world basis. The group recommends that an FAO working group on education and training of fisheries technologists be set up to consider the present programs and facilities for training and to make recommendations for their improvement. It seems logical that in the first instance any expansion of the program should be based on existing institutions presently active in this field of training. The group particularly commends the type of arrangement recently instituted at the Tokai Regional Fisheries Research Laboratory, Tokyo.

Recommendation 6

Delegates from a number of countries which are participating in this Conference have been greatly impressed by the outcome of the discussions. As a result of *ad hoc* informal discussion, they have set up a working group which strongly endorses the importance of basic science in the improved use of fish in nutrition and technology. This group, therefore, recommends that FAO hold a symposium covering the significance of fundamental research in successful utilization of fish to be used as a basis for technological development. It is further recommended that the symposium include reports from laboratories concerned with chemical, biochemical, physiological, microbiological, and nutritional research.

Recommendation 7 (U.S. Delegation)

The papers on lipids have clearly brought out the fact that oxidative changes in the oil constituent in marine products represent one of the research areas still in need of concerted effort. Since better use of

marine resources, both as food for people and in the manufacture of many industrial products, can be attained if this problem can be overcome, the U.S. Delegation recommends that the member nations of FAO expand their research effort on this important subject.

Recommendation 8 (U.S. Delegation)

It was never intended, however, that preoccupation with fish flour should obstruct other worthwhile avenues of research. For example, canning is still one of the best methods of eliminating the effects of time and climate on fishery products. This allows fish of excellent quality and palatability to be placed within physical reach of a maximum number of people. If the costs of producing and distributing canned fish could be reduced, then more canned fish might be brought within economic reach of undernourished peoples. The same could be said for other methods of utilization or preservation, where particular processes have unique technological characteristics and social or economic implications. In planning research and development programs for better utilization of fishery resources, therefore, attention should be paid, not only to new processing techniques, but also to improvement of methods already in use.

There was a sad lack of technical papers on the nutritive value of frozen and canned fish products. Papers on these subjects were solicited from researchers all over the world, whether in industry or in university or in Government laboratories. Since no papers were submitted in response to this request, however, it would appear that nowhere in the world is anyone engaged in a comprehensive investigation of the composition and nutritive value of these two very important market forms of fishery products. The U.S. Delegation, during its deliberations on the papers presented in Topic V, noted that few papers explicitly recognized the nutritive activity of a food product to be a function of certain biochemical compounds within the product. For example, the beneficial amino acid distribution of fish protein concentrate is to be found also in canned,

frozen, dried, and smoked fish. Further, the great mass of nutritional information available on the benefits of fish meals in animal feeding can be applied, in whole or in part, to fishery products destined for human consumption. More is known about the nutritive value of fishery products fed to mink and chickens than about the value of the fishery products eaten by man. The U.S. Delegation recommends that FAO encourage scientists of member countries to undertake research in these relatively neglected fields. In planning future conferences, scientists working on processing methods and nutritional aspects of all types of fishery products should be encouraged to submit papers.

DOCUMENTATION

In the field of fish processing technology, the following circulars and documents were circulated to members of the Technical Committee II, Panel B.

(i) *Solar Drying*: Copy of a paper by Dr. E. Heen. Utilization of solar energy for artificial drying of fish.

(ii) *Country Statements*: A circular requesting Country Statements for the FAO International Conference on Fish in Nutrition, Washington, D.C. (September 1961). The response to this circular has been fairly good and copies of Country Statements presented at the Conference were received from India, Japan, Korea, Malaya and Philippines.

(iii) *Fish Containers*: A report on this subject has been presented as a Technical Paper. A questionnaire was issued and replies received have been incorporated in the above report to ensure quicker publication.

(iv) The Fisheries Products Manual, the first draft of which was considered at the 9th Session of the Council is under revision following the FAO/EPTA/IPFC Training Center in Quezon City, Philippines, during 6 March-15 April 1961.

(v) The final report on boiling of fish as a short term method of preserving fish in

the tropics has been presented as a technical paper to ensure quicker publication of the document.

(vi) The report on the use of seaweeds as human food is also presented as a technical paper.

FAO TECHNICAL ASSISTANCE PROGRAMS

The only FAO/EPTA expert in fish technology assigned to this Region concluded his assignment in India where he assisted in organizing the research programs of the Processing Wing of the Central Institute of Fisheries Technology, Cochin.

Following the request by the Indo-Pacific Fisheries Council, an FAO/EPTA Fish Processing Training Centre was organized in Quezon City, March/April 1961. Twenty-four participants from ten countries of the Indo-Pacific Region took part. The course of instruction included lectures, demonstrations, discussions and original papers by the participants on the status of the fish processing industry in their countries. Keen interest was shown and the demonstrations included pilot scale fish drying, smoking, sausage making, flaking and laboratory techniques of analysis and quality control. The results of the Training Centre indicate that research activities particularly to improve current practices of icing and traditional methods of processing should be expanded and that steps should be taken to overcome shortages of technical personnel, funds, laboratory equipment and library facilities for technical research and to obtain and retain competent technical staff. It was also recommended that taste panels and quality control criteria should be established. A Report of the Training Center is available as a Contributed Publication (IPFC/C62/CP11) by FAO.

SUMMING UP

During the intersession period, considerable developments have taken place in traditional methods of fresh fish handling, processing and research which point to the following trends:

(1) Ice supply position has generally improved and in many countries the prices have come down considerably. A consequence of this has been increasing supply of fresh iced fish to consuming centers.

(2) Considerably improvements are taking place in transport and distribution of fishery products which has been facilitated with improvements in communications, i.e. road, railways, etc.

(3) There has not been any noteworthy development in the traditional methods of fish curing except that in some areas, with the increase in sea fisheries, cured products (salted, smoked) made from sea fish are gradually replacing the traditional salted and smoked fish made from fresh water fish. In certain areas use of cold rooms for storage of salted fish appears to be practicable.

(4) Frozen fish industry has shown a trend to increase particularly production of frozen shrimp, frog legs and lobsters.

(5) Production of canned fishery products is on the increase.

(6) There has been no commercial production of fish flour but studies have been initiated on the nutritive value and dietetics of this product.

(7) Certain non-traditional products have entered the market outside Japan, e.g. the fish sausage.

(8) Research activities have increased considerably and the programs are mainly aimed at improvements in traditional processes and adoption of suitable non-traditional processing techniques such as freezing, fish sausage making, canning, etc.

B. SESSION REPORT

Fish Processing Technology

The Council notes that in the handling, storage, and distribution of fish, the use of ice has considerably increased in many countries of the Region but that the prices of ice supplied to the fishing industry vary widely in the different countries. The Council learns with interest that in India capital and running costs of ice plants are subsidized by the Government thus bringing about lowered ice prices to the fishing industry. Noting further that ice prices are still high in many parts of the Region, the Council recommends that facilities be provided to supply ice at minimum prices to the fishing industry and where feasible to subsidize the cost of ice. The attention of the Member Governments is drawn to the Table on pp. 96-97 of the Inter-session Report (IPFC/C62/WP 4) which illustrates the prevailing prices of ice in Asian countries of the Region. It may be noted from the above table that the minimum price is US \$2.50-3.00/ton in India, Japan and Korea.

The Council stresses the desirability of establishing extension services to educate

fishermen in care, handling, and transportation of fish, by use of proper icing techniques. The Council recommends to Member Governments that as the first step in such education programs, pamphlets describing correct techniques be distributed to the industry.

The Council notes that in some countries some prejudice exists against iced fish and recommends to Member Governments that wide publicity be given to the wholesome quality of such product.

The Council examined with interest rubber tyre fish containers which were kindly exhibited by the Korean Delegation and decides that relevant material regarding this should be incorporated in the report on fish containers (IPFC/C62/Tech. 10).

The Council after considerable discussion on the freight rates for transport of fresh fish requested FAO to circulate a questionnaire among Member Governments as a preliminary step to preparing a comprehensive report on this subject to serve as a guide to Member Governments in their consideration of reduction of freight rates for fishery products.

The Council notes that the main factors responsible for high price of ice are loss of ice due to melting at prevailing high temperatures and existence of uneconomical plants. Development of cheap insulated containers, cheap materials for insulating fish boxes, holds, etc., as well as installation of economical ice plant units are regarded as essential.

The Council notes with gratification that a comprehensive report on fish containers the preparation of which was requested during the 9th Session, has been prepared and notes that the report has been submitted as Document IPFC/C62/Tech. 10 for quick publication.

The Council notes that in many countries of the region considerable advances had been made in the provision and improvement of transport facilities for fish but believes that there is still much more to be done in this respect. The Council therefore urges the Member Governments to provide improved facilities for transport and distribution of fish such as insulated or refrigerated trucks, rail cars and insulated containers, and reduced freight rates for fish.

The Council having reviewed the situation regarding the use of artificial driers for drying fish notes that in Korea, beginning has been made on the use of such driers on a commercial scale. The necessity of research to develop economical as well as simple type artificial driers which could be used without difficulty by unskilled operators, like fishermen is stressed. The Council having discussed the use of solar energy for artificial drying of fish considers that some trials should be made with this type of driers where feasible and makes a recommendation to Member Governments accordingly.

The Council notes with satisfaction that the final report on boiled fish which was requested at its 8th and 9th Sessions has been presented as IPFC/C62/Tech.3. The Council considers this to be a valuable contribution.

Having discussed fermented fisheries products and noting that the traditional

techniques take too long resulting in products of variable quality, the Council recommends that Member Governments consider the feasibility of instituting research programs to shorten the period of processing as well as to ensure that products of uniform quality be produced.

The Council noted with satisfaction that non-traditional methods of processing such as freezing and canning have made significant headway in some parts of the Region. Noting that the industry requires guidance in correct methods of handling frozen fishery products during all stages, e.g. quality of raw material to be used, technique of freezing, cold storage, transport and distribution, handling at retail and wholesale markets, etc., the Council invites the attention of the Member Governments to the desirability of instituting extension services to advise the industry. The Council also believes that at a stage when frozen fish is beginning to be introduced in a country, it is important that consumers be educated regarding the use and handling of this product.

The Council noted that there has been an expansion in canned fish production during the intersession period and learns with interest that in order to promote export of canned fishery products, Government of India has instituted a special export production scheme in which there is a subsidy on imported tin-plate and a drawback on customs duty on imported tin-plate and packaging material when the final product is exported. The Council reiterates the observations made at the 8th and 9th Sessions that though the market for canned fish in the Region is at present limited, the possibilities of exporting many tropical varieties of fish in processed form should be considered. In order to facilitate exports and also because of the high cost of packaging material, the Committee invites the attention of the Member Governments to the fact that subsidies, exemption of import duty, sales tax, etc., on tin-plate and other packaging materials would assist the indus-

try in developing export markets for processed fish.

Noting recent trends in the development of fish sausage in Japan, the Council invites the attention of the Member Governments to the possibilities of developing this product in their countries from species of fish which command a low price. It was noted that a beginning was being made for the pilot production of this product in India, Korea and Thailand.

Noting that animal protein deficiency exists in certain parts of the Region and that fish protein concentrates would be a useful addition to the diets of the people, the Council feels that at present, fish flour has not much future in the Region as it is a new product and consumer reactions to this product vary widely. If however some Member Governments found it necessary to introduce this type of product, the Council feels that it is desirable to investigate the economic aspects of production such as availability of raw material, seasonal nature of the industry, and cost of production. The Council feels that products such as freeze-dried fish as well as fish protein concentrates resembling closely traditional products, e.g. concentrated fish sauce, should also be considered as possibilities subject to their economical production and consumer acceptance.

The Council noted that in some countries of the Region, modern fish meal plants are being set up but that there has been difficulty in securing sufficient raw material to keep the plants working on a year-round basis. The scope for large scale production of fish meal in most countries of the Region is rather limited and the Council considers it is its duty to invite the attention of the Member Governments to the fact that before deciding on the setting up of new fish meal plants, availability of raw materials, as well as the economics of production should be examined.

Having reviewed the existing status of the fish liver oil industry in the Region, par-

ticularly the possible adverse effects of synthetic Vitamin A on the industry, the Council requests FAO to collect available data on the comparative clinical studies on synthetic Vitamin A and fish liver oil and make such data available to the Member Governments for their future guidance. The Council learns with interest that a molecular distillation plant for concentration of fish liver oils is being set up in Korea.

The Council notes that refined fish oils are utilized for human consumption and in processed food industry, e.g. canned fish, in some developed countries, e.g. Norway and invites the attention of the Member Governments to this method of utilization of refined fish oils in those countries where fish oils are produced in commercial quantities.

The Council having reviewed the document IPFC/C62/Tech. 2 "The use of seaweeds directly as human food in the Indo-Pacific Region" commends to the Governments of Member Countries where seaweeds are not used for human consumption the information contained in this document. The Council believes that it serves a most useful purpose when the introduction of this important aquatic product is under consideration.

The considerable advances in research activities in some countries of the Region which have taken place during the intersession period is noted with satisfaction. The Council invites the attention of other Member Governments to the desirability of instituting research programs in this field where such programs do not exist, and of expanding the same in order to effect improvements in existing methods of fish handling and processing.

The Council reiterates its earlier recommendation that the IPFC Fisheries Products Manual be published as soon as possible and requests FAO to allot sufficient funds to have this useful document printed at an early date.

CHAPTER V

SOCIO-ECONOMIC, STATISTICS AND FISH MARKETING

Part A

*Report from the Chairman of Technical Committee II on the recent developments in the field of
Socio-economics, Statistics and Marketing*

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I. FISHERY CREDIT

Australia

In addition to the credit facilities reported at the 9th Session of the IPFC, another source of credit became available in 1960 with the establishment of the Commonwealth Development Bank by the Commonwealth Government under the Commonwealth Banks Act 1959.

The Bank is empowered to provide finance for primary production or for the establishment or development of industrial undertakings, particularly small undertakings, if in the Bank's opinion the provision of finance is desirable, and if the finance would not otherwise be available on reasonable and suitable terms and conditions. The Bank may also provide advice and assistance to promote the efficient organization and conduct of such enterprises.

The Bank is directed to have regard primarily to the prospects of the borrower's operations becoming, or continuing to be, successful, and is empowered to disregard the value of the security available in respect of its advances.

Applicants are expected to have a reasonable equity in their undertakings, and the efficiency, managerial capacity, and integrity of applicants are taken into consideration.

Finance is usually made available by way of term loans, repayable by instalments at half-yearly intervals. Progressive loans which may be drawn over a reasonable period are provided where appropriate. The Bank prefers not to make loans in excess of A£25,000 to primary producers.

Interest rates are influenced by the contribution of the project to development, and the risk factor. The maximum rate of interest on loans to any primary producer is 7 per cent.

A fee of A£10 (refundable if no loan is approved) must be lodged with each application for a loan.

The Bank will, in appropriate cases, provide hire purchase facilities for the acquisition of producer goods. Initially the basic interest charge on new goods was set at 2½ per cent per annum of the full amount borrowed.

The total funds available to the Bank, in 1960/61, were A£45.2 million. Loans of A£10.8 million were made, and A£14.1 million was provided for financing hire purchase of equipment during 1960/61. However, the Bank assists a wide range of industries, its assistance to fishermen is small by comparison with its total financing. Unfortunately, no detailed information is available of actual loans granted to fishermen.

In Papua and New Guinea, the only credit at present made available for fisheries is through Native Loans Fund which does grant credit for the purchase of outboard motors and occasionally for fishing gear. Applications are treated on their merits.

Hong Kong

(a) Four loan funds are operated for the benefit of the Hong Kong fishing industry, namely the Fish Marketing Organization Loan Fund, the Fisheries Development Loan Fund, the Colonial Development and Welfare Fund and the C.A.R.E. Loan Fund for shrimp fishermen. In February 1961, the ceiling of the Fish Marketing Organization Loan Fund was increased from HK\$1,500,000 to HK\$1,800,000. The ceiling was again raised in December 1961, and now stands at HK\$2,500,000. The Fisheries Development Loan Fund was established by the Government in January 1960 with capital of HK\$2,000,000. In December 1961, this capital was increased to HK\$5,000,000.

(b) A number of loans issued from the Fisheries Development Loan Fund have been for substantial amounts to enable the borrowers to have constructed pairs of deep-sea

'Kwong-sun' type trawlers. One such approved loan amounted to HK\$340,000. In such cases, a fairly elaborate form of agreement has been designed to afford adequate security. In particular, where such loans are guaranteed by the fishermen's Cooperative Society, although the full sum is paid over to the Society on signing the agreement, the money is re-lent to the fishermen in a series of instalments which are directly related to progress on the construction of the hulls and the purchase and installation of the engines. A typical example is as follows: "The Society covenants and agrees with the lender to make payments to the fisherman in respect of the cost of the building of the hull of the boat and the purchase and the installation therein of the engine only by way of crossed cheques in favour of the creditors in respect thereof, of the fisherman, and to advance the principal sum in the instalments set forth in the Schedule hereto.

Schedule

For the purpose of this agreement, the principal sum of HK\$ is divided into four parts, namely:—

- (1) *The Hull Loan* of HK\$ which will be advanced in the following instalments:—
 - (a) HK\$ on the signing of a contract for the building of the boat in such terms as shall be approved by the Society;
 - (b) HK\$ on the completion to the satisfaction of two members of the Committee of the Society and to the satisfaction of the Commissioner or of his duly authorized representative, of the laying of the keel and the fixing of the garboard strake and of the first two hull planking strakes;
 - (c) HK\$ on the completion to the satisfaction as aforesaid of the laying of the deck beams;
 - (d) HK\$ on the launching of the boat; and

- (e) HK\$.....on the completion of satisfactory trials of the boat, its acceptance by the Fisherman and its licensing by the Marine Department.
- (2) *The Engine Purchase Loan* of HK\$..... which will be advanced in the following instalments :—
- (a) HK\$..... on the placing of the order for the engine with the supplying firm;
- (b) HK\$..... on the delivery of the engine and its acceptance by the Fisherman; and
- (c) HK\$..... on the completion to the satisfaction of the Fisherman and to the satisfaction aforesaid of engine trials.
- (3) *The Engine Installation Loan* of HK\$..... which will be advanced in the following instalments:—
- (a) HK\$..... on the signing of a contract for the installation of the engine in such terms as shall be approved by the Society;
- (b) HK\$..... on the completion to the satisfaction of two members of the Committee of the Society and to the satisfaction of the Commissioner or of his duly authorized representative, of the stern tube, stern shaft and propeller;
- (c) HK\$..... on the completion of the installing of the oil tanks, fuel tanks, and piping; and
- (d) HK\$..... on the completion of satisfactory trials of the engine, its acceptance by the Fisherman and its licensing by the Marine Department.
- (4) *The Fishing Gear Loan* of HK\$..... which will be advanced in the following instalments:—
- (a) HK\$..... on the signing of a contract for the building of the boat;

- (b) HK\$..... on the launching of the boat; and
- (c) HK\$..... on the completion of the installation of the engine.

Several large loans have also been issued to commercial trawling companies from the Fish Marketing Organization Loan Fund to assist them in the purchase of second-hand steel hulled trawlers from abroad. In these cases, in addition to the usual form of Indenture, statutory mortgages of the vessels to be purchased have been executed in favour of the Director of Marketing.

India

Maharashtra State

(a) *Grant of Loans under "State Aid to Fisheries Rules"*

Loans are granted in accordance with "State Aid to Fisheries Rules" to the fishermen and other cooperative societies as well as to those engaged in the fishery industry for the following purposes: purchase of and repairs to boats, nets and other fishing equipment, engines, fish carrier trucks and launches, and refrigerated cabins; installation of ice plants and cold storages, construction of godowns for storage of dried fish.

Loans are also made available to the local boats for construction and improvement of fish markets.

The intending applicant has to submit his application in the prescribed form which elicits information regarding the applicant's name, age, village, particulars of business, assets owned by him, purpose of loan and amount of loan required, etc. In respect of loan for engines the fishermen have to form a group and to submit a collective application. The number of group members varies from 3 to 12, depending on the H.P. of the engine. According to the existing procedure, the loanee is required to offer as security, assets worth $1\frac{1}{2}$ times the amount of loan applied for. This security is taken in the form of boat, engines, houses, and other immovable properties. The assets to be created out

of loan are also computed towards the security for the loan. If the assets offer the requisite security, personal surety is obtained to cover twice the amount of the loan.

The valuation of assets for purpose of sanction of loan is conducted through the Executive Engineer, Collectors of the Districts, Range Officers, Central Excise Department, and Superintendents of Fisheries of this department.

(b) *Repayment of Loans*

The period of repayment in case of general purpose loans is five years. It is seven years for mechanization loans. This period extends over 10 years in respect of big loans for purchase of carrier launches, trucks, ice plants, etc. The payment of instalment is spread over a period of eight months from October to May, the monsoon period being off. The repayment of loan starts three months after its disbursement.

In respect of the monthly instalments the experience of the department has been that the income of the fishermen being uncertain and dependent upon the season, most fishermen do not adhere to payment of regular monthly instalments. It would be desirable, therefore, to fix quarterly instalments. Similarly, the period of repayment at seven years may be made uniformly applicable to loans for mechanization and general purpose loans. Necessary proposals in this respect have been forwarded to the Government.

Breakdown of engine, loss of fishing gear in stormy weather, accidents to boats, etc. which retard repayment of loan are not uncommon with fishing vessels. It is therefore proposed that in genuine cases where the Director of Fisheries is convinced about the fishermen's handicaps in clearance of loan instalments, he may be authorized to grant time to clear the loan in easy instalments so as to facilitate recovery of the Government loan.

(c) *Rate of Interest*

The prevailing rate of interest is 5 per cent in case of insured assets, and 9 per cent if the assets are not insured. Interest is calculated on diminishing balances of the principal amount. It is payable as the last instalment after clearance of the principal amount.

The present rates of interest are on high side, considering the fact that these loans are granted for development of fishing industry. The rates of fishing accessories have gone up. There is also a heavy central levy on diesel oil. As it is, an appreciable indebtedness prevails among the fishermen due to their poverty and ignorance which results in their exploitation by the private fish merchants and the money lenders. The fishermen also draw short term credit from their cooperatives at the start of the season for purchase of coal tar, shembi-bark for dying nets, ropes, twine, resin ('chandroos'), floats, paints and oil, etc. which are the items of an annual recurring nature. Under such circumstances if their present indebtedness is to be alleviated and their miserable lot improved, it is essential that the financial assistance is made available to them by the Government at as low a charge as possible. The department has, therefore, proposed that rate of 3% be charged when assets are insured and 5½% when they are not, as against the prevailing rates of 5½ and 9% respectively.

Gujarat State

Development of fisheries in Gujarat State mainly depends on the credit facilities extended by the Government or other bodies for various activities such as fishing, preservation, transport, processing, storing and marketing. The outstanding progress made by this state in the fishing industry is due to the liberal financial assistance extended by the Government for various items.

Realizing this importance, the State Government have provided funds to meet the increased demands of loans and subsidies for the Third Five Year Plan period, which is

about double the amounts provided during the Second Five Year Plan. Such facilities are to be given for the following items:

1. Loan and subsidy for marine diesel engines.
2. Loan and subsidy for construction of improved boats.
3. Loan and subsidy for purchase of transport vans and carrier launches.
4. Loan and subsidy for construction of godowns and fish markets.
5. Loan and subsidy for erection of ice factories and cold storages.
6. Loan and subsidy for establishment of boat building yards.
7. Loans for establishment of ancillary industries such as net making plant, etc.
8. Subsidy for outboard motors.
9. Subsidy for purchase of fishery requisites.
10. Loan to cooperatives for undertaking marketing of fish.
11. Subsidy for cooperatives for starting small scale industries on fisheries.
12. Subsidy and grants to cooperatives for exploration of markets and other aspects.

It will be seen that from the amount provided by the Government, it will be difficult to meet all the demands of loans and subsidies for the items mentioned above. For the Third Five Year Plan period, a sum of Rs. 23.62 lakhs towards the loan and Rs. 22.69 lakhs towards the subsidy have been provided by the State, which is not at all adequate. Only for the year 1961/62, the Department had advanced loans to the tune of Rs. 8.06 lakhs towards purchase of engines for boats. The Department has, therefore, made arrangements with the Gujarat Fisheries Central Cooperative Association Limited, Ahmedabad, to meet a part of the requirement of loans. This apex Cooperative Organization has a paid up share capital of Rs. 5.62

lakhs. The Organization imports marine diesel engines, outboard motors, nylon fishing twine, etc. and distributes them to the fishermen. They also distribute marketing loans to the fishermen and cooperatives. The Association spends about Rs. 20 lakhs per annum towards this purpose.

Thus the Government credit facilities have been strengthened by (i) increasing the provision in the budget, (ii) supplementary demand from Government, and (iii) through Apex Cooperative Organization as described above.

The Government of Gujarat has also taken adequate steps to provide staff for distribution and recovery of loans and to protect the Government money by prescribing suitable procedure. Special staff have been provided in each district to assist the district officers in the distribution and recovery of loans. The Government also grants a subsidy to the Apex Cooperative Organization so as to enable them to appoint adequate staff for distribution of loans and to recover them on their side.

The loan and subsidy applications are accepted from fishermen or cooperatives in prescribed forms giving details of solvency, sureties, properties and their requirements. The district officers scrutinize the application. If they are satisfied, they forward the loan applications to the Director of Fisheries, who, in turn, sanctions the loan after rectification, if it is within his power, or forwards the same to the Government for sanctioning the loan. As soon as the sanction is issued, money is drawn by the applicant from the treasury after the execution of the mortgage deed with the Government. The following are the important terms and conditions under which loans are advanced:—

1. The loan is to be repaid within 5 to 7 years in regular monthly instalments. No payment of instalment is essential during three months in a year which is off season.

2. The item for which the loan has been granted should be insured by the party and

the policy assigned to the Government. This will be continued until the loan is completely repaid by the applicant.

3. One and a half times of the loan amount is taken as security towards the advancement of the loan. The loanee has to mortgage his assets procured with the Government loan.

4. The interest on the loan is 5% which is collected along with the loan instalments.

5. A penal rate of interest of 1% is prescribed in case of default. If the loanee does not insure the item purchased or made from the loan amount, he has to pay an interest of 9% to the Government.

6. In case of default, the arrears of the loan are recoverable by the Government as arrears of land revenue through the Revenue Department.

Philippines

Except for the plan of the Development Bank of the Philippines to liberalize its loans from ₱2,000 to ₱2,400 per hectare for the development of brackish water fish ponds, there are no new measures for the purpose of strengthening Government facilities.

Measures concerning fishery credit will be considered in connection with the Five Year Plan for the development of fisheries in the framework of the Five Year Social Economic Program of the Government.

Pakistan

The Government of Pakistan has granted the following loans to the fishermen's cooperative societies on both wings of Pakistan:—

<i>Karachi</i>	Rs. 850,000
<i>Mekran Coast</i>	
(a) Ormara 80,000	} Rs. 400,000
(b) Pasni 120,000	
(c) Gwadur 120,000	
(d) Jiwani 80,000	
<i>East Pakistan</i>	Rs. 1,250,000

The loan of Rs. 850,000 granted to the Fishermen's Cooperative Society, Karachi, by the Agricultural Development Bank of Pakistan is on the following terms and conditions:—

1. The amount may be utilized for procuring such fishing equipment as may be required by the majority of fishermen for the increased production of fish.

2. The equipment may be procured and utilized in consultation with the fisheries officers of the respective areas and the Board of Directors of Cooperative Societies.

3. The fishing equipment may be issued to the fishermen under the guidance of the officers of the Central Fisheries Department and local administration.

4. The loan will bear interest at the rate of $4\frac{1}{4}\%$ and will be recoverable in 5 years in equal instalments.

5. The guarantee may be obtained from the Karachi Fishermen's Cooperative Purchase and Sales Society Ltd. and the Standard Cooperative Bank Ltd., Karachi.

Sufficient staff has been provided by the Fishermen's Cooperative Society, Karachi, for the recovery of such loans granted to the fishermen's community.

Precautionary measures have been taken by the Cooperative Society, Karachi, regarding the operation of fishery credit, e.g. the recovery staff will collect 50% of the total sale proceeds of the borrowers out of which 20% cut will be taken for the loans previously granted in the form of nylon twine and marine diesel engines and 30% cut will be deposited towards the loan of $8\frac{1}{2}$ lacs granted to the fishermen for the supply of fishing requirements.

Korea*

Under the present military government, Korea has embarked on a Five Year Economic Development Program which includes

* Report by Ro, Jai Dong.

expansion in fishing operation and a material increase in the production of fish and other marine products for domestic consumption and for export.

In initiating the program the Government has recognized the important and urgent need to provide financial aid to fishermen and the industry. For 1962, the first

year of the plan, the Government has allocated a sum of 847,777,000 Won (equivalent to US\$6,675,200) for such financial assistance. Of this amount, 216,477,000 Won is for grants or subsidies and 631,300,000 Won is for loans.

Allocation of subsidies and loans during 1962 is as follows:—

Government Financial Assistance for Fisheries in 1962
(The first year of the Five Year Plan)

Project title	Subsidy or Grant (1,000 Won)	Loan (1,000 Won)	Total (1,000 Won)
1. Fishing Vessel Procurement	—	76,680	76,680
2. Boat Construction and Equipment	65,950	32,520	98,470
3. Fishing Port Repairing	26,120	—	26,210
4. Shallow sea, Tide flats and Fresh Water Fishery	34,647	10,600	45,247
5. Processing Plant and Fish market	34,350	106,550	140,900
6. High sea Tuna Fishing	—	44,000	44,000
7. Fishnet Replacement	30,860	30,860	61,720
8. Fishing Operation Fund	—	195,090	195,090
9. Products Collecting Fund	—	75,000	75,000
10. Production Fund	—	60,000	60,000
11. Fishermen Training	2,560	—	2,500
12. Cooperative's Staff Training	1,000	—	1,000
13. Mutual Relief Insurance for Fishing Vessel	10,100	—	10,100
14. Mutual Relief Insurance for Fishermen	2,890	—	2,890
15. Fishery Product Export encouragement bounty	8,000	—	8,000
TOTAL	216,477	631,300	847,777

Subsidy or Grants

Korea has been providing a small amount of grant assistance to poor fishermen and for encouragement of the industry for a number of years. Regulations Governing Delivery of Fishery Subsidy were promulgated on 1 November 1952. Since, then, these regulations have changed several times with certain items being either added or eliminated.

According to the Regulations of Fishery Subsidy, the Ministry of Agriculture and Forestry may give grant assistance within the scope of the annual budget, for establishing ice-making, freezing, cold storage and consignment sale facilities; for break-waters or piers recognized as a public need; and for aquiculture, deep-sea fishing boats, fish processing plant, etc.

The maximum grant allowed may not exceed 80 per cent of the expense involved and shall be made only to an individual, juridical person or a fishery cooperative. In certain approved cases assistance for investment may be granted on the basis of 50 per cent subsidy, 30 per cent government loan and 20 per cent of own fund.

Loan

There are three sources of loans available to fishermen. These are government guaranteed loans, loans from U.S. Counterpart funds and Fisheries special funds. Of the 631,300,000 Won available during 1962, 154,700,000 Won were provided as government guaranteed loans, 126,600,000 Won as U.S. Counterpart loans and 350,000,000 Won Fisheries special loans.

The government guaranteed loans are made by the Finance Department of the National Agricultural Cooperative Federation (NACF) and Korean Reconstruction Bank (KRB). Most of these loans are for capital investment. They are secured by mortgage of fixed real property and/or fishing vessels and have repayment periods of up to 10 years.

Two types of loans are available from U.S. Counterpart funds, i.e. production loans and small vessel modernization loans. Production loans are made mainly to individual fishermen through his cooperative, are payable within one year and are secured by marketing agreement. Production loans may not exceed 20,000 Won per individual.

Small vessel modernization loans are made to individual boat owners and are secured by marketing agreement with his cooperative and the guarantee of his cooperative and/or others. The repayment period is up to three years. The maximum loan is 500,000 Won. Both counterpart loan funds are administered by the NACF.

The Fisheries special loans also are made by the NACF from government provided resources. These loans are made to fishery cooperatives for carrying out joint activities. Repayment periods range from 1

to 10 years depending on the nature of the activity. Loans are secured by suitable collateral belonging to the cooperative. In the case of product collecting loans the collected products are considered the security. Interest rates under these government credit programs are between 8 and 10% per annum.

Loans for Fishing Vessel

Loans for vessel construction are limited to 75 percent of the construction cost; these loans made to fishermen by the Korean Reconstruction Bank. In case the boat size is over 20 gross tons, loans are normally secured by mortgage of the vessel and other collateral, the total being equivalent to 120 percent of the loan amount.

The vessel, regardless of the size, must be covered by the vessel insurance program administered by the Central Federation of Fisheries Cooperatives. Loans for vessels of over 20 gross tons should be repaid in a period of 5 years, the interest rate being 8 percent per annum.

The fisheries cooperative is responsible for guaranteeing repayment of principal and interest on loans obtained by its members. When fish is landed at the fish market (Cooperative's consignment sale place), the cooperative usually deducts 15 percent of the total proceeds for repayment on the loan and this deduction is continued until the loans are retired.

Liquidation of Usurious Loans

The sources of credit for fishermen which have been described above are largely of very recent origin. Except for vessel and facility construction loans through the Korean Reconstruction Bank under U.S. Aid projects and a small revolving loan fund provided by U.S. Counterpart fund, fishermen have had to depend on commercial banks or private sources for the credit necessary for their operations. Since the amount of commercial bank credit was limited and the majority of the fishermen could not qualify for loans, the greater amount of loans were obtained in the

past from private money at lenders interest rates ranging as high as 5 to 10 percent per month.

This situation had a demoralizing effect on the fishing industry and had been a major factor in retarding development. Such usurious interest charges made fishermen more and more indebted.

In recognition of this situation, which applied to the Korean farmer as well, the Government on 10 June 1961, promulgated the Law on the liquidation of usurious loans in farm and fishing villages. Under this law usurious debtors and creditors were required to report the loan amounts to designated committees in the locality within a specified period of time. Such loans properly reported and certified were liquidated under the following conditions:—

1. Liabilities to creditors for usurious loans were repayable by the Korean Agricultural Bank (now NACF) on behalf of the debtors, provided however that such repayment would be made in bonds issued by the Korean Agriculture Bank.

2. The KAB would pay off the value of the bonds to the creditors with 20 percent annual interest in periodic instalments over a period of 4 years after a deferment period of 1 year. However, in case of bonds having a face value not in excess of 1,000 Won (\$7.69) repayment would be made in one year.

3. The debtor would be obliged to pay off the amount of his loan to the KAB with interest at the rate of 12 percent per annum.

In order to assist the Government in meeting the credit need created by eliminating the source of usurious loans, the United States Operations Mission to Korea allocated counterpart funds of 126,600,000 Won as production loan funds.

On 20 February 1962, a Fisheries Cooperative Law was promulgated. This law authorizes the establishment of fisheries cooperatives by area, by type of fishing and by fishery manufactures and formation of a

National Fisheries Cooperative Federation. The Federation, among other things is authorized to carry on credit and finance activities. When the Federation assumes these functions, funds now administered by the NACF will be transferred to it. One of the major objectives of the Federation will be to develop a credit program that more fully meets the particular needs of the fishing industry.

Japan

In order to facilitate the modernization of fishing installation and equipment of coastal fishermen, the Agriculture, Forestry and Fisheries Financing Corporation, a Governmental banking organ, has provided equipment loans to them.

Thailand

There are 3 revolving loan funds operated by the Department of Fisheries:—

1. *Revolving Loan Funds for Marine Fishermen*

Source of loan fund: In 1957 the Ministry of Agriculture borrowed Baht 5,000,000 as loan fund from the Ministry of Finance at the interest rate of 4% per annum, and through the competence of the Department of Fisheries, in turn, charges the fishermen borrowers 8% per annum. The Ministry of Agriculture must repay this loan to the Ministry of Finance within 5 years, and the fishermen borrowers are obliged to refund their debts to the Department of Fisheries within 3 years by either monthly or quarterly instalments.

Loan purposes: Loans may be granted to the sea fishermen for the following purposes:—

1. To purchase the engines to mechanize the fishing boats.

2. To purchase the hulls or boats for fishing operation.

3. To purchase the fishing nets to be used with the mechanized boats.

4. To repair the engines of the fishing boats.

Applications approved: From 1957 to 1961, there were 511 applications for loans, and the total amount was Baht 46,546,748. The number of applications already approved each year were as follows:—

Year	Number of applications approved	Amount of loan (Baht)
1958	102	3,727,500
1959	21	941,500
1960	32	1,059,000
1961	31	1,170,000
TOTAL	186	6,898,000

2. Revolving Loan Funds for Fish Culture

In 1960, the Department of Fisheries received a Government budget of Baht 500,000 as a revolving loan fund for fish culture. This loan will be granted for fish pond culture, or culture of fish in *krachang* (cage for rearing fish, placed in canal or river) at 4% rate of interest per annum. There is an identical foregoing Loan Committee competent to handle this loan. In 1960/61 there were 121 applications for loan amounting to Baht 452,664 sent in to the Fisheries Department by applicants from five provinces: Bangkok, Dhonburi, Nonburi, Chacherngsao and Samutprakarn. Up to the end of 1961, the Committee approved 43 applications amounting to Baht 289,000.

3. Revolving Loan Funds Promotion of Coastal Fisheries

The Fisheries Department has realized that communication by means of radio-telephone helps the fishermen to obtain information with respect to weather, market news, S.O.S. due to accidents and natural hazards, to maintain contacts among the fishing boats, to locate schools of fish, etc. For these reasons, the Department of Fisheries has established 4 radio-telephone stations on the coasts, two in

Bangkok and one each in the provinces of Rayong, Chumporn and Chanburi.

In connection with the above activity, the Department has provided, since 1959, the following revolving loan funds:—

(1) Baht 480,000 for purchasing the marine radio-telephone sets.

(2) Baht 420,000 for purchasing the fish echo-sounders.

The above loans, under the foregoing Loan Committee, will be granted to each eligible marine fisherman to purchase a radio-telephone set and an echo-sounder to equip his fishing boat.

As yet, there has been no submission of application for this loan, due to the fishermen's insufficiency of the technical know-how to operate this apparatus.

The first radio-telephone training course, having 19 fisherman trainees, was opened in 1961 by the Fisheries Department, and the courses will be arranged from time to time. The Department is also experimenting with echo-sounder equipment to ensure reliable results. After the completion of the studies, the fishermen will be instructed in the method of operation, and encouraged to equip their boats with this apparatus.

II. INSURANCE

Australia

No governmental assistance is offered to Australian fishermen in respect of the insurance of their vessels and gear.

Rising capital and operating costs in the fishing industry have made some insurance companies reluctant to write insurance on fishing vessels and gear. Those companies which have continued to offer such insurance have raised premiums and imposed restrictions on coverage. Vessel owners complain that the cover is inadequate and premiums prohibitive, with the result that many do not insure their vessels and equipment.

At least one fishermen's cooperative—the South Australian Fishermen's Cooperative Ltd.—has recently been also able to negotiate with an insurance company an improvement in rates for its members. The annual rates now chargeable to such fishermen are:

Vessels under			
A£1,000	7½%	of insured value	
A£1,000— £4,999	5¾%	„	„
A£5,000—£10,000	4¼%	„	„

All these quotations include a condition that the first A£10 of any loss is sustainable by the owner.

In *Papua and New Guinea*, insurance of fishing boats and gear is private and voluntary, except for items purchased on Government loans for which insurance is mandatory. It is not thought that many indigenous people insure in other cases, and insurance companies are very reluctant to cover vessels of native construction. Information is not available about the insurance provisions made by the few Europeans involved in the industry.

Hong Kong

For the larger type of loans utilized in vessel construction, the following clause is usually incorporated in the agreement: "The borrower undertakes to maintain and keep the boat seaworthy and in proper order and repair and, with effect from the date on which it is licenced, insured with an insurance company approved by the borrower in a sum not less than the balance outstanding of the principal sum, against total loss, and to pay all premiums for such insurance and, if required, to produce to the Lender the policy of insurance and the receipt for the payment of the last premium thereon"

India

Maharashtra State

Insurance is compulsory for loans of Rs.5,000/- and above. Insurance is compulsory

in respect of loans for mechanization. The insurance policy is assigned to Government and the risk has to be kept covered until such time as the loan is repaid in full by periodically renewing the policy.

Where insurance is compulsory no loan is disbursed to fishermen unless they produce insurance policy covering the risk for a minimum period of a year for the value of the loan amount duly assigned in favour of Government. As per terms of the mortgage deed, this policy is required to be renewed to keep it running till the loan is repaid. However, great difficulty is experienced in the matter of renewal of the policies by fishermen. In spite of reminders issued by the Fisheries Department and insurance companies and their agents, loanees, due to their ignorance and poverty, do not respond and in many cases coercive measures are required to be adopted for recovery of insurance premiums. This procedure, though somewhat effective, entails much time and the risk remains uncovered for a considerable time. This situation could be set right if the Insurance Officer of the Finance Department undertakes to insure the fishing vessels. A reference on this subject has already been made to the aforesaid officer and his reply is awaited.

In the matter of insurance it may be pointed out that the risk covered by marine insurance companies is not specially appropriate to fishing vessels. The marine insurance companies cover risk for all sea-going vessels from steam ship to fishing toney. As compared with the mercantile ships the risk to fishing vessels is rather high in view of the narrower margin of safety frequently observed in order to take full advantage of the waters fished, the very great strains and reduced manoeuvrability imposed upon fishing vessels when actually fishing, especially in bad weather and in certain areas, and the limited complement of qualified crew carried. In practice too the incidence of claims not entertained by the insurance companies under the terms of the policies is high.

In fisheries, total loss, collisions, groundings and engine breakdowns do occur with greater frequency than in other shipping enterprises and, in particular, the great strain on machinery does often result in breakdown and disablement involving costly salvage claims. The fishing vessel owner, therefore, finds such insurance not only very expensive but also inadequate. No cover is given against some of the serious losses in respect of fisheries represented by loss of fishing time through interruption of voyage during stormy weather and lay-up for repairs. In these circumstances, there is a strong case for special insurance arrangements suited to the fishing industry, whether by private insurance companies, or a Government agency such as Insurance Fund.

Gujarat State

Insurance in fishing boats by fishermen is insisted by the Government when loans are advanced to them for construction of new boats or for purchase of engines for installation in the boat. This is not only to safeguard the interest of the fishermen but also of the Government. The fishermen insure the boats and assign the policy to Government against the loan. The boats are registered in the name of the Government and this continues till the loan amount is repaid by the loanees in full. If these boats meet with accidents the Government gets the compensation from the insurance company towards the loan amount paid by the Government to fishermen. However, the Government does not insist on the continuation of the insurance of the boats or engines once the loan amount is repaid by the loanees. The Government persuades them to continue the insurance with a view to safeguard the interest of the fishermen.

The interest charged by the Government on the loans granted to the fishermen for boats and engines is 5 percent if they are insured and 9 percent on those that are not insured.

It has been found essential to provide for insurance of fishing boats at reasonable

rates of premium, especially when the fishermen do not have adequate security in the form of immovable property and also to safeguard the loan granted by the Government. The fishermen are advised to insure their boats with the cooperative insurance societies, whose premium rates are reasonable.

Once the boat is insured by the fishermen, the policy should cover for the period for which it is insured. But this is not the case with certain companies. They say that if boats meet with any accident during the monsoon months (when the sea is rough) the companies are not liable to pay the compensation. The companies are not agreeable for comprehensive insurance of the boats. The Department is, however, trying to find out a solution for this. In this State monsoon fishing is not commonly undertaken.

Korea

The cooperative insurance of fishing vessels in Korea started in 1955 and is operated by the Central Federation of Fisheries Cooperatives.

As at the end of July, 1962, the number of fishing boats in Korea is estimated at 42,000. Of these, approximately 25,000 boats are eligible for insurance.

As at the end of July, 1962, 4,000 vessels, approximately equivalent to 16 percent of the total number of eligible vessels, are insured under the mutual relief insurance.

The premiums are fixed according to the age, size, equipment and value of vessels insured. Also the rate of premiums varies from 1.8 percent to 3.8 percent per annum of the value of boats insured.

The mutual relief insurance system is voluntary and is on a one-year basis. In case of accident the insured amount is to be

released, but shipwrecks caused by any malicious intention will not be paid.

According to recent statistics the rate of accidents which account for more than half wreckage is 3 to 3.5 percent of the total number of insurance-eligible boats.

The total amount of government subsidies received by the Central Federation of Fisheries Cooperatives for the last 8 years for the mutual relief insurance for fishing vessels is as follows.

Year	Subsidy
1955	1,625,000 (US\$1.00-130 Won)
1956	3,960,000
1957	9,480,000
1958	5,930,000
1959	6,091,000
1960	16,400,000
1961	4,000,000
1962	10,100,000
	57,586,000 Won

Also, the present status of mutual relief insurance for fishing vessels is shown in Table I and Table II.

TABLE I
Insurance Appraised

Year	No. of Vessels	Gross Tons	Evaluation of insured vessels	Insured value	Premium	Premium rate in average
			————— Thousand Won —————			
1959	5,562	51,797	9,784,508	585,730	9,214	1.6%
1960	2,847	32,207	7,619,032	369,285	10,041	2.7%
1961	3,093	38,276	9,451,293	615,988	13,397	2.2%

TABLE II
Payment of Insurance

Year	No. of Cases	Gross tons	Losses	Payment
			————— Thousand Won —————	
1959	215	1,197	126,757	17,331
1960	192	1,875	172,852	14,884
1961	63	672	79,395	4,161

Pakistan

The Fishermen's Co-operative Societies have started insuring the boats, engines and nets, etc., issued on loan basis through insurance companies, so that the loan issued may be covered against all risks. In addition to this the Mercantile Marine Registration Certificates, in respect of the vessels involved in such loans, is produced to the Mercantile Marine Department for adding the name of the Chairman, Fishermen's Co-operative Society (as a Co-partner) with the name of the boat owners so that the borrower may not transfer, mortgage, sell, etc. without obtaining a *No Objection Certificate from the Fish-*

ermen Cooperative Society and the Central Fisheries Department in respect of No Dues outstanding against the boat owners.

Philippines

There are no available data on hand at present. Plans are being finalized to make a study on this.

III. FISHERIES STATISTICS

Australia

(a) A conference of Commonwealth and State Government Fisheries Officers in September 1960 established a committee to design uniform systems of collecting statistics

of the fishing industry in all Australian States and the Northern Territory. The composition of the committee is: a chairman representing the Commonwealth Department of Primary Industry, one member representing the Commonwealth Bureau of Census and Statistics, one representing the Commonwealth Scientific and Industrial Research Organization, and one official of the Victorian Fisheries and Wildlife Department, who represents all State authorities.

The Committee has designed a model system for collecting uniform inventories of vessels and manpower, and has almost completed the design of a system for the uniform recording of catch and effort. It is expected that these systems will come into general operation within a short time. A copy of the final report of the Committee will be tabled at the 10th Session of the IPFC

The Committee aims to consider in the future the coordination and improvement of statistics of fish-marketing and processing, and the improvement of the statistical reporting of imports and exports.

Mechanical tabulation of statistics has been provided for in the systems already designed, and its appropriateness will be considered in the design of the other systems.

(b) No statistical surveys have been conducted in the period under review. The Fisheries Division of the Commonwealth Department of Primary Industry intends to institute regular surveys of several branches of the Australian fishing industry after the proposed reorganization of the Fisheries Division

(c) In *Papua and New Guinea*, records of catches by the Division of Fisheries are kept, but no staff is available for the collection of other statistics. Records of the export of commercial shell (*Trochus*, green snail, pearl shell), of crocodile skins and of edible marine products are processed by the Statistician of the Department of the Administrator, and this is not correlated with actual production.

Hong Kong

(a) Marketing statistics are produced at wholesale fish markets and forwarded daily to a coordinating statistical section in the Head Office of the Cooperative Development and Fisheries Department. This system operates satisfactorily and no changes are contemplated except that certain duties of the Statistical Section in the Head Office may, in future, be carried out at the wholesale fish markets. Routine surveys were carried out in the past year.

(b) Statistical surveys made or being planned include a survey on retail prices in relation to wholesale prices, a statistical survey on the salt dried fish trade and survey of consumption of marine fisheries products in the Colony.

India

Maharashtra State

During the Second Five Year Plan a beginning was made in collection of fisheries statistics with the establishment of a statistics section in the Fisheries Department of the then existing Bombay State. The section started functioning with the following staff :—

(i) Staff at Head Office, Technical and Administrative

- 1 Statistical Officer
- 1 Senior Clerk
- 1 Peon to Statistical Officer

(ii) Field Staff

Statistical Investigators (one each at Bassein, Alibag and Ratnagiri and two at Bombay)

Fisheries Enumerators (one each at Dahanu, Satpati, Alibag, Murud, Harnai, Dabhol)

The field staff under this scheme was meant for the collection of marine fisheries statistics. Compilation and collation of all

data is done at Head Office and thus there was no separate statistical unit for different parts of the State. There is no *ad hoc* staff for collection of inland fisheries statistics as yet and this work is done by the regular staff of the department as and when required.

A sample survey sponsored by the Indian Council of Agricultural Research to determine effects of mechanization of fishing craft in Maharashtra State has been initiated in July 1960 with the following additional staff :

- 1 Assistant Statistician, Bombay
- 2 Statistical Assistants, Bombay
- 1 Inspector
- 1 Coding Assistant
- 2 Clerk-cum-typists
- 10 Statistical Investigators
- 1 Peon

This scheme is being continued. A consolidated position of staff as on 31 March 1961 is given below :—

(i) **Technical and Administrative staff at Head Office**

- (1) Statistical Officer 1
- (2) Assistant Statistician 1
- (3) Statistical Assistants 2
- (4) Research Assistant 1
- (5) Inspector 1
- (6) Coding Assistant 1
- (7) Clerk typist 2
- (8) Peon 1

(ii) **Field Staff**

- (1) Statistical Investigators 13
- (2) Fisheries Enumerators 6

A statistical section was established in the department with a view to collecting all statistical information found necessary by the State Government, and by other agencies, official and private. During the three years of the plan, the section has taken up the collection of statistics on several aspects of fisheries.

A pilot census was undertaken in the off season of the year 1958 in 20 fishing villages of Thana District. Subsequently a census of fishermen, craft and tackle has been completed in all the marine and estuarine fishing villages of Maharashtra State. This has given for the first time a clear idea as to the various magnitudes in respect of the fishing industry.

The sample survey to estimate marine fish catch was initiated in the year 1959. Thereafter the survey is being conducted every year on a routine basis.

Collection of fish price data has been taken up at Bombay. A sample socio-economic survey of marine and estuarine fishermen with fishermen households in 49 selected villages a sample of 588 has been completed and data is being analysed.

The program of mechanization of fishing craft has made tremendous headway in the State. At the instance of this department, the Indian Council of Agricultural Research, New Delhi, sponsored a scheme of sample survey to determine the effects of mechanization in the State. The enquiry was initiated in July 1960 and will continue until July 1963.

Apart from this, the biological and experimental data obtained by research workers and scholars working at the Marine Biological Research Stations at Bombay and Ratnagiri of the Department is analyzed, and interpreted by the Statistical Officer.

Development and surveys planned: The field staff employed at present for marine fish catch survey is found to be inadequate to provide dependable estimates of the marine fish catch. During the Third Five Year Plan of the state, it is proposed to strengthen this staff. The emphasis at present regarding the collection of statistics is on the side of marine fisheries. Besides, it is intended to conduct a census of fishermen, craft and tackle and the socio-economic surveys periodically, to assess the development of fisheries in the State. It is also proposed to organize some

research scheme on population dynamics of certain important fisheries and on the bagnet fishery of the State.

Gujarat State

(a) A scheme to create a separate statistical cell in the Directorate of Fisheries of Gujarat State was included under the Third Five Year Plan scheme of "Collection of Fisheries Statistics". When the State came into existence in this Department during the year 1961/62 with a staff of 4 persons—one statistical Officer and 3 fisheries officers, (Statistics).

The statistical cell is entrusted with the collection of fish catch, etc.; statistics from both marine and inland sources.

(b) The following sample surveys are being planned:—

- (i) Sample survey to estimate the marine fish catch of the State
- (ii) Survey to determine the effects of mechanization of fishing crafts in the State
- (iii) Socio-economic survey of the fishermen in the selected villages of the State.

Japan

The recent economic growth in Japan has brought forth some changes in the national policy for fisheries. In the field of fisheries statistics also, emphasis has shifted from the conventional statistics on production to those on employment and incomes.

(a) *Survey on fisheries economy*: In order to obtain more accurate statistics, the number of samples has been increased since 1962.

(b) *Survey on fishing workers or employees*: For the purpose of investigating the movement or increase and decrease of fishing workers, the number of fishing households, and their members and members who have just graduated from schools, a preliminary survey was made in 1961. The final survey will be carried out in 1962.

(c) *Survey on market prices*: The number of markets where the price of marine fishery products are surveyed will be increased in 1962, from 102 to 235 markets in order to replete the contents of statistics.

(d) *Preparation for forthcoming Fisheries Census*: The Fisheries Census is carried out once every 10 years in compliance with the provisions of the law in Japan. The third Fisheries Census is scheduled to be made in 1963. As preparatory operations, a pilot survey and pre-test will be carried out during 1962.

Pakistan

Organization

The systematic coordination of fishery statistics from all available sources, their compilation and analysis was undertaken by the Central Fisheries Department (now Marine Fisheries Department) when it came into existence in the year 1951.

The Marine Fisheries Department at Karachi and its branch offices at Pasni and Chittagong are the primary sources of all statistical information concerning Marine Fisheries in Pakistan.

The sources of information, regarding the fresh water fisheries, are the *Provincial Fisheries Directorates*, having their head offices at Lahore (West Pakistan) and at Dacca (East Pakistan).

The Central Fisheries Department is primarily responsible for compiling, analyzing and interpreting the fisheries catch statistics, received from its branch offices and Provincial Directorates. The catch statistics include the information on fish production, gear and crafts used and the manpower employed in marine and inland fisheries of Pakistan.

There are two sources for the collection of the information on foreign fish trade in Pakistan: (i) Custom collectorates are the primary source of information on the processed fishery products imported from and exported to the foreign markets; (ii) The

Central Statistics Office is the secondary source of the information because all the publications of that department are based on the information supplied by the Custom Offices.

Collection and Processing of Fishery Statistics

(a) Catch Statistics

For the economics/statistical purpose, every attempt is being made to collect catch statistics by the Central Fisheries Department in accordance with the recommendations of the First International Meeting on Fisheries Statistics held in Copenhagen, Denmark, (26 to 30 May 1952). It was recommended by the Meeting that "Species should be correctly identified in recorded statistics by the Scientific as well as by common names; if possible the catch of every species should be recorded separately; a single figure covering more than one species is of little value to a Fishery Biologist and should be avoided as far as possible". Unfortunately, due to the shortage of technical personnel and lack of other facilities, catch statistics of each specific species could not be recorded separately. However, care was taken to record the quantities of the principal species groups of fish landed at different fishing settlements in the East and West wings of Pakistan.

For the purpose of estimating the yield of fish from different fishing areas, the marine fisheries of Pakistan have been divided into two main fishing zones; the East and West Coasts of Pakistan. The West Coast is further sub-divided into three fishing areas:—

- (i) Mekran Coast
- (ii) Karachi Coast
- (iii) Former Sind Coast

With respect to their geographical locations and managerial jurisdiction, these divisions coincide more with the natural environments rather than statistical divisions. At the end of each calendar year the catch statistics of marine and inland fish are

compiled and a comparative analysis is made to study the trend of the yield of different fishing areas of Pakistan. In all the other fishing zones, except the Karachi Division the production of fish is generally estimated by random sampling.

From 6 August 1959, on the completion of the fish harbour, all the fish caught on Karachi and Former Sind is now brought to the Wholesale Fish Market at the fish harbour where it is desposed of after proper weighing. This is, therefore, the only place where the actual weight of fish caught in this region is recorded.

The catches are divided into 9 principal species groups as detailed below:—

- 1) All fresh water teleosteans and genoids
- 2) Salmon, trout and similar species
- 3) Teleostean flat fishes
- 4) Cod, hake, haddock and similar species
- 5) Herring, sardines and similar species
- 6) Tuna, true mackerels and similar species
- 7) Other marine teleosteans, perches, croakers, basses, etc.
- 8) Elasmobranchs (Sharks, skate, ray)
- 9) Crustaceans (Lobsters, crawfish, shrimps, prawns, crabs, etc.).

The catch statistics of the group No. 1, namely all fresh water teleosteans and genoids, are collected by the Provincial Fisheries Department while the Statistics of the other groups is collected by the Marine Fisheries Department and its branch offices at Pasni and Chittagong.

(b) Production of Processed and Cured Fishery Products

The production of frozen shrimps, frozen lobster tails and fish, canned prawns and fish, cured fish and prawns and fish meal

and manure is recorded separately. The data of the processed products are obtained from the record maintained by the management of the processing plants while those of cured products are estimated from the quantities exported abroad. Cured fish is consumed locally among the fishermen's community only and the home consumption of this product is less than 2% of the total produce. The remaining 98% is being exported to the foreign markets. As the home consumption of the processed fish products is negligible, that is why the quantity exported is almost the quantity produced by the processing plants.

The production of each and every species of fish which is cured is not recorded separately. However, quantities of some of the species or groups is recorded.

(c) Gears, Crafts and Manpower Statistics

The mechanization of the fishing fleet of Pakistan is of very late origin. In the year 1957-1958, the Government provided 156 marine diesel engines to mechanize the fishing fleet. Afterwards the Fishermen Cooperative Society procured diesel engines under the import licenses granted by the Government for distribution to the fishermen in order to mechanize their boats.

In the year 1958 there were only three trawlers and few mechanized boats. The number of the trawlers and mechanized boats in the year 1961, rose to 141 and 292 respectively.

The Mercantile Marine Department is the primary source of information about the number, type and constructional details of the fishing crafts.

The marine nets used for fishing on the East and West Coast of Pakistan are generally gill-nets. These are indigenous nets designed to suit the local conditions of different areas of the coast. Different varieties of the following types of nets are generally used for fishing on the coastal areas :

1. Fixed Gill-nets (Stationary gill-nets)
2. Drift gill-nets
3. Beach Seine nets
4. Tidal operated nets
5. Cast nets
6. Trawl nets

The estimates of the marine nets used on the East and West Coast of Pakistan is 300 trawl nets and 10,000 different types of gill-nets. The nets used for fishing freshwater fish are generally drag and hand dip nets. The number of freshwater nets could not be ascertained so far, as the provincial Directorate of Fisheries is understaffed and has no statistics sections attached to the offices.

The total population of fishermen is recorded as 500,000 out of which 190,000 are subsidiary and 310,000 are active fishermen.

Foreign Trade Statistics

The foreign trade of fish in Pakistan has made satisfactory progress during the last 5 years (1957-1961). The total quantity of fish exported in the year 1957 was 676,358 cwts. while in 1961 it was 589,575 cwts. The foreign exchange earning from the export of fish products in the year 1957 was Rs. 28,687,605 while in 1961 it amounted to Rs. 60,199,422 which is almost double that of 1957.

The primary source of information of the volume and the value of the different commodities exported abroad are Custom Offices. The publication of the Central Statistical Office on the fish trade, is based on the information supplied by the Custom Offices. The function of the Marine Fisheries Department is to analyse and interpret the export figures supplied by the Custom and the Central Statistical Office. If, in the compilation and publication of the Foreign Trade Statistics, any omission of essential information or commission of the mistakes found during the processing of the data by the Marine Fisheries Department, are intimated to these departments.

Recommendations

The need for reliable and detailed fishery statistics has long been felt by the fishery workers in Pakistan. Due now, as the country has an enormous program envisaged in the Second Five Year Plan for the development of various industries, the collection, compilation and analysis of fishery statistics has all the more become a pressing necessity as guide lines for the research workers and capitalists, who are ready to invest handsome amounts in this industry but hesitate to step in the field due to the lack of accurate and detailed statistical information without which future prospects and forecasting the trend of this industry cannot properly be ascertained.

To achieve these objectives, the following recommendations are made :—

(1) It is the proper time to evolve more scientific and workable methods of the collection and compilation of fishery statistics to meet the requirements of those who are interested in this industry both at home and abroad. For this purpose an adequate trained staff, both of executive officers and field workers, is needed.

(2) It is very difficult for the fishery workers to collect fisheries statistics during field investigation and to check the record of the industrialist without any legal authority from the Government. It is, therefore, recommended that the fishery workers may be invested with the authority as provided in clause 16, sub-clause (1) and (2) of the Fish Supply Managements (Marketing) ordinance 1962, submitted to the Ministry of Law for approval and promulgation, to collect and check the fisheries statistics from different agencies. These recommendations may be provided in the Fishery Act of Pakistan as and when it comes into existence and enforced.

(3) The fisheries statistics supplied by the Provincial Directorates are of little or no value for the purpose of analysis and interpretation. Mostly the data supplied are defective in the following respects :—

1. Omission of the essential information.
2. Collection of the unrepresentative data.
3. Supply of biased data.
4. Supply of production data without mentioning the source of information, and procedure adopted.

The Provincial Directorates are recommended to employ trained staff in fishery statistics to eliminate the above-mentioned shortcomings.

IV. FISHERIES COOPERATIVES

Australia

(a) In 1961 the Government of Victoria extended an offer of assistance to a Co-operative which had not previously had any financial aid from that Government.

No other organized Governmental or institutional measures specifically aimed to strengthen Co-operatives have been taken since the 9th Session.

(b) No new organized measures have been taken in regard to extension and educational services to Co-operatives.

In *Papua and New Guinea*, assistance is given to existing co-operatives in the form of loans of equipment (fishing gear and refrigeration plants) and technical advice on fishing methods, gear technology and processing of fish.

Hong Kong

(a) Following a modest increase in staff in the closing months of 1961, it became possible to establish a four-man audit team which specializes in the audit of Societies' accounts. Audits are now carried out at more frequent intervals than before and include a study of accounts, managerial activities and efficiency and an annual report on the financial standing of each Society. Comments and suggestions by the team on Society business are conveyed to the Committee through established field Co-operative Officer channels.

(b) A series of seminars were conducted during the year to which Officers and members of fisheries co-operatives were invited. These seminars concentrated mainly on the principles of co-operative law and co-operative accounting but also included subjects of a more general nature. An attempt is being made among selected fishermen to introduce the practice of keeping accounts and a number of fishermen are being encouraged to list daily their income and expenditure in order to achieve some form of input-output relationship in respect of their operations.

India

Maharashtra State

Correct figures of production finance required for fresh and dry fish trade are not available, but it is estimated that finance to the extent of about Rs. 50 lakhs for fresh fish and Rs. 80 lakhs for dry fish is usually required, out of which about Rs. 9 lakhs for fresh fish and Rs. 5 lakhs for dry fish is made available through co-operative societies. It will thus be seen that bulk of the finance required for this trade is provided by merchants and middlemen. These merchants charge a commission of $6\frac{1}{4}\%$ and an additional $3\frac{1}{2}\%$ as 'Kasar' (discount), whereas the co-operatives charge only $6\frac{1}{4}\%$ commission and besides give a rebate of 2% if all the fish is sold through the co-operative. Thus, the extent of additional charges which fishermen are required to pay to private traders can be gauged taking into consideration that fresh fish worth about $1\frac{1}{2}$ crores is brought yearly to the Crawford Market for sale. In case of dry fish, most of the business is monopolised by merchants and one can very well imagine their profits taking value of dry fish marketed in Bombay at Rs. 4 crores. The principal market for dry fish is at Sewree, Bombay, and here not even 2% of the business is in the hands of the co-operatives. The reason for this is obvious since the co-operatives do not have even a fraction of the finance required to handle this business. In addition, some of the co-operatives have established direct contacts with the foreign

traders in United Kingdom, Singapore, Hong Kong, etc. to whom they have started exporting fish maws, which helps to earn foreign exchange. Here also due to inadequate finance, bulk of the business is handled by private traders.

It is evident that many of the societies and their office bearers are able workers who have been conducting the affairs of the societies with zeal and energy. In spite of this, the societies have been unable to make proper headway in the field of marketing, export etc. even with the large finance made available by the Department of Fisheries for long term requirements. The following are some of the causes which account for this :

(i) *Share capital* : Most of the societies are functioning with insufficient share capital. Since the bank credits are granted in proportion to the share capital, it is necessary to take steps to increase the share capital of societies who have been doing good work. Government's participation in the share capital is necessary.

(ii) *Creditworthiness* : According to rules the banks have to provide finance eight times the capital and funds. However, in actual practice, the banks do not allow finance more than 4 or 5 times the capital. Thus the societies are unable to provide adequate advances to fishermen, who take recourse to merchants or money lenders and are thus free to sell their fish anywhere. Besides, the quantum of advance required by fishermen's groups varies from region to region and this fact has also to be taken into account when the bank lays down its limitations for distribution of such advances. It is necessary that the limit of advance for each groups should be increased according to requirements and loan credits increased accordingly.

(iii) *Marginal grants* : In the distribution of such advances, the bank lays down conditions for contribution of certain amount in such advances by the co-operative society. This margin amount is usually to the extent of 20% to 30%. The societies find it difficult

to provide funds for this purpose and hence they are unable to derive the benefit of the credits of the bank. It is necessary in such cases that either the bank waives this condition for margin amount or Government stands guarantee.

(iv) *Production finance* : It is necessary that the Co-operative Bank frames its rules for the provision of production finance on the basis of actual needs of the fishing industry and not necessarily on the basis of the usual rules laid down for this purpose. A study of the conditions varying from region to region and the type of fishing undertaken will be helpful. Unless this is done, fishermen are bound to take recourse to merchants, who are in a position to meet the requirements.

(v) *Loan repayment* : Credits granted by the Bank have to be returned within the stipulated period. Many a time the production of fish of a unit is not satisfactory and it is not possible to recover the entire advance or at times, it is not desirable to recover the entire advance. Hence it is necessary for the banks to allow extension of the repayment period of such advances since the credits once extended cannot be withdrawn. The banks also do not sanction fresh credits unless the previous credit is fully returned but since the entire fish marketing is run on credit basis, many a time recoveries are delayed. The banks should, therefore, adopt a more sympathetic attitude. As against this the other merchants at the Crawford Market are not keen on recovering their entire advances from fishermen since they are anxious that their business goes on and the same unit continues to sell their catch of fish during the next fishing season.

(vi) *Dry Fish transactions* : Dry fish is a sort of each crop for the fishermen. They are anxious to dispose of it for cash and reasonable payment. They hardly like to wait for the market to improve since they have to make provision for the monsoon and meet other expenses. If the societies get adequate finance to pay sufficient advances to fishing

units, a good deal of this business will come to societies. It is, therefore, necessary to increase the hypothecation credits.

(vii) *Interest* : The present rate of interest charged by the bank is 6½% which is considered very high. It is necessary to reduce the rate of interest.

(viii) *Clean credit* : Societies are allowed clean credit by the bank for their trading activities. These credits are based on the financial position of the society and are found to be quite inadequate for societies to run their activities. If necessary, Government may stand guarantee for better credits after looking into the working of such societies.

(ix) *Hypothecation credits* : Hypothecation credits are also given by the banks for goods in charge of the societies. These credits which are usually to the extent 60 to 70 per cent of the value of goods, are found insufficient. Several societies have now undertaken export of fish maws and it is necessary that credits to these societies are sanctioned on the basis of their transactions. The present rules do not cover such transactions and hence a rational viewpoint is necessary. The same consideration will have to be shown for boat building which is a new activity undertaken by co-operative societies in the fishing industry.

(x) *Consideration by Reserve Bank* : It is the plea of many fishermen's co-operatives that fishing operations involve more hazards than agricultural operations and concessional finance provided by the Reserve Bank for agricultural purposes are not extended to the fishermen's societies. It is understood that the Reserve Bank's approach to the problem of finance to fishermen's societies is as under :

(a) The State or Central Government would have first to provide finances required by the society.

- (b) The Co-operative Central Bank may agree to finance the societies after the stage of nursing is over and when the societies have been firmly established.
- (c) The Co-operative Central Bank may approach the Reserve Bank when the demands from the fishermen's societies are too large to be met from their own sources.
- (d) The Reserve Bank could at that stage examine the question of providing funds to the industry.

It may be possible to explore the possibilities of obtaining accommodation from the Reserve Bank under Section 17(2)(bb) of the Reserve Bank of India Act. A meeting is requested to examine this question and to urge upon the Reserve Bank to extend the facilities of granting concessional finance to fishermen's co-operatives.

Summary

(1) Facilities for clean, hypothecation pledge and loan credits be increased. Government may stand guarantee for losses, if any, to allay the fears of the co-operative bank.

(2) Time limit for the return of these credits be increased.

(3) Rate of interest should be lowered.

(4) The quantum of advances to be granted to fishermen's groups be increased according to fishing conditions in different regions and the fish catching capacity of different groups.

(5) Reserve Bank be requested to increase their financial accommodation to the State Co-operative Bank and charge concessional rate of interest.

Gujarat State

To strengthen the financial standing of the Societies financial help is given in the form of (i) contribution to share capital, (ii)

grant of loan on easy terms, (iii) subsidy in deserving cases for managerial staff and capital expenditure and (iv) financial accommodation by standing guarantee.

In order to improve the management of the societies extensive training is being given to the personnel, both official and non-official. For the state as a whole, the Gujarat State Cooperative Union functions as the apex body. It runs four Cooperative training schools for training of subordinate personnel both for Cooperative institutions and Co-operative Department. At the district level, district Cooperative boards are in charge of Co-operative Training. The boards arrange for the training of the president, vice-president, managing committee members and secretaries. In addition, seminars conferences and study tours are organised and prizes distributed to well managed societies, Suitable text books, pamphlets, booklets, etc. are being prepared and distributed among the cooperatives to improve the working of the society.

Japan

(a) Fishermen have organized their cooperative associations all over the country, which are playing an important role in the economy of fishing villages. The recent changes in fisheries conditions have caused the cooperatives to expand their economic activities and the consolidate their economic foundations. Various measures are being taken by the Government for the rehabilitation or amalgamation of those cooperatives which are in financial difficulties.

(b) In addition to the primary economic services for fishermen, such as joint marketing of catches and purchasing of fishing materials, in order to cope with the latest modernization of fishing craft and gear, cooperatives are now making efforts to secure production facilities. The Government is also making special studies on this matter.

Korea*

1. The outline of the development of Korean Fisheries Cooperatives

The Fisheries Cooperatives of Korea are now organized in accordance with the Fisheries Cooperative Law enacted on 20 January 1962. However, predecessor fisheries associations, guilds and unions were organized as early as 1929 under Japanese occupation. Prior to establishment of the Cooperatives, these organizations were organized under the Central Fisheries Federation of Korea.

In the years since the establishment of the Fisheries Organizations, adjustment and reorganizations have been carried out several times, in order to consolidate those of poor economic condition or to combine them with stronger ones. Shortly before enactment of the Cooperative Law, a number of guilds and all of the eight provincial unions were abolished. This was not an attempt to do away with fishermen's organization but rather was designed to strengthen the organization.

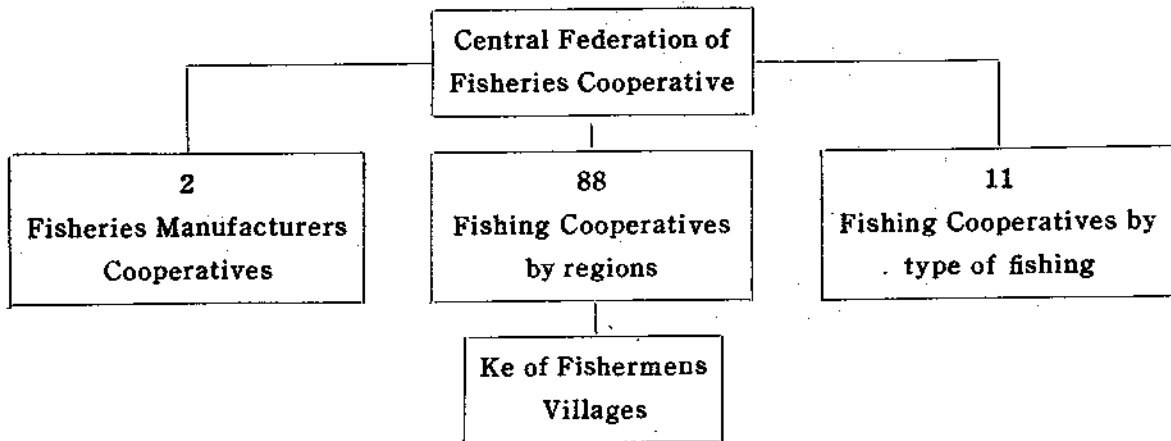
The present Fisheries Cooperative Law was established for the purpose of giving the fishermen greater independence and to broaden the functions of such fishermen's organizations.

2. The organization of Fisheries Cooperatives

Three types of Cooperatives are authorized under the Central Federation of Fisheries Cooperatives. These are fishing cooperatives by region, fishing cooperatives by type of fishing and cooperatives of manufacturers. Eighty-eight regions and eleven types of fishing have been designated as eligible to form cooperative. The regional fishing cooperative may organize "Ke of Fishermen Villages" in accordance with the cabinet decree.

This "Ke of Fishermen Villages" shall be organized for the purpose of managing joint fishing by regional groups of fishermen by mutual agreement among them for their common interest.

The structure of fisheries cooperative organization is as follows:—



3. Business Activities of Cooperatives

A Cooperative may perform any or all of the following functions for the benefit of its members.

- a) Guidance and protection of member fishermen.
- b) Procurement of supplies.

- c) Storing and sales.
- d) Trust.
- e) Utilization.
- f) Mutual relief.
- g) Welfare project.
- h) Execution of business and projects involving government subsidies.

* Information provided by Lee, Byong Kak.

- i) Conclusion of collective agreements to promote the economic interests of the members.
- j) Other projects necessary for the attainment of the cooperative purpose.

Each fisherman is required to purchase at least one share of stock in order to become a member. Though any member can purchase up to two times the average number of shares he can have only one vote. Cooperatives are not trade unions (which also have a place in the fishing industry) and they may not except in some exceptional cases, take any part in political or religious controversy. They are not official bodies administered by government, though their existence depends upon government approval and they are eligible to receive government financial support.

Fisheries cooperatives are required to operate as a non-profit organization for the mutual benefit of their members.

4. Supervision by Government

The Minister of Agriculture and Forestry, Government of Korea, may, when deemed necessary, request reports pertaining to the business and property status of a cooperative, in order to determine whether its administration is in conformity with its articles of incorporation and other applicable regulations based on law and decree.

The fact that Fisheries Cooperatives are subject to government supervision does not mean unnecessary government intervention in their affairs. However, Government has the responsibility for a balanced development of the national economy by promoting a cooperative organization of fishermen and fisheries manufacturers which will enhance their economic and social status and augment the productivity of fisheries. Government guidance is especially helpful during the early stage of organization.

5. Prohibition of political relations

Prior to enactment of the Fisheries Cooperative Law, political influence on

fisheries organizations was one of the great handicaps to the development of the fisheries industry in Korea.

In order to achieve sound development and political independence of fishermen's organizations the Fisheries Cooperatives Law stipulates that no staff member of a cooperative or the central organization shall participate in any political activity.

6. Investment system

The Law defines that a member may have more than one share in his cooperative to permit the erection of a larger business operating fund. The number of value of shares are not uniform but, in general, the value of one share is about 500 Won (130 Won per one U.S. dollar). Therefore, each new cooperative will need a considerable amount of government financial assistance for starting business because only 50,000 Won of own fund would be collected assuming an average membership of 100 members.

Recognizing this situation the government has planned a financial assistance program in the form of government subsidy. This assistance continues until the cooperatives develop sufficient resources to operate independent of government help.

Philippines

The few fishermen's marketing cooperatives were short-lived due to mismanagement. No new cooperatives have been formed.

Thailand

The Department of Fisheries has no jurisdiction with respect to fishery cooperatives. According to the Cooperative Act of B.E. 2471 (1928), the Ministry of Cooperatives has the sole jurisdiction regarding all cooperative activities including fishery cooperatives.

Since 1947 only four fishery cooperative associations were reported by the Ministry of Cooperatives to have been orga-

nized. Practically, the Fisheries Department cooperated with the Ministry of Cooperatives fostering the organization of the cooperative associations. The fourth cooperative association, the latest one, has come into existence since 1957. After that, field fisheries officers investigated the possibility of organizing a few additional fishery cooperative associations, and applications were presented by local fishermen to the Ministry of Cooperatives for approval. Unfortunately, their applications have not been approved.

The four fishery cooperative associations which exist at present are as follows:

1) *The Thai Fish Processing Cooperative Society Ltd.*

This Cooperative was organized and registered in 1947 with the primary objectives of assisting the catfish fishermen to obtain a fair price for their catches through the increase of their bargaining power.

2) *The Central Cooperative Fishery Society Ltd.*

This Society was organized and registered in 1952 and has its headquarters in the compound of the Fish Marketing Organization. It has branches in various provinces on the eastern and western coasts of the country. The Society has borrowed from the Ministry of Cooperatives the revolving loan fund of 4 million baht and has granted it to the fishermen members as production loans. The Society markets members fish products and also purchases fishing implements for the member.

3) *The Pisnu Fishermen Cooperative Society Ltd.*

The Cooperative was registered in 1956 with the primary objective to assist the fishermen of small means who live in the houses or floating houses along the canal of Kabangpongnon, District of Horklong, Amphur Prompiram, Pisanulok Province, through the privilege of their organized cooperative society, to gain the fishing right in the said canal without competitive bidding.

4) *The Lamsing Shrimp Farmers Cooperative Society Ltd.*

The Ministry of Cooperatives has legally approved since April 19, 1958, upon the request of the shrimp Farmers Cooperative Society, Ltd. with two-purposes, credit and marketing. This cooperative society is located in District of Nongchim. The society has received the government loan of Baht 70,000 for a revolving fund reloaned to the members who need credit. The government provided the mentioned loan to this cooperative society Ltd. with the idea to bring these two societies into connection in the interest of improving the efficiency of marketing of fishery products. This cooperative has 30 active members holding 62 shares. Each share costs Baht 100.

Pakistan

a) In addition to the loans and import licences granted to the Fishermens Cooperative Society 6¼% commission is charged by the Society on the auction of fish in the wholesale fish Market which on an average amounts to Rs. 14 lacs per year. A nominal commission 10-15% is charged by the Fishermen's Cooperative Societies on the fishing articles procured under Commercial or Industrial Import licences issued to them for Marine Diesel Engines; spare parts; Burma teak; floats; coir and Nylon ropes; winches; masts; tonies etc. imported under the licence. The income from the sale of ice supplied to the fishermen community from the cold storage and ice plant is also collected by the Fishermens Co-operative Society for the uplift of fishermen community which amount to Rs. 40,000/- per month.

b) The Fishermen Co-operative Society has extended welfare activities such as Medical and Education, old age pensions and scholarship to poor deserving students of the Fishermen Community. Primary schools have been established at Ibrahim Hyderi, Rehri, Gaddani and Sonmiani fishing villages. A dispensary is in operation at Ibrahim Hyderi fishing village and arrangements are being

made by the Society to extend more facilities to other fishing settlements for education and medical aid. Fresh water supplies have also been made available to Ibrahim Hyderi, Rehri, Baba, Bhit and Shamspir islands. Similar social welfare and economic uplift program has been chalked out for other important fishing settlements.

In both the wings of the country the formation of the Fishermens Co-operative Societies is being encouraged with all out Government help and efforts. With this aim in mind Fishermen Cooperative Societies have been formed in various important fishing settlements in East Pakistan and West Pakistan, specially at Khulna, Chittagong, Dacca, Sondia, Hamidia and Cox's Bazar area. On Mekran coast Fish Cooperative Societies have been formed at Pasni, Ormara and Gwadur.

The Karachi Fishermen's Co-operative Society has a membership of 1600 bonafide fishermen mostly fishing craft owners. Its income from import of fishing equipment, fish market commission, proceeds from ice-plants and cold stored etc. is in the neighbourhood of about Rs. 12 to 15 lacs per year. The society has a reserve fund of about 33 lacs as per their audit report ending 30 June 1962.

V. PLANNING FOR FISHERIES DEVELOPMENT AND FISHERIES ADMINISTRATION

Australia

(a) No long-term plans for fisheries development have been published in the last two years.

(b) Following an enquiry into the Victorian fishing industry, the Government of that State set up in 1961 Marine Fisheries Branch in its Fisheries and Wildlife Department. The Branch is to be concerned with research into marine fisheries, the management and development of such fisheries, and the provision of a scientific service to the industry.

(c) A Conference of Commonwealth and State Ministers responsible for fisheries

matters decided, in September 1961, to arrange a short training school for Governmental fisheries field officers. Such a school had never before been conducted in Australia.

The two-week school was held in New South Wales in October 1961. All States were represented among the students. Theoretical and practical instruction on fishing operations, Governmental administration of the fishing industry, and the study of marine fishery resources, was given by experts from Commonwealth and State Government Departments.

The school proved to be successful, and a second school, of three weeks' duration, was opened on 30 July 1962. It is hoped to conduct such schools annually.

It is proposed to expand the Economic and Statistics Section of the Fisheries Division, Commonwealth Department of Primary Industry in order to facilitate intensified economic and statistical study of the Australian fisheries.

For *Papua and New Guinea*, the following is reported:

(a) Long-term plans for development of fisheries have been in existence since the establishment of the Division of Fisheries. Modifications of the plans with additional knowledge and changes in conditions are made as required. The first phase consists of evaluating the fisheries resources, and the methods of utilizing them. The second phase is in improving the latter where possible, and in the case of freshwater fisheries, in increasing the resources by the introduction of suitable species. All these aspects are in progress.

(b) There have been no recent changes in the responsibilities or functions of Government fisheries administration.

(c) No measures have been necessary to strengthen fisheries administration within the Division of fisheries. However, a separate Department of Trade and Industry has

been formed and part of its interest lies in this sphere.

Hong Kong

There has been no significant change.

India

Fisheries development received greater emphasis in India's Third Five Year Plan. The total outlay for fisheries development in the plan is Rs. 286 millions against Rs. 107 millions in the Second Five Year Plan and Rs. 38.9 millions in the First Plan. Fisheries Development is primarily the function of the

various State Governments, the Central Government being responsible for research, fishery beyond the territorial waters, international relations, financial assistance to the State, coordination and guidance of the activities. Out of the total of Rs. 286 millions provided for fisheries schemes Rs. 219 millions provided for the State Government's plans and Rs. 67 millions in the Central Government's plans. Again in this total, Rs. 142 millions is set apart for marine fisheries purposes, Rs. 74 millions for inland fisheries development and nearly Rs. 70 millions for ancillary schemes relating to research, marketing, training, etc. as indicated below :

	States	(Rs. crores) Central
A. Marine Fisheries:		
1. Mechanisation	4.28	—
2. Supply of fishery requisites	1.63	—
3. Fish Storage and Distribution	1.03	0.90
4. Landing and Berthing facilities	1.97	0.05
5. Fish Curing Yards	0.22	—
6. Fish Canning and Processing Plant and by-products	0.28	—
7. Exploratory fishing	—	2.04
8. Pilot and Commercial Fishing	04.0	—
9. Industrial Units	0.38	1.00
10. Miscellaneous	0.10	—
	<u>10.30</u>	<u>3.99</u>
B. Inland Fisheries:		
1. Fish Farming	3.37	—
2. Fish Seed production and distribution	1.42	—
3. Reclamation and Development of derelict fisheries	0.59	—
4. Development of reservoirs and lake fisheries	0.76	0.08
5. Riverine fisheries	0.17	—
6. Storage and distribution	0.22	—
7. Technical services and equipment	0.24	—
8. Survey of culturable waters	0.17	—
9. Fisheries Extension and Demonstration	0.27	—
10. Conservation of inland fisheries	0.03	—
	<u>7.34</u>	<u>0.08</u>

C. Ancilliary Schemes :

	States	(Rs. erores) Central
1. Fish Markets	0.71	—
2. Fish Cooperatives	1.07	—
3. Training	0.38	—
4. Research	0.07	1.55
5. Housing	0.42	—
6. Feeder Roads	0.10	—
7. Fisheries Education	0.17	1.10
8. Staff	0.75	—
	<u>3.67</u>	<u>2.65</u>

Japan

The Investigation Commission on Agriculture, Forestry and Fisheries Basic Problems, a consultative body of the Prime Minister, submitted after full deliberation, its report to the Premier in October 1960, on "Basic Problems of Fisheries and Measures to be taken".

The essential points of the report may be summarized as follows:—

The recent economic development in general, has brought forth ill-balance in the income between the people engaged in fishing industry and those engaged in other industries as well as a decline in the population of fishing villages. In order to maintain the productivity of fisheries, it is of paramount importance to take measures to keep a proper balance with respect to the income per capita between fishermen and workers in other fields and at the same time to carry out the modernization of fisheries, especially coastal fisheries.

Upon having received this report, the Government has undertaken the drawing up of plans for facilitating the modernization of fisheries, and work to improve the structure of coastal fisheries has been inaugurated. Now the Bill of Promotion of Coastal Fisheries has been brought before the Diet for its deliberation.

Korea**(a) Five Year Development Plan and Administration***

The present Military Government has already taken various important measures to improve the difficult situation in the fishery industry. First of all, the Government has set in motion a program to lift the burden of usurious debts from the shoulders of fishermen under the law on the liquidation of usurious loans in farm and fishing villages which was promulgated on 10 June 1961.

On 20 February 1962, a Fisheries Co-operative Law was promulgated. Also, the Government has embarked on a Five-Year Fisheries Development Plan under the overall Five-Year Economic Development Program.

The targets of the plan are to boost the annual catch from the current 350,000 tons to 590,000 tons and also to increase fisheries exports from the current US\$ 7,300,000 (in 1961) to US\$ 20,120,000 in 1966.

The average annual growth rate of the fishery industry during the five years of the plan is projected at 8.7 percent. This is higher than the average annual growth rate (7.1%) of the overall Five-Year Economic Development Program for 1962/66. The average agricultural growth rate during the same period was proposed as 5.5 percent.

* Reported by Ro, Jai Dong.

In the past, fisheries administration of this country was carried out by three sections, e.g. Fisheries Administration Section, Fishing Section and Marine Processing Section. After the revolution of 16 May 1961, the Government has created four new sections to strengthen fisheries administration and to help implement the fisheries development program effectively. At the same time, the Fisheries Bureau was transferred from the Ministry of Commerce and Industry to the Ministry of Agriculture and Forestry. At present, the Fisheries Bureau consists of six sections: Administration Section, Pelagic Section, Marine Processing Section, Aquiculture Section, Marine Resources Section and Fishing Vessel and Fishing Port Section.

This year, all Government employees should take a two-week course covering 20 subjects, including moral education (16%), efficiency in administration (65%) and others (9%). Besides this, senior officers should take another three-week course after the two-week ordinary course. This training is held at the Central Training Centre for Public Employees or provincial training centres.

Particularly, all fisheries officers and fisheries cooperatives' staff members should take the two-week course covering 12 subjects, including fisheries administration (30%), new technical knowledge (60%) and others (10%). This training is held at the Central Fisheries Experiment Station in Pusan.

For 1962, the first year of the plan, the Government has allocated 865,641,110 Won (equivalent to US\$6,658,777) for fisheries budget.

Of this amount, 631,300,000 Won is for fisheries loans, 221,677,910 Won for fisheries development expenditures and 12,663,200 Won for ordinary expenditures. This is the largest fisheries budget ever for the Republic of Korea. In the previous fiscal year it amounted to 140,000,000 Won which was established by the old Government.

Details of the Five-Year Fisheries Development Plan are shown in Table I and those of the Five-Year Fisheries Export Plan in Table II.

TABLE I
(Unit: Thousand M/T)

	Standard Year 1960	Initial Year 1962	1963	1964	1965	Target Year 1966
Marine Catch	342.5	432	468	503	537	571
Fish	241.7	308	337	365	393	421
Shellfish	13.5	15	16	17	18	19
Seaweed	27.4	35	37	39	41	43
Others	59.8	74	78	82	85	88
Inland Fishery Products	14.7	15.2	15.8	17.2	18.9	22.3
TOTAL:	357.2	447.2	483.8	520.1	55.9	593.3

TABLE II
Five Year Fisheries Export Plan

	Standard Year 1960	Initial Year 1962	1963	1964	1965	Target Year 1966
(Thousand US\$)						
Live fish		250	500	625	750	1,000
Fresh fish	1,560	1,800	2,100	2,700	3,300	3,900
Frozen products		1,500	1,500	1,500	1,800	1,800
Dried cuttle fish		1,500	1,500	2,100	2,100	2,700
Dried shrimp	982	120	156	156	240	240
Dried anchovy		100	150	250	350	500
Canned seafood	28	300	300	500	600	800
Dried oyster	—	50	150	350	500	750
Dried laver	1,288	1,000	1,000	1,300	1,700	2,000
Agar-Agar	927	1,200	1,200	1,500	1,800	2,100
Sea-weed	612	590	600	650	700	780
Fish liver oil	190	500	550	600	660	720
Others	147	1,725	1,745	2,000	2,320	2,830
TOTAL:	5,734	10,635	11,451	14,231	16,820	20,120

(b) *Taxation of fishermen**

Up to the tax reform of January 1, 1962, various taxes borne by Korean fishermen numbered about eight. The number was reduced to six by the tax revision. With respect to the rate of tax, however, the actual reduction was no more than 3 percent, namely from the previous 22 percent of the fishermen's annual gross income.

Fishery enterprises, except for those of manufacturing and processing, belong to primary industry, as does agriculture. The production structure of the fishery industry is extremely weak and the capital formation is considered very difficult. It is therefore considered that the fishery industry needs special protection and fostering measures for its future development.

As to agriculture, a single land tax is levied on farming, with a tax rate not exceeding 6 percent of the income of farmers. This might well be attributed to the weakness of the production structure of farming, and special consideration given by policy.

Since the Revolution, the Government has made efforts to improve living standards of by extending loans to fishermen who live in poverty at submarginal level.

The production cost keeps on increasing, whereas the prices of the catch are rather declining at the market. In view of such adverse factors, it is felt that the taxation on fishermen has been rather heavy under the present tax system.

It may be difficult to reduce drastically, the rate of the fishery taxes when tax sources as state revenue are taken into account. However, there still remains the need to review the possibility of unifying various types of taxes or of lowering the tax rates for fishing communities in order to improve their living standards and to encourage their production activities.

In view of the above, Government authorities are now studying ways and means to lower the rate of taxes collected from fishermen. The following tables show the taxation for the fishermen, present and former.

* Reported by Lee, Byong Kok

Types and Amounts of Tax, Present and former

(Amount of Income : Won 600,00)
(Unit : Won 1)

(By Present Tax Laws)

Category	Type	Taxation Basis	Tax Rate	Amount	Ratio (%)
National Tax :					
	Income Tax	Income Amount	15/100	9,000	65.5
	Business Tax	Amount of Sales	5/100	1,500	11.0
Local Tax :					
	Surtax of Income Tax	Income Tax Amount	10/100	900	6.5
	Surtax of Business Tax	Amount of Business Tax	20/100	300	2.2
	Acquisition Tax	Amount of Acquisition	1/100	1,000	7.3
	Property Tax	(Housing) per index as per the grade (Ships) per tonnage or 10 sok of loading	W 0.02 per index W 20 per ton	628 400	4.6 2.9
TOTAL :				13,728	100.0

(By Former Tax Laws)

Category	Type	Taxation Basis	Tax Rate	Amount	Ratio (%)
National Tax :					
	Income Tax	Amount of Sales	7/1000	2,100	11.8
	Education Tax	— ditto —	3/1000		
Local Tax :					
	Household Tax	Amount of Income	W 0.04 per index	928	5.2
	Surtax of Household Tax	Amount of Household Tax	150/100	1,392	7.9
	Fisheries Tax	Amount of Sales	2/100	6,000	33.9
	Surtax of Fisheries Tax	Amount of Fisheries Tax	100/000	6,000	33.9
	Ship Tax	Per tonnage or 10 sok of loading	W 10	200	1.1
	Surtax of Ship Tax	Amount of Ship Tax	100/100	200	1.1
TOTAL :				17,720	100.0

Remarks : The tax amount under the present tax laws corresponds to 77.5 percent of the amount levied under the former tax laws, when the base is set at the annual income of W60,000. Accordingly, the substantial benefit from the revised tax laws, on the part of fishermen, amounts to W 3,992 or 22.5 percent in the tax payments.

Comparison of Tax Burdens of Farmers and Fishermen

(Fishermen)

Category	Type	Taxation Basis	Tax Rate	Amount	Ratio (%)
National Tax :					
	Income Tax	Amount of Income	1/100	600	
	Business Tax	Sales Amount	5/1000	300	
Local Tax :					
	Surtax of Income Tax	Amount of Income Tax	5/100	30	
	Surtax of Business Tax	Amount of Business Tax	10/100	30	
	Sub-Total :			960	
	Annual cumulative total (At least once a month or twice a year)			11,520	
	Property Tax		W 20 per ton	20	
	License Tax	From W3,600 down to 800	2,000	Total: 13,540	

(Farmers)

Category	Type	Taxation Basis	Tax Rate	Amount	Ratio (%)
National Tax :	None				
Local Tax :					
	Farmland Tax	Amount of Standard Income	6/100	3,600	
	Property Tax	Price of Land Leased	5/100	3,600	
TOTAL :				6,600	

Remarks : As shown above, fishermen are burdened with twice as much tax as farmers.

Philippines

(a) There is a five-year plan prepared for the development of the fisheries in conjunction with the Five-Year Socio-economic program of the Government. Its implementation will depend on the availability of funds.

(b) A bill was approved by Congress

making the Bureau of Fisheries into a bigger and more effective organization to be known as Fisheries Commission. Before the fisheries body could certify to the President the passing of such a bill, Congress adjourned. It is expected that when Congress convenes next year, the necessary measures will be finalized.

Thailand

A. Long-Term Plans for Development of Fisheries for 1961-1963 and 1964-1966

Long-term plans for the development of fisheries laid out by the Department of Fisheries with the approval of the National Economic Development Board, are as follows:—

1. Project on experimentation and promotion of inland fisheries.
2. Project on experimentation and promotion of brackish water fisheries.
3. Project on experimentation and promotion of marine fisheries.
4. Project on experimentation and promotion of fishery technology.
5. Project on landing pier in Ranong Province.
6. Project on fishery credit.

1. Project on Experimentation and Promotion of Inland Fisheries: comprising 4 sub-projects:

1.1 Propagation of fish seeds. The propagation of fresh water fish seeds suitable for cultivation is carried out at 13 fisheries stations including Pond Culture Section, Bangkokhen, located in the North, Central, North-East and South of the country.

1.2 Research. The research aiming at finding certain means to increase fish stock, is undertaken by all fisheries stations and the Pond Culture Section.

1.3 Extension of Fish Culture. The foregoing institutions, all provincial fisheries agents, and the Fish Culture Extension Section of the Department, in coordination, carry out the fresh water fish culture extension towards the people, and render assistance with respect to this work on calls from these who need them.

1.4 Improvement of Watersheds. The foregoing authorities operate the survey and improvement of the watersheds suitable for pisciculture.

2. Project on Experimentation and Promotion of Brackish-Water Fisheries: comprising 3 sub-projects:

2.1 Studies on the Propagation of Brackish-Water Fish Seeds. This sub-project concerns the studies on the propagation of the brackish-water fish seeds suitable for cultivation, conducted by the brackish-water fisheries stations, one at Klongwarn, Province of Prachuabkirikan, and the other at Bangchan, Province of Chonburi.

2.2 Research. The research concerns the study of life histories of brackish-water fish, experimentation of culture of some of such fish, farming of shrimps, oysters, sea crabs, etc., and survey of uncultivated coastal muddy areas in the interest of introducing brackish-water fish culture towards the people.

2.3 Extension of fish culture. The above-mentioned authorities cooperate in carrying out the extension service on culturing of certain brackish-water fish towards the people.

3. Project on Experimentation and Promotion of Marine Fisheries: comprising 10 sub-projects:

3.1 Scientific Investigation on Platu (*Rastrelliger neglectus*). The purpose of the investigation is to collect for the study of the biology of platu. The gained knowledge will be used in the regulation of the fish size permitted for the fishing exploitation, in the interest of conservation and the best utilization of this species.

3.2 Survey of New Fishing Grounds. The survey is implemented in the Gulf of Thailand and the Indian Ocean to determine the economically exploitable fishing grounds, to draw up fishery chart indicating the grounds where commercial fishing is feasible, species caught

in certain grounds and their relative abundance. The analyses of these studies will present the information with respect to where and when fish is abundant and where there are new economically exploitable fishing grounds discovered from the survey, in the best interest of the Thai fishermen.

3.3 Research with respect to Demersal and Pelagic Fish. This work aims at obtaining essential data relating to such fish and their life histories. Various fishing methods are to be studied to ascertain the ones that yield the catch per square kilometre not less than 1,000 kilograms.

3.4 Investigation with respect to the Life Histories of the Aquatic Fauna other than Fish. Relevant data of size, species compositions and abundance of aquatic fauna other than fish in Songkla Lake are to be evaluated. Attempts will be made to increase the production of shrimp to 12,000,000 kilograms by increasing the scientific knowledge with respect to this fauna and the efficiency of commercial fishing gear.

3.5 Research pertaining to the Improvement of the Efficiency of Fishing Gear and Fishing Boats. This research concerns the experimentation and operation of the designed otter-board trawl, so as to rejustify it most efficiently for fishing in the demersal fishing grounds; design of the expected efficient fishing gear, and experiment and rejustify them to ensure reliable results. These ascertained efficient gear will soon thereafter be introduced to the fishermen. Through this activity, the 1963 catch production of demersal and pelagic fish is expected to increase by 11,000 tons and 1,000 tons respectively.

3.6 Fishery Demonstration. This activity is to demonstrate to local fishermen (on the Thai Gulf and the Indian Ocean coasts) the efficiency of fishing gear which have been studied by the Fisheries Department, by means of the use of audio-visual technique at the various fishing communities. This will help bring about a more successful approach to the increase of production according to itmes 3.2 and 3.3.

3.7 Catch Statistics. The sub-project deals with the collection and compilation of statistics of catch of Platu, demersal fish, and other commercial fish by selected fishing grounds and by selected types of fishing gear. The data so derived are to be evaluated for the annual trends.

3.8 Training Centre. Training centres are to be established or suitable locations, to train fishermen in navigation, operation and maintenance of fishing craft engines and efficient fishing gear, etc. The objective is to increase the production of demersal and pelagic fish.

3.9 Coastal Radio-Telephone Service. Communication by means of radio-telephone helps fishermen to obtain rapidly information with respect to climatic conditions, marketing news, S.O.S. due to accidents and natural hazards, to maintain contacts among fishing boats, to locate schools of fish, etc. For these reasons, the Department has already established 5 radio-telephone stations along the coasts, two in Bangkok and one each in the Provinces of Rayong, Chumporn and Chantaburi.

Two research vessels of the Fisheries Department and four private trawlers have been equipped with a radio-telephone set in each of them.

The Department has procured the loan fund available for each eligible sea fisherman to purchase a radio-telephone set and an echo-sounder to equip his fishing boat.

The Department has received to Government budget to organize in 1962, the additional 3 such stations, one each at the fisheries stations in the Provinces of Chiengrai, Nakornsawrn, and Puket.

3.10 Publication on Technical Documents. This sub-project concerns the publishing of commercial fishing maps, technical papers relating to fisheries and the statistics for official use and the distribution of these publications to organizations and individuals affiliated or interested.

4. Project on Experimentation and Promotion of Fishery Technology: breaks itself down into 4 sub-projects:

4.1 Improvement of transportation of fresh fish.

4.2 Research and analysis to ascertain the proportion of chemical components of fish and fish products.

4.3 Improvement of fish processing methods.

4.4 Providing instruction on efficient and economic methods of transporting fresh fish.

5. Project on Landing Pier, Ranong Province. The Department of Fisheries is constructing a landing pier in the Province of Ranong on the Indian Ocean coast, the first centre organized for commercial fisheries in this ocean. This pier is projected to provide facilities for the simultaneous landing of a good number of fishing boats, handling of fish, auction service to create stronger bargaining power for fishermen, icing and re-icing of fresh fish, social welfare, such as supply of drinking water, merchandising of food and other professional materials for fishermen, etc. This pier and its various beneficial services will give impetus to growth of the fishery industries in the Indian Ocean of that province itself and the related ones.

6. Fishery Credit. In carrying out this sub-project, the Fisheries Department has secured the credit services for sea fishermen who need partial capital and have difficulty in obtaining loans from elsewhere. The credit services are of two categories.

6.1 *Revolving loan for marine fishermen.* Baht 5,000,000 have been set aside for this loan fund which may be granted to the marine fishermen for the purposes of purchasing engines to mechanize the fishing boats, purchasing the hulls or boats for fishing operations, and fishing nets, and repairing the fish boat engines. This loan is of intermediate term, to be repaid within 3 years by either

monthly or quarterly instalments. The rate of interest is 3% per annum. Real estates, houses, and mechanized fishing boats are allowed to be mortgaged to guarantee for loans. The Loan Committee with Fisheries Director as chairman, appointed by the Minister of Agriculture, is authorized to conduct this credit service.

6.2 *Revolving loan for promotion of coastal fisheries.* To promote the coastal fishing industry, the Department of Fisheries has procured, since 1959, the following revolving loan funds:—

6.21 Baht 480,000 for purchasing the marine radio-telephone sets.

6.22 Baht 420,000 for purchasing the fish echo-sounders.

These loans, through the conduction of the foregoing Loan Committee, will be granted for each eligible marine fishermen to purchase a radio-telephone set and an echo-sounder to equip his fishing boats.

The Fisheries Department has been attempting to expand these credit services towards the fishermen whenever monetary convenience permits the increase of the revolving loan funds.

B. Adjustment regarding Responsibilities and Functions of the Government Fisheries Administration

The Department of Fisheries and the Fish Marketing Organization are cooperating to rejustify the Act Organizing the Fish Marketing Organization of B.E. 2496 (1956) with the aim to reduce to a minimum the sale commission and other handling costs charged on fishermen, so as to maximize the residual or real incomes for them. The second objective is to authorize the Fish Marketing Organization to take over the businesses of all fish dealers now located within the organization's compound whenever the Organization deems fit. The third one is to regulate the flow of fish in such a way that all catches, whether marine or inland fish which are brought to Bangkok, must be delivered to

the Fish Marketing Organization. This regulation is to prevent fishermen from being badly exploited, and also for the benefit of obtaining landing statistics with accuracy.

C. Recruitment or Training of Staff

Faculty of Fisheries of the Kasetsart University, Bangkok, is the institute for training in fisheries science in Thailand. Students who complete the five years course of training will obtain the degree of Bachelor of Science in Fisheries. Such graduates have the right to undergo the competitive entrance examination for recruiting the staff of the Fisheries Department as third grade fisheries technical officers. Those who graduate the same bachelor degree or higher from U.S.A. and Western Europe have the same right of candidature for the entrance examination. In recruiting the staff of the Department, the latter receive a salary higher than the former to a certain degree.

One year course of training in elementary fisheries to recruit trainees who pass the final examination, as junior assistant fisheries officers, may be arranged by the Department from time to time at its option.

Those who have the degree of Bachelor of Science, or higher, in Chemistry, Economics, Physics, Statistics, Engineering, etc., on passing the competitive entrance examination, may be recruited as officials in the staff of the Fisheries Department.

Short training courses ranging from two to six weeks duration for junior assistant fisheries officers and fourth grade officers to improve their knowledge in fisheries, have been arranged by the Department from time to time at its discretion.

VI. FISH MARKETING

I. General

Australia

a) In March 1962 a tender commenced operations as the first storage and transport ancillary to Australian tuna and salmon

fishing fleets. Fish are taken into cold store on the tender, and delivered to canneries.

b) The Fisheries Division of Commonwealth Department of Primary Industry, in co-operation with the New South Wales Chief Secretary's Department, is about to commence a survey of fish-marketing in New South Wales, as the first step in a projected survey of fish marketing in all States.

c) In Papua and New Guinea, the Division of Fisheries has assisted in the installation of two refrigeration plants at Fisheries centres in Papua. Field workers of the Fisheries Division and of the Division of Extension and Marketing are continuing to demonstrate processing methods throughout the Territory.

Hong Kong

a) The Fish Marketing Organization in Hong Kong continued to function in the usual manner and the only change was the introduction of additional auctions at two markets. The Organization's smallest market in Sha Tau Kok which previously operated on a temporary site, has now been rebuilt on a permanent site with the full range of facilities for fishermen that can be found in any of the larger markets in the Colony. An additional wholesale fish market is being built at Castle Peak. Fish landings in this area have increased and the population in nearby towns and villages has expanded substantially and it is expected that this new market will handle some 20 tons of fresh marine fish daily. A modern up-to-date wholesale market is being planned for the urban area of Kowloon, which will replace the present Kowloon Wholesale Fish Market.

b) The use of aluminium fish baskets has been tested and found satisfactory. This new type of container will be cheaper and cleaner to use and will eliminate the need for the present large areas used for the storage of bamboo baskets which have a much shorter life.

Pakistan

Pakistan has an immense wealth of fish in her waters, both marine and inland and the fishermen are in no way inferior to

those of any advanced country as far as the professional skill is concerned although most of their crafts and gears are still of primitive types. Production of fish in the year 1961 has been estimated as follows :

<i>West Pakistan</i>			<i>East Pakistan</i>			Total Production of Pakistan
Marine Fish	Freshwater Fish	Total	Marine Fish	Freshwater Fish	Total	
6.750	17.86	85.36	35.70	198.05	233.75	319.11

It is evident from the above figures that at present inland fish forms the bulk of Pakistan's fish production which comes to about two thirds of her total production.

Although there is a great demand for fresh fish in all parts of the country these days, due to considerable depletion in the cattle wealth, the general public has not yet become fish-minded especially in the northern regions of West Pakistan for the simple reason that fish is not available in fresh condition and abundance at reasonable prices. This is all due to the fact that handling and marketing of fish is not well organized. Consequently the producer gets very poor return for his hard labour and the consumer pays many times more than what is paid to the poor producer on account of so many middlemen who exist between a producer and a consumer. This state of affairs is deplorable, no doubt, but things cannot be changed overnight as the old traditional customs and systems cannot be done away with immediately for two reasons: viz (i) illiteracy of fishermen and (ii) inadequate facilities for landing, transport and disposal of fish throughout the country.

Government is fully conscious of the situation and is doing its best for the uplift of the fisherfolk on one hand and is trying hard to organize marketing of fish on the other by providing suitable landing jetties, fish carrier vessels, cold storage and ice plants etc., in all major cities and at important landing centres in the country as far as possible within its limited resources. In addition to this the Government is also en-

(In 000 metric tons)

<i>East Pakistan</i>			Total Production of Pakistan
Marine Fish	Freshwater Fish	Total	
35.70	198.05	233.75	319.11

couraging the establishment of fishermen's cooperative societies who enjoy many concessions by way of which the cooperatives can import all necessary equipment and fishing requirements free of import duty and sales tax. It means that now the fishermen or a member of the cooperative societies have to pay only 50% of the cost of what they previously had to pay for the same article in the open market.

The Government is also taking keen interest in encouraging the fishermen to educate their children by establishing schools in fishing vilages and granting scholarships to them to give an incentive and inducement with an idea that the coming generation of fishermen should not be illiterate and superstitious like their forefathers who are not prepared to switch over the modern scientific methods of fishing, handling, transport and marketing of fish by giving up their centuries old primitive methods.

Since marketing of fish does not mean only buying and selling of fish but includes all other functions that are to be performed until the fish reaches the consumer from the producer, various important aspects are connected with the marketing such as landing jetties, transport, fish containers, supply of ice, cold storage, motorable roads, fish markets and efficient and effective marketing channels. Too many middlemen in this trade need serious attention and complete overhauling of the existing practices is necessary before the measures to improve fish marketing in the country can be adopted. The task is gigantic, as a lot of funds will be

required for the purpose and a lot of opposition will be confronted from the fishermen and middlemen side, but things are to be improved and a beginning has already been made in this respect.

Landing Jetties

Fisheries experts have located suitable sites for the construction of landing jetties in both wings of the country. A well planned fish harbour consisting of 1750 ft. long jetty, spacious fish market with an attached cold storage and ice factory, a model fish curing yard, a fishermen's restaurant, a rest hall for fishermen, 4 net mending halls, two banks, a post office, a petrol pump and a diesel oil pump have been established in Karachi and have been functioning since October 1959.

The Karachi Fish Harbour Project is a joint venture of the ICA and Government of Pakistan. ICA has contributed Rs. 2,565,100 in the form of foreign equipment and technical assistance required in designing the project and the Government of Pakistan has met all the internal cost amounting to Rs. 11,567,810.

It was intended to establish a fish marketing Organization on the same pattern as that of Hong Kong, to run the wholesale fish market by eliminating the middleman (mole holders) but for certain reasons this has not yet materialised and the middlemen (mole holders) are still there. Their commission has been reduced to 50% of the 6¼% of the total commission, being collected by the Fishermen's Cooperative Society from fishermen through them. The Fishermen's Cooperative Society has the administrative control of the wholesale Fish Market. After two years of operation the commission of the auctioneers has been further reduced from 50% to 25% of the total commission which will ultimately be brought to zero with an aim to oust them out of the organization and the Cooperative will take the entire function of Marketing of Fish.

Similar facilities are being provided at other important fishing centres, such as

Pasni, Ormara, Ganz, Pushkan, Gwadur, Jiwani, Sonmiani and Demb.

Construction of a landing jetty with another wholesale fish market has been sanctioned at Ibrahim Hyderi Village (Korangi) under the 2nd five year plan. In Pasni and Gwadur fresh water is being made available for the towns as well as fish processing plant and industry. Permission for setting up fish freezing, canning, oil-extraction and fish meal plants, etc. has been given to private individuals.

Marketing facilities are also being provided in East Pakistan at Chittagong and Khulna area. It is proposed that a fish harbour will also shortly be established in Chittagong area for which about 40 acres of land has been selected and acquired for the establishment of a fish harbour. A number of fish harbours would be established at important fish landing centres in East and West Pakistan. In West Pakistan the selection falls in places like Pasni and Gwadur and in East Pakistan at Chittagong and Khulna initially.

Transport

Fish is transported from catching centres to assembling centres by head loads, on camels, bullock or horse driven carts, bicycles, lorries, launches, steamers and railroad cars according to the bulk of the catches, distance and weather conditions in both the wings of the country. The Government has an ambitious programme of constructing metal roads to link up various fishing settlements to important wholesale fish markets throughout the country.

Two carrier vessels to transport fish from Mekran Coast to Karachi have been built in Karachi and handed over to the Fishermen's Cooperative Society at Pasni and Ormara. Eight Gillnetter launches have also been built under the scheme "Mechanization of Fishing Crafts" for Mekran Coast which will start functioning during the next fishing season which commences in September 1962.

Refrigerated railroad wagons have been provided in West as well as in East Pakistan for the transport of fresh fish up-country. The railway authorities in collaboration with Marine Fisheries Department are carrying out trials by sending fish in these refrigerated wagons.

Marine diesel engines and other fishing requirements are being supplied to the Fishermen of East Pakistan also. Import duty and sales tax is exempted on the import of all fishing requirements. Aided items are used on easy instalments through Fishermen's Cooperative Societies. Twelve fishing launches are being built in East Pakistan under 'Mechanization of Fishing Crafts' out of which 5 are complete. Forty marine diesel engines were issued to individual Fishermen for the mechanization of their fishing fleet on easy instalment bases, 10% cash down and the balance to be recovered from 20% of their fish catches.

Fish Baskets and Containers

For the marketing of fish gunny bags and mat baskets are commonly used in West Pakistan and bamboo baskets in East Pakistan. Inadequate quantities of ice and crude sort of packing without proper grading of quality and size is resorted to because no proper fish packing yards exist anywhere in Pakistan. Consequently, the quality of the fish deteriorates and it gets bruised by the time it reaches fish markets. Metallic barrels are used in East Pakistan to transport fresh water fish such as *Clarias batrachus*, *Heteropneustes fossilis* with fresh water.

The Marine Fisheries Department, Karachi, have recently, in collaboration with

Cold Storages and Ice Factories

For the storage and ice plants are very few. The existing cold storage space for fish. The only one is locally for fish with Karachi Fish Harbour. A plan to set up a chain in all important landing in the country. Cold storage machinery received and installed in East Pakistan Chittagong and on Me

Fish Markets

New wholesale markets are being constructed and the existing ones are providing cement pillars and windows and fresh

The Government has set up stalls for retailing of fish in various conditions in various parts of 1957. The stalls were generated fish display stalls did not prove to be always preferred by the stalls where they could and other allied commodities along with fish. Most could not compete with sold fish at much cheaper where such fish stalls

In short, it can be seen that fishermen and fish dealers in the improvement of Pakistan. The Government the commercial aspect

The only solution of this is the establishment of fishermen cooperative societies which should take up the marketing of fish and adopt the system of cooperative marketing through an autonomous organization which may advance necessary loans to fishermen in place of mole holders as is being done by the Fish Marketing Organization in Hong Kong. To achieve this purpose will take another couple of years. The Government's attitude is sympathetic and encouraging in this respect.

Korea*

Marketing by Consignment

In accordance with the Fisheries Regulations, fishermen are required to consign catches to the designated marketing outlets operated by local Fisheries Associations, for auction to designated jobbers.

The proceeds, less sales commissions which are set aside for the Fisheries Association, are paid to the fishermen. The middlemen either sell the fish locally for commission, or delivers it to central fish markets in the larger towns or cities for appropriate profit.

Central Wholesale Market, Ltd.

On the Central Wholesale Market also, fish are sold to middlemen as at the marketing outlets of local Fisheries Associations, and the middlemen in turn sell the fish either to intermediate wholesale dealers or retailers. The Central Wholesale Market Ltd. is a joint-stock company established under a licence of the Minister of Commerce and Industry in accordance with the provisions of the Central Wholesale Market Law. There are, besides, central wholesale markets for vegetables, fruits, etc. There are a total of 20 central wholesale markets in 14 cities throughout the country.

Measures for Improvement

a) *Reduction of Consignment Sales Commissions*

Commission rates collected by Fisheries Associations for the consignment sale of fish

and other marine products are set at the Meeting of Deputies, subject to approval of the competent authorities. However, since the rates were considered too high, the authorities, on May 30, 1961, ordered a reduction of the commission rates to the following levels:

- 1) 4.5% or less if sales proceeds exceed 100 million Won.
- 2) 5.0% or less if sales proceeds are more than 50 million and less than 100 million Won.
- 3) 6.0% or less when sales proceeds are less than 50 million Won.
- 4) 4.0% or less for communal purchases.

b) *Improvement of Fish Marketing*

Unnecessary steps or channels in the marketing of marine products will be eliminated in order to bring the producers' quotations closer to market prices in consumer centres. The following flow chart is being tried on a tentative basis:

Producer—Fisheries Associations—Wholesale Market—Retailer—Consumer.

Shipping Procedures

- 1) Producers (fishermen), deliver landed fish to the local Fisheries Association for consignment sale.
- 2) The Fisheries Association weighs the catch in the presence of the consigner and promptly pays 80 per cent of the current local price.
- 3) The Fisheries Association ships the consignment to its agent(s) at the Central Wholesale Market in Seoul.
- 4) The agent in Seoul auctions the consignment and remits the proceeds to the Fisheries Association.
- 5) The Fisheries Association pays the gross proceeds, less the advance payment of 80% and the fixed commission fees, to the consignor.

* Reported by Han, Shiin Wook.

- 6) In case the gross proceeds fall short of the advance payment, deduction will be made at the next consignment sale.

Communal Shipping

During 1962, the Central Federation of Fisheries, with government assistance, undertook the tentative trial plan of shipping landed fish to the Central Wholesale Market in Seoul on a communal basis, to sell not more than 20 per cent of the total amount of consignment by the aforesaid method.

Transportation of Fresh Fish

Fresh fish are shipped to consumer centres either by train or by truck. At present, Korea has only four refrigeration trucks, all owned and operated by exporters of frozen marine products. The number of refrigeration freight-cars in operation are as follows:

- 1) For use of U.N. Forces in Korea:
 - 133 mechanized refrigeration freight cars.
 - 10 converted refrigeration freight cars.
- 2) For General Consumer:
 - 44 Converted refrigeration freight cars.
 - (26 working, while 18 are in-operative)

In most of the inland regions of Korea, there are no cold-storage facilities for fresh fish, and ice is used for transportation of fresh fish. Therefore, the Government has begun issuing loans to facilitate the installation of cold-storage facilities in the major consumer centres. Three new cold-storage plants will be built this year. Studies are under way for a more effective utilization of cold-storage freight-cars and also for the introduction of refrigerator trucks.

Containers for Fish

Korea has used each year more than 8,000,000 wooden box containers for the

transportation and distribution of fresh fish, but following the Military Revolution in May last year, the illegal felling of trees has been put under strict control, making the supply of lumber for box containers scarce. To make up the shortage, the Government has released 10 million Won in loans to the Fisheries Associations to facilitate the substitution of light-metal box containers which would be cheaper in the long run and more sanitary. The use of rubber tire fish containers and brush-wood containers is also encouraged.

India

Maharashtra State

The present marketing activities and the Government's role: Fish marketing which comprises collection of fish from producing centres and then wholesaling and retailing is dependent largely on the middlemen in this State. The traders who have established themselves in this field for a long time make advances to producers to enable them to prepare themselves for the fishing season and recover the amount in the form of fish for which a comparatively low rate is offered. The producer generally cannot receive a fair return for the catch in spite of his toiling as he has little voice in price fixation due to his indebtedness. The fish thus procured by the merchant is then transported by him to the wholesale market (i.e. Bombay) where it is auctioned to the retailers. Furthermore, the auctioneer is not an independent body but the merchant himself who conducts the auction through his agent at the wholesale market.

On account of the flip extended by Government to co-operative effort, some fishermen's cooperatives have commenced marketing of fish in Bombay. They obtain credit facilities from the cooperative banks and in turn extend this credit to their members. Thereafter, the fish caught by the members is sent to the marketing society for disposal by open auction. After deducting from the sale proceeds 6 $\frac{1}{4}$ % as commission and the instalments towards the credit the

remaining amount is returned to the producer member. Although this type of cooperative marketing has been initiated for the past few years it has not yet made satisfactory headway, hardly 15 to 18 per cent of the total output being handled in the co-operative sector. Influence of this sector has, however, been very distinctly felt as there has been considerable awakening among the fishermen. They have improved their bargaining power, but their lack of confidence in co-operative efforts and the long standing hold of the traders on them is withholding further progress.

With a view to removing the aforesaid handicaps and organising the marketing in a proper way, the Government have undertaken various steps, important amongst which are :

- a) Grant of financial assistance to fishermen's cooperatives to take up marketing.
- b) Provision of preservation and transport facilities, which indirectly influence the marketing activities.
- c) Propaganda to induce fishermen's cooperatives to undertake marketing activities.
- d) Providing technical guidance and financial assistance for construction of fish markets and remodelling of old ones.
- e) Provision of fish marketing intelligence.

Further clarification of the points (c), (d) and (e) above is given hereunder to have a clear picture of the Government's efforts:

(c) Realising the need to undertake marketing activities on a cooperative basis by fishermen themselves, the Government have been concentrating their attention in inducing fishermen's cooperatives to come forward so as to eliminate gradually middlemen from the trade. Full encouragement

is given to the apex bodies of fishermen, viz. the Thana Jilla Machhimar Sahakari Sanstha Ltd., and the Bumbai Rajya Machhimar Sahakari Sanstha Ltd., Bombay, in the fresh and dry fish business undertaken by them. These associations market the produce of the members and affiliated societies. Impressed by the success of the aforesaid bodies and the persuasive methods of the department, many other multi-purpose cooperative societies have also since evinced interest in the marketing activities. This is definitely a good sign of progress. The situation will improve further if the cooperatives are liberally financed and fishermen realise the importance of cooperative efforts.

(d) The municipalities, municipal corporations and Gram Panchayats are supplied, on request, with model designs for fish markets. If these bodies experience difficulty in finding funds to construct new fish markets at places where they do not exist at present, the Government has a scheme to grant them financial assistance in the form of a loan on construction work. A loan has accordingly been sanctioned to Municipality at Nagpur. The construction of a fish market is in progress.

(e) Detailed information about the marketing potentialities of the various areas, existing marketing system, possible development, etc. is collected from important centres in the State and is passed on to the interested parties. The information covers availability of fresh and processed fish, by-products, prevailing rates, possibility of undertaking exports, etc. This helps arrangements for distribution of fish and reasonable return to producers, retailers and wholesalers.

Account of transportation facilities in fish marketing: With the exception of a few areas like Ratnagiri and Kolaba districts, the facilities for transport of fish from landing sites to assembling centres, consuming centres etc. are fairly adequate in this State. Transport is made by rail, road and sea. Transport by air has not, however, been attempted on any noticeable scale.

At the instance of this department and on recommendations of the All India Fisheries Conference and Fisheries Ministers' Conference, the railway authorities have introduced several improvements with a view to facilitating expeditions and safe transport of fish. Instructions have accordingly been issued (1) to reserve sufficient space in the brake vans for fish consignments to be loaded at stations nearest to important fishing centres; (2) to increase the halting time of trains, when necessary, to ensure that fish parcels do not remain to be loaded; (3) to accept fish parcels by available mail and express trains; (4) to relax the quota for fish parcels, whenever the fish traffic is found to have been increased and (5) to give priority to fish consignments.

Fish being a highly perishable commodity, is charged by railways at half the usual parcel rates.

In addition to the aforesaid facilities, the railway authorities are also considering introduction of refrigerated vans. The scheme will go a long way in solving a major difficulty of despatching fish to consuming centres at a longer distance.

Although a bulk of fish is transported by rail and road, quite a large quantity is also sent by sea in carrier launches. The system is naturally prevalent in such areas as are not easily accessible by road and rail. The transport launches and an equal number of sailing craft are engaged in transport of iced fish (fresh). Under the Konkan Vikas scheme, the Government proposes to construct two more carrier launches which would be operated departmentally, one of the carrier launches is now nearly ready and would be put into operation shortly. This will not only improve the existing transport facilities but will serve as an impetus to fishermen to catch more fish.

Transport of fish from landing sites to local markets is generally done by trucks. Landing centres up to about 100 miles north of Bombay supply fish to the city (Bombay),

the main fish consuming centre in the State. Although about 25 trucks are owned by fishermen's cooperative societies in the Bombay and Bombay Suburban District and Thana District, in other areas the work is done by private truck owners. The private owners sometimes charge exorbitant rates. In order to safeguard the interest of fishermen, the Government made efforts to persuade fishermen's cooperatives in various areas to purchase their own trucks and hire them to their members at reasonable rates. Financial assistance in the form of loan and subsidy is also granted to the cooperative societies for purchase of trucks to undertake fish transport. Government have started plying a transport truck in Ratnagiri District affording facilities to fishermen for transport of their fish to marketing centres at reasonable rental.

Government also grant special permits enabling the cooperative societies to take fish vendors along with their fish baskets in the trucks, to the retail markets and vice versa. This has considerably helped retailing of fish by wives of fishermen themselves.

Gujarat State

In view of the fact that fishermen are not getting suitable returns for their catches and that fish production in Gujarat has been increasing year by year, the necessity to organise fish marketing on a systematic line was felt by the Government as early as 1955. An apex Fishermen Cooperative Marketing Association, viz. the Gujarat Fisheries Central Cooperative Association Ltd. was therefore, set up by the Government in 1956 with Government participation. The Government had invested a sum of Rs. 4.50 lakhs towards the share capital of the Association, out of authorised share capital of Rs. 10 lakhs. Fishermen's Producers Cooperative Societies all over the state and individual fishermen are other members of the Association. The main objective of the Association is to undertake fish marketing on Cooperative lines by linking credit and marketing so as to offer fishermen a fair share of prices

offered for their fish by the consumers. The Government also offer financial assistance to the Association for supply of fishery requisites and grants to meet their managerial cost and other initial expenditures.

The Association initially took up marketing of dried fish in 1956-57 which has less risks than fresh fish. In spite of difficulties facing the private dealers and competing with them, the association succeeded in occupying a permanent footing in the dried fish trade. Till the year 1960-61 they have been marketing dried fish to the value of Rs. 5 lakhs per year. By the Association taking up the marketing the fishermen are now getting about 10% more on dried Bombay Ducks and 20% on dried Prawns.

When the Association gained sufficient confidence and experience in the trade and when the Government gave all facilities and assistance in establishing their trade permanently, the Association re-entered into fresh fish trade in 1960-61 and 1961-62. The departmental ice factories and cold storages at the production centres and insulated road vans were hired to the Association. Loans and subsidies were granted to the Association for construction of carrier launches for transport of fish by sea, purchase of insulated road vans and transport trucks, construction of cold storages at other centres, construction of godowns for storage of fish etc. Funds which were provided for grant of financial assistance to the Fishermen for purchase of fishery requisites, construction of boats, purchase of engines etc. were channelled through the Association. The Association also got institutional finance from Cooperative banks for advancing marketing loans to the fishermen. The scheme prepared by the Government of India, Ministry of Food and Agriculture, and the Reserve Bank of India for development of fish marketing in the State and the financial assistance extended by the State Government for this purpose, gave incentive to the Gujarat Fisheries Central Cooperative Association Ltd. not only to launch fresh fish marketing but also to expand their dried fish marketing.

The Association started fresh fish marketing on a small scale in 1960-61 and expanded it in 1961-62. Their method consists of advancing off-season interest-free loans to the boat owners and binding their catches. They fix the prices for different varieties of fish at the time of advancing loans, after reviewing the cost of production, economical condition of the fishermen, preservation and transport charges and price structure at the consuming centres. It has been possible for the Association to pay to the fishermen 15% more than what they used to get from middlemen previously for their fish and at the same time earn profits.

The incidental and other overhead charges incurred by the Association for marketing the fish is less, because they have their own arrangements for transporting fish from landing centres to the consuming centres. The Association have their own staff at the production centres. They have their own ice factories, cold storages, transport trucks and carrier launches for preservation and transport. At important consuming centres, the Association have their staff, cold storages, godowns, transport vehicles and in some areas stalls for retailing fish.

During the year 1961-62, the Association marketed fresh fish to the value of Rs. 35.00 lakhs and dried fish to the value of Rs. 12.00 lakhs. They also exported dried fish, fish maws etc. to the value of Rs. 70,000.00. Now 25% of fish marketing of the state is in their hands. They have established new markets for fresh fish in Ahmedabad, Surat, Delhi, Calcutta, Ajmer, etc. and Delhi, Assam, Nagpur, Poona, etc. for dried fish, besides Bombay which is the main market for both.

The fishermen of Gujarat have now realised the benefits of Cooperative marketing and there is good response from them for joining the movement. The Association has, therefore, proposed to expand its activities during the year, 1962-63 by about $1\frac{1}{2}$ times. They propose to have their own plants for canning and freezing fish, ice factories, and cold storage at all important centres and godowns for storage of dried fish.

Japan

(a) With the recent trend of increased consumption of highly processed foods and frozen foods, the marketing channel of fishery products has been changed. They are now sold not only at fresh fish shops but also at grocer's shops. In large cities now there are super-markets of provisions where highly processed fish foods are sold in quantities.

(b) In order to secure the necessary number of workers or employees in the market, the Central Wholesale Market in Tokyo has adopted a weekly holiday system since May 1961.

(c) A new policy has been enforced since 1961 to stabilize fish prices in producing centres. The Law for Fisheries Production Adjustment Association and the Fish Price Stabilization Fund Law, both of which passed the Diet July 8, 1961, embody this new policy. The former helps fishermen adjust their fish landing or operation autonomously, while the latter provides fishermen and price stabilization programme with financial assistance.

(d) For the purpose of normalization of the retail prices of fresh fish in consuming centres, the Tokyo Metropolitan Government authorized a certain number of standard fish retail shops July 1962. These shops are ordered to put up in their shop windows a list of the standard prices by fish species, which are determined on the basis of prices in the central market.

(e) The Central Fisheries Wireless Station has been established recently with governmental subsidy. This station is responsible for prompt reporting of fishery and sea conditions as well as market news on a national scale.

Philippines

Six refrigeration units and six ice-plants costing \$1,000,000 will be received by the Bureau of Fisheries from Japan through the Reparations Commissions. These units will be installed at strategic fish landing

sites in the country to improve handling and marketing methods.

Survey on ice-plants, cold storage, and freezing facilities

I. Ice Plants

Australia

The exact number of ice plants whose production is wholly or partly used for the fishing industry is not available. However, there are numerous ports around the coast line where fish is landed and ice is generally readily available from one source or another at all ports.

Ice is produced in the form of block, crushed or flake ice. The prices of ice vary with seasons and localities. No statistics are compiled of production nor is any break-up of costs available.

The majority of ice plants are commercially owned. Most cooperatives have their own plants. In Northern areas some local government authorities operate ice plants but whether ice thus made is used in fish preservation is not known. Normally, most fishermen's cooperatives have an ice plant and also cold storage facilities.

Ice is extensively used in all phases of the fish trade, including chilling fish on fishing boats, chilling fish during its transport from landing places to consuming centres and chilling fish at retailers' shops.

Hong Kong

The production of ice in Hong Kong is carried out by four commercial firms operating a total of eight ice plants which, in February 1962, had a combined capacity of 620 tons per 24 hours. Total production in 1961 was 167,000 tons.

The fishing industry consumes over 90 percent of the ice produced in the Colony. The type of ice manufactured is mainly blocks of 300 lbs. although increasing quantities of crushed ice are delivered to the larger types of modern fishing vessels. The largest of the four companies sold a total of some 41,000

tons of crushed ice to the fishing fleet in 1960. In 1961, this quantity had increased to nearly 49,000 tons. Ice plants in Hong Kong are, in the main, situated on the Hong Kong Island and in Kowloon. 100 tons of ice is produced daily in the New Territories by the largest of the four ice-making companies (which was responsible for over 87 percent of the total ice production in 1961). This company is planning, at the end of 1962, to expand its ice-making capacity in out-lying districts by an additional 50-ton plant.

The four commercial companies are the only producers of ice in Hong Kong. Five ice plants operated by the largest company are combined with cold stores and four have, in addition, also freezing facilities. The cost of ice in Hong Kong was HK\$31.00* per ton (ex-factory) in both 1960 and 1961.

The use of ice in the fishing industry is principally for the chilling of fresh fish at sea, transportation of fresh fish from out-lying fishing districts to wholesale fish markets and from wholesale fish markets to retailers' places of business and the keeping of fresh fish by retailers in their market

stalls and shops. It is estimated that the cost of ice used by retailers is approximately 0.05 percent of the wholesale price in the summer months and approximately 0.25 percent during the cool period of the year.

The Colony's ice-making capacity continues to expand and several new ice plants will be built in the foreseeable future. Production in 1961 represented an increase of nearly 28 percent in comparison with the quantities manufactured in 1960.

Japan

As at 1 January 1960, there were 1,744 ice plants in all parts of the country covering consuming centres, most of them more or less concerned with the fishing industry.

The total ice-making capacity is estimated to be 28,357 tons per day. The production figure is available for 1958, this being 5,550,774 tons. It is roughly estimated that about 60 percent of the total production is used for fishery industries.

The main consuming centres and ice-marking facilities located there are shown as follows:—

Consuming centres	Population (in ten thousands)	No. of Plants	Capacity (Ts. per day)
Tykyo	762	82	3,372
Yokohama	114	16	346
Kyoto	121	20	514
Nagoya	133	40	626
Osaka	254	67	1,785
Kobe	98	22	440

As to landing centres, the following shows only a few representative ones of large, medium and small-scale centres, and the number and capacity of ice plants there together with the amount of landing.

Landing centres	Estimated fish-catches (in ten thousand tons)	No. of plants	Capacity (Ts. per day)
Large scale	Yaizu	11	387
	Nagasaki	11	995
Medium scale	Onagawa	4	160
	Hamada	9	177
	(in thousand tons)		
Small scale	Kushimoto	1	16
	Hedate	2	20

* US\$ 1.00 = HK\$ 5.714

Ice is produced mostly in block form. Ice is used both for preserving fish and for human consumption. Average ex-factory price of ice per ton in 1960 and 1961 was roughly 2,000 yen* in winter, 3,300 yen in summer and 3,000 yen during other seasons.

With respect to the ownership of ice plants, there are no ice plants owned by the Central Government but there are some which are owned by Municipal Governments of large cities in connection with municipal wholesale markets (Central Wholesale Markets) owned by them. About 240 ice plants are owned by fishermen's cooperatives and about 1,500 are owned by commercial firms.

Approximately 80% of the total ice plants are combined with either cold storage or freezing facilities or both.

Ice is used very extensively including chilling fish on fishing boats, during its transport from landing places to consuming centres and at retailers' shops. Ice is also used for chilling fish as raw material at processing plants.

Since the retail price of fish varies greatly depending on fish species and uses, it is difficult to state the proportion of the price of ice used, included in the retail price of fish, but generally it can be said that it constitutes a very small part of the retail price.

Difficulty in providing adequate ice supply is due to the shortage of ice occurring locally and temporarily when fish is landed in great quantities. To construct ice plants locally with sufficient capacity to meet the seasonal fish catches, is an uneconomical proposition. Therefore, ice is often shipped from other areas but, in many cases, fish has to be marketed for exceptionally low prices.

At present, there are no particular plans for building more ice plants. However, the Central Government assists particularly fishermen's cooperatives, by mean of loans,

in their construction of ice plants at strategic points. This Government assistance was felt necessary since the freshness of fish is becoming increasingly important in fresh fish marketing as well as in fish processing.

Korea

There are about 83 ice plants in Korea, the production of 48 of these ice plants being wholly or partly used for the fishery industry. Their total ice-making capacity is about 1,900 tons per day. It is estimated that they produce, on an average, about 970 tons of ice per day.

It is also estimated that approximately 90 percent of the ice produced is used for the fishing industry. The main fish-landing and consuming centres in Korea and the number of ice plants and their capacity located in those centres are as follows:—

Place	Fish-Landing Centres No. of ice plants	Capacity (Ts. per day)
Pusan	11	613
Yosu	3	92
Inchon	5	127
Mokpo	4	87
Masan	3	77
Kunsan	2	30
Cheju	3	32
Pohang	2	40
Kuryong po	1	20
Yang po	1	20
Samchon po	1	30
Chung mu	2	40
Chin Hae	1	10
Sok cho	1	26
Muk ho	1	75
Hupo	1	10
Dae cheon	1	8
Chang hang	1	15
Huksan do	1	10

* US\$ 1.00=360 yen.

Place	Fish Consuming Centre No. of ice plants	Capacity (Ts. per day)
Seoul	30	536
Soo Wun	2	15
Kwang Joo	2	20
Dae Jeon	2	22
Dae Koo	1	15
Cheong Joo	1	20

Ice is produced mostly in block form. Ice is used both for preserving fish and for human consumption. Average ex-factory price of ice per ton in 1961 was roughly 390 won in winter, 520 won in summer and 400 won during other seasons. With respect to the ownership of ice plant, there are no ice plants owned by the Central Government and Municipal Governments.

About 12 ice plants are owned by fishermen's cooperatives and about 65 are owned by commercial firms. Approximately 80% of the total ice plants are combined with either cold storage or freezing facilities or both.

Ice is used very extensively in chilling fish on fishing boats, during its transport from landing places to consuming centres and at retailers' shops. Ice is also used for chilling fish as raw material at processing plants. The Central Government assists by means of loans, in construction of ice plants.

This Government assistance was felt necessary since the freshness of fish is

becoming increasingly important in fresh fish marketing as well as in fish processing.

Federation of Malaya

There was 52 ice plants in 1961 whose production was wholly or partly used for fishery industries. Their total ice-making capacity was 1,210 tons per 24 hours. As to the actual production of ice, it is affected by seasonal fluctuation of fish landings as well as by the rainy seasons of the North East and South West Monsoons, and it is estimated that actual production is in the region of 70% of the capacity, namely 300,000 tons.

Out of the total production as mentioned above, it would be reasonable to expect that in the case of ice plants located in or near fishing centres, almost their entire production is used for fishery industries. As regards the ice plants located inland, it is estimated that at least 70% of their production is used for fishery industries including wholesale fish distribution, retail marketing, storage, and also shipment to fishing centres in times of shortage. In coastal areas, 26 ice plants, with a daily capacity of 450 tons, produce, in 1961, approximately 115,000 tons of ice which was almost entirely used for fishery industries. In inland areas, 26 ice plants, with a daily capacity of 760 tons, produce, in 1961, 194,200 tons, 70% of which (namely 135,900 tons) was estimated to have been used for fishery industries.

The main fish-landing and consuming centres and number and capacity of ice plants located there are as follows:—

State	Landing Centres	No. of Ice-Plants	Capacity 1961 Tons	Consuming Centres	No. of Ice-Plants	Capacity 1961 Tons
<i>Perlis</i>	Kuala Perlis	2	56	—	—	—
<i>Kedah</i>	Kuala Kedah	1	16	Alor Star	2	96
				Sungei Patani	1	30
<i>Penang</i>	Sungei Acheh	1	10	Penang	2	90
				Bukit Mertajam	1	26

State	Landing Centres	No. of Ice-Plants	Capacity 1961 Tons	Consuming Centres	No. of Ice-Plants	Capacity 1961 Tons
<i>Perak</i>	Kuala Kurau	1	30	Taiping	3	44
	Pantai Remis	1	15	Ipoh	6	98
				Kampar	1	10
	Pangkor	2	80	Teluk Anson	1	20
	Lumut	1	10			
<i>Selangor</i>	—	—	—	Kuala Lumpur	4	172
				Klang	2	45
<i>Negri Sembilan</i>	—	—	—	Seremban	1	40
<i>Malacca</i>	Malacca	1	12	Malacca	1	80
<i>Kelantan</i>	Kota Bharu	3	45	—	—	w
<i>Trengganu</i>	Kuala Trengganu	1	17	—	—	w
<i>Pahang</i>	Kuantan	1	25	—	—	w
<i>Johore</i>	Muar	1	15	—	—	w
	Batu Pahat	1	22	—	—	w
	Pontian Kechil	1	15	—	—	—
	Mersing	1	25	Johore	1	50
TOTAL		19	393		26	801

Ice is produced in blocks of 30 lbs. to 350 lbs. The most common size is 224 lbs.

The average ex-factory price per ton was (M)\$ 30.00* in 1960 and 1961. The proportion of the costs of various production factors is estimated as follows: Electricity 50%; wages 30%; depreciation 10%; chemicals and miscellaneous 10%.

No ice plants are owned by the Government. Two are owned by fishermen's co-operatives and 50 by commercial firms. Out of the 50 ice plants, 33 have combined cold storage facilities and one has both cold storage and quick freezing facilities.

The main uses of ice in fishery industries are preserving fish on fishing boats, preserving fish during transport from landing places to consuming centres, preserving fish at retailers premises and also preserving surplus fish for distribution from one wholesale centre to another or for storage.

* US\$ 1.00 = (M)\$ 3.03.

With respect to the proportion of the price of ice included in the retail price, the following could be said: During transport from landing centres to markets, an average of $\frac{3}{4}$ lb. of ice is used for preserving 1 lb. of fish. The retail price of ice is (M)\$5 to (M)\$6 per block of 224 lbs. or about (M)2½ cents per lb.; thus the cost of preserving 1 lb. of fish works out to about (M)2 cents. The proportion of the price of ice to the retail price of fish varies according to the types of fish and their retail prices which are from (M)15 cents per lb. for the cheaper types to (M)\$2 per lb. for the expensive types.

In retail sale, ice is used only on a small scale except for the storage of unsold fish.

It is considered that ice is already used extensively in fish production and marketing. Almost all fishing boats carry ice to sea except the small coastal fishing

boats. Distribution of fish from landing centres to consuming centres is also considered efficient due to the fairly abundant supplies of ice and availability of good road and transport facilities. The only limiting factor to an increased use of ice is the high cost of ice transport from the factory to the fishing centres. In some isolated fishing centres, this cost exceeds (M)\$20.00 per ton.

One ice plant of 15 tons is under construction in Pantai Remis in the State of Perak; in addition 1 factory in Penang, 2 factories in Perak and 1 in Trengganu are to be installed with additional ice tanks totalling in all 108 tons.

North Borneo

There are 6 ice plants with a total ice-making capacity of 30 tons per day. Out of the 6 plants, in Sandakan there are 3 plants producing 8 tons of flake ice, 8 tons of cube ice and 1 ton of block ice per day. In Si-Amil Island there is one plant producing 12 tons of flake ice per day. It is estimated that about 3,000 tons of ice were used for fishery industries in 1961. The ex-factory price of ice per block (220 lbs.) is about (M)\$10* in Sandakan and Jesselton.

Two ice plants out of the 6 have combined cold storage or freezing facilities.

Ice is used mainly for chilling fish on fishing boats and chilling fish during its transport from landing places to consuming centres. Ice is not used at retail shops.

It is roughly estimated that 7% to 12% of the retail price of fish represents the price of ice used.

The main factors preventing ice from being used more extensively are the high price of ice and the fact that consumers are not used to eating iced fish.

It is contemplated to build 2 more ice plants in the near future, one at Labuan and the other at Sandakan.

*US\$ 1.00 = (M)\$3.03

**US\$ 1.00 = Rs. 4.762

Pakistan

There are a number of ice plants but only a part of the facilities is used for fishery industries.

In the Karachi area, there are 20 ice plants all owned by commercial firms. Their ice-making capacity per day ranges from 5 tons to 50 tons totalling 431 tons. No further information is available and it is not known what proportion of the total production of ice is used for fishery industries.

In West Pakistan, excluding the Karachi area, it is reported that there are 120 ice plants. It is estimated that only a very small proportion of the ice production is used for fishery industries. The ex-factory price of ice is approximately Rs. 1** to Rs. 3 per maund (1 maund—37.324 kgs.).

In East Pakistan it is reported that there are 32 ice plants but the proportion of the ice production which is used for fishery industries is not known.

Philippines

There are 138 ice plants whose production is wholly or partly used for fishery industries. The main uses of ice in the fishery industries include chilling fish on fishing boats, during its transport from landing places to retail markets and consuming centres and at retail shops.

Approximately 2% to 5% of the retail price of fish is estimated to represent the price of ice used.

Although ice is extensively used to chill fish on fishing boats, housewives consider fish as not being fresh if they see it iced in the retail markets. Retailers therefore avoid displaying fish on ice but attempt to keep it fresh by constantly dousing it with fresh water.

With respect to future plans for the construction of ice plants, information from private sectors is not available. However,

there is a Bill introduced presently which envisages the establishment of a Central Fish Exchange in the city of Manila and other fish-landing places. If and when the Central Fish Exchange is established, landing and marketing facilities, including ice plants, will be provided.

Singapore

There are 5 ice plants with a total capacity of 120 tons per 24 hours. It is estimated that about half of the total production of ice is used for fishery industries.

Ice is produced in block form. The average ex-factory price is a fixed price of \$18 per ton. All 5 ice plants are owned by commercial firms and 4 of them have combined cold storage and freezing facilities.

The main uses of ice include chilling fish on fishing boats, chilling fish during its transport from landing places to consuming centres and at retailers' shops. It is estimated that approximately 2 lbs. of ice is used for 1 lb. of fish. The proportion of the price of ice included in the retail price of fish varies according to the price of fish and it is therefore difficult to mention any definite figure. The main factor preventing ice from being used more extensively is reported to be the cost of ice.

U.S.A. (Trust Territory of the Pacific Islands)

Marshalls District

There is one ice plant with an ice-making capacity of one ton per day, and with an ice storage capacity of two tons. Ice is produced in blocks of 50 lbs. and is therefore presently available for fishermen. However, fishing is done on a daily basis and catches are consumed as caught and therefore little icing is done.

Caroline Islands

There is one ice plant owned by the Trust Territory Government with a capacity

of approximately 2 tons per day and with an ice storage capacity of 7 tons. Ice is produced in flake form and production amounted, in 1960, to approximately 638 tons per year. The production is used totally for fishery industries. The ice is used mainly for chilling fish on dock prior to sale.

Viet-Nam

There are some 29 ice plants in Central Viet-Nam whose production is wholly or partly used for fishery industries. Ice is produced in block form of 50 kgs. each. The proportion of ice used for fishery industries out of the total production ranges from 30% to 70% depending on individual ice plants.

In High Lands there is only one ice plant with a capacity of 0.7 ton per day and its actual production amount to 210 tons in 1960. Approximately 80% of the total production goes to fishery industries.

In South Viet-Nam, there are some 86 ice plants whose production is wholly or partly used for fishery industries. The ice-making capacity varies greatly from plant to plant ranging from 1 ton to 150 tons per day. Accordingly, there is great variation in actual production by each plant ranging from less than 100 tons to 38,000 tons per year.

Ice is produced in block form of 50 kgs. each. According to individual plants, 50% to 80% of production is used for fishery industries.

II. Cold Storage Facilities * **

Australia

Although details of cold storage facilities are not known on a port-by-port basis, there are numerous ports where cold storage units are located which are wholly or partly used to store fish or fish products.

* Cold storage in this report includes :

- (1) Insulated room with mechanical refrigeration, and
- (2) Tanks with mechanical refrigeration for cooling sea water or brine.

** Cold storage unit means an entity of cold storage facilities consisting of a certain number of cold storage rooms or tanks.

Cold storage units are mainly commercial but fishermen's cooperatives also own units and several Government-owned units are also in operation. Charges for cold storage of fish and fish products are not generally available. It is, however, stated by one firm that its charge to store frozen fish is 1/12th of a penny per lb. per week.

With respect to refrigerated boats, such boats are generally confined to the crayfish, tuna and prawn fleets but their numbers are not available.

Hong Kong

Twenty-two cold storage units operate in the Colony making up a total of approximately 42,000 tons of storage at temperatures ranging from 32°F to -30°F. Storage costs range from HK\$0.025 to HK\$0.05 per lb. per month. The fishing industry utilizes some 10% of the total cold storage capacity in Hong Kong.

All cold storage units are operated by commercial companies with the exception of one unit situated in the Aberdeen Wholesale Fish Market which is operated by the Fish Marketing Organization as part of its wholesale marketing services. Cold Stores operated by commercial companies are situated in or near the main fishing centres

on the Island of Hong Kong and Kowloon. Limited, but expanding cold storage facilities are available in fishing centres in outlying districts. Refrigerated vehicles and vessels operate in the Colony, but the demand for their use by the fishing industry is negligible.

In Hong Kong over 90% of all marine fish marketed is landed fresh and retailed only a few hours after landing. There is, consequently, a good demand for ice, but only a small demand for cold storage facilities. As most of the fish placed in cold storage is removed within a day or two, low-temperature storage is rarely required.

Japan

As at 1 January 1960 there were 2,594 cold storage units throughout Japan. Most of these are more or less concerned with storing fish or fish products. The total capacity of the cold storage is estimated, as at 1 January 1960, at 3,355,161 cubic metres including the capacity for storing ice. It is estimated that, on an average, some 60% of the total capacity is used for fishery industries.

The main consuming centres and cold storage facilities located in each place are shown as follows :—

Consuming Centres	Population	No. of plants	Capacity (m ³)
	(in ton thousands)		
Tokyo	762	111	353,260
Yokohama	114	24	59,212
Kyoto	121	38	74,495
Nagoya	133	26	69,417
Osaka	254	75	214,678
Kobe	98	31	131,062

As to landing centres, the following shows only a few representative centres on a

large, medium and small scale and the cold storage facilities located there :—

Landing Centres		Estimated fish-catches	No. of plants	Capacity (m ³)
(in ten thousand tons)				
Large	Yaizu	11	25	46,308
scale	Nagasaki	22	12	28,633
Medium	Onagawa	4	12	16,575
scale	Hamada	6	9	9,542
(in thousand tons)				
Small	Kushimoto	4	1	672
scale	Hedate	5	2	2,717

With respect to the ownership of the cold storage units, fishermen's cooperatives own and operate 326 units and commercial firms 2,268 units.

The average charges for cold storage of fish or fish products is as follows:—

65 yen per ton per day (A Class Units)

47 yen per ton per day (B Class Units)

26 yen per ton per day (C Class Units)

(A, B and C indicate classes of temperature). Charges are usually made on a half-monthly basis.

In view of the importance of the cold storage facilities in the stabilization of fish prices and maximum utilization of catch, the Government assists, by means of loans, the construction of cold storage units particularly by fishermen's cooperatives.

There are about 4,000 refrigerated wagons operated by the National Railroad Corporation. There are 723 refrigerated boats including carrier and fishing boats.

Korea

It is estimated that there are about 37 cold storage units out of which 34 are used wholly or partly to store fish or fish industries.

The total capacity of the cold storage is estimated, in 1961, at 12.627 M/Y.

The number and capacity of cold storage units located in the main fish landing and consuming centers are as follows:—

Place	Landing Centres No. of cold storages	Total capacity
Pusan	10	6,527 tons
Mokpo	3	1,417
Yosu	2	132
Masan	3	328
Chungmu	2	190
Kunsan	2	110
Cheju	1	10

Place	Consuming Centres No. of cold storages	Total capacity
Seoul	7	1,780
Kwang Joo	1	10
Dae Jeon	1	12
Cheong Joo	1	30

The average charges for the cold storage of fish in 1961 about 15 won per day.

With respect to the ownership of the cold storage units, fishermen's cooperatives own and operate 8 units and commercial firms 29 units.

The cold storage units are mostly combined with ice plants.

In view of the importance of the cold storage facilities in the stabilization of fish prices and maximum utilization of catch, the Government assists, by means of loans, the construction of cold storage units particularly by fishermen's cooperatives.

Federation of Malaya

Out of the 52 ice plants, 34 have cold storage facilities. In addition, there are other commercial cold storage units not

wholly confined to fish and some big fishing establishments also own cold rooms. However, the total number of such units are not known. With respect to the 34 cold storage units, combined with ice plants, they have a total capacity of approximately 4,200 tons. It is estimated that the capacity is almost entirely used for fishery industries. The main fish-landing and consuming centres and the number and capacity of cold storage units located in place are shown below:—

State	Landing Centres	No. of Units	Capacity 1961 Tons	Consuming Centres	No. of Units	Capacity 1961 Tons
<i>Perlis</i>	Kuala Perlis	1	214	—	—	—
<i>Kedah</i>	Kuala Kedah	1	12	Sungei Patani	1	27
<i>Penang</i>	Sungei Acheh	1	24	Penang	2	70
				Bukit Mertajam	1	105
<i>Perak</i>	Pantai Remis	1	30	Taiping	3	68
	Pangkor	2	310	Ipoh	4	532
	Lumut	1	24	Kampar	1	10
<i>Selangor</i>	—	—	—	Kuala Lumpur	2	1,642
				Klang	2	255
<i>Negri Sembilan</i>	—	—	—	Seremban	1	80
<i>Malacca</i>	—	—	—	Malacca	1	188
<i>Kelantan</i>	Kota Bharu	3	212	—	—	—
<i>Trengganu</i>	Kuala Trengganu	1	32	—	—	—
<i>Pahang</i>	Kuantan	1	47	—	—	—
<i>Johore</i>	Mersin	1	20	Johore Bahru	—	88
	Pontian Kechil	1	36	—	—	—
	TOTAL	14	961		20	3,221

Fishermen's cooperatives own one cold storage unit and 33 are owned by commercial firms. There is no Government ownership. Average charges for cold storage for fish or fish products in 1960 and 1961 were (M)6 cents to (M)10 cents per day per hundred pounds.

The benefits of the cold storage facilities are fully appreciated by fishery industries and such facilities are being established wherever economical.

It is now planned to increase the capacity of one unit in Taiping by 50 tons and one in Teluk Anson by 45 tons.

There are 2 refrigerated trucks operated by fish merchants, one of $\frac{3}{4}$ ton and one of 8 tons. The North East Fishermen's Cooperative Credit, Marketing and Transporting Union also operates 2 insulated vans. The railways do not operate refrigerated wagons and ordinary wagons are sometimes

used for transporting fish packed with ice in boxes. There are no refrigerated boats but large fishing boats or fish carriers have fish holds for preserving catches in ice at sea.

North Borneo

There are 13 cold storage units which are wholly or partly used for selling fish or fish products. The total capacity is about 1,000 tons of which about 350 tons are used for fish and fish products. The cold storage units are located in the main landing and consuming centres as follows:—

Jesselton	—	6 units (500 tons)
Sandakan	—	5 units (300 tons)
Tawau	—	2 units (200 tons)

Out of the 13 cold storage units, 2 are owned by the Government, 8 by commercial firms and 3 by others.

The rate for cold storage at Jesselton is \$2 per month per square foot of floor area (10 feet high).

The main factor which prevents the more extensive use of cold storage facilities is that consumers are not used to eating frozen fish and the high rate of cold storage

rent. It is also felt necessary to reduce the cost of electricity used for cold storage plants.

At the moment, 2 more cold storage units are planned to be built, one at Labuan and the other at Sandakan.

Pakistan

There are very few cold storage units which are used even partly for storing fish. The only cold storage specifically used for fishery industries is a chain of cold storage units in all important landing and consuming centres. Cold storage and ice-making machinery received under the aid of ICA is being installed at Sadar-Ghat and Chittagong, East Pakistan and at Pasni on the Mekran Coast.

Philippines

There are 23 cold storage units which are partly used to store fish or fish products. The total capacity is estimated to be 1,474,137 cubic feet, out of which roughly 15% to 20% is used for fishery industries.

Main fish landing centres and the proportion and capacity of the cold storage units located in each place are shown below:—

Fish Landing Centre	No. of Units	Total Capacity (cubic feet)
Mercedes, Camarines Norte	1	2,000
Naga City	1	4,450
Calabanga, Camarines Sur	1	5,000
Pasacao, Camarines Sur	2	106,000
Iriga, Camarines Sur	1	6,000
Cebu City	1	20,140
Iloilo City	5	53,400
San Pablo City	1	2,805
Manila	4	677,990
Bacolod City	1	6,804
Caloocan, Rizal	2	106,675
Navotas, Rizal	2	480,213
Zamboanga City	1	2,600
TOTAL	23	1,474,137

Average rates for cold storage for fish and fish products are as follows:—

a) Per cubic metre in sharp freezing (temperature 15 to 20 degrees)

	<u>Per Day</u>	<u>Per 30-day Month</u>
Less than 1 cubic metre per cubic metre	₱0.47*	₱14.10
1 to 50 cubic metres " " "	0.39	11.70
50 to 500 cubic metres " " "	0.33	9.90
500 to 1,000 cubic metres " " "	0.26	7.80
Over 1,000 cubic metres " " "	0.20	6.00

b) Per cubic metre in chill rooms (temperature 32 to 38 degrees)

	<u>Per Day</u>	<u>Per 30-day Month</u>
Less than 1 cubic metre per cubic metre	₱0.39	₱11.70
1 to 15 cubic metres " " "	0.32	9.60
15 to 30 cubic metres " " "	0.27	8.10
30 to 150 cubic metres " " "	0.21	6.30
Over 150 cubic metres " " "	0.17	5.10

All cold storage units are owned and operated by firms or corporations. Out of the 23 cold storage units, 17 units have combined ice plants.

Usually fish production does not reach such over-abundance as to necessitate keeping them in cold storage to a large extent. However, in Manila where gluts occur during peak seasons, the general practice is to keep the fish in iced holds until demand or convenience requires operators to unload.

Singapore

There are 6 cold storage units which are all located in the city area except for one. Data are not available on their capacity and on the extent to which they are used for storing fish or fish products. One cold storage unit is owned by the Government and 5 by commercial firms.

Data on charges by commercial firms are not available but the Government cold storage unit charges (M)\$21** per day for a room 10 ft. x 6 ft. x 8 ft. There is no seasonal variation.

*US \$1.00 = ₱3.40

**US \$1.00 = (M)\$3.03

The main factor which prevents more extensive use of cold storage facilities in fish marketing is reported to be the high cost of cold storage.

U.S.A. (Trust Territory of the Pacific Islands)

Marshalls District

There is 1 cold storage unit with a capacity of 4 tons owned by the Trust Territory Authorities in Majuro, Marshall Islands. In 1960, 25½ tons of fish were stored for hospital and school feeding programmes. The rate for cold storage for fish is \$.02 per pound for 3 months and \$.01 per pound after 3 months.

At present limited catches and immediate consumption reduces the more extensive use of present facilities. Additional cold storage facilities will be needed when catches are larger than for immediate demand.

Truk District

There are 5 cold storage rooms with a capacity of 4½ tons owned by the Trust Territory Government. In 1960 as well as in

1961, approximately 38,000 lbs. of fish were stored.

Yap District

There are 2 cold storage units with a total capacity of 10 tons. Approximately 5% of the capacity was used in 1960 as well as in 1961 for storing fish.

Pending establishment of a fishing industry, present facilities are adequate.

Caroline Islands

There is 1 cold storage unit with a total capacity of 25 tons, owned by the Trust Territory Government. Roughly 75% of the capacity is used for storing fish.

Viet-Nam

There are 8 cold storage units which are all located in Saigon wholly or partly used to store fish or fish products. One cold storage unit with a capacity of 250 cubic metres, owned by the Directorate of Fisheries, is located in Saigon fishing harbour. The facilities are totally used for storing fish. The capacities of the other units varies from 250 cubic metres to 2,400 cubic metres.

III. Freezing Plants

Australia

There are many freezing plants mainly owned by commercial firms and cooperatives and also some owned by the Government. However, the number and capacity of the freezing plants which are wholly or partly

used for freezing fish are not available. It could be said, however, that only a minor part of the capacity is used for freezing fish in relation to the whole frozen food industry. The main types of freezing include contact, blast and brine freezing.

Hong Kong

Two commercial companies operate a total of 5 quick-freezing plants with a combined capacity of 50 tons per 24 hours. Some 70% of the total capacity of these freezing plants was used for fish freezing in 1961. The freezing plants are situated in the main fishing centres on the Island of Hong Kong. A further 3 quick-freezing plants will be built in the near future.

The cost of freezing fisheries products varies from HK\$0.15 to HK\$0.20 per lb. (including labour) depending on the type of processing demanded for any particular type of product. However, frozen fish is not in great demand in Hong Kong and freezing is confined chiefly to frozen fisheries products intended for export.

Japan

As at 1 January 1960, there were 976 freezing plants which are wholly or partly used for freezing fish. The total capacity is 10,340 tons per day. The main types of freezing are air-blast and brine freezing. The main consuming centres and freezing facilities located there are shown below:—

Consuming Centres	Population	No. of plants	Capacity (Ts. per day)
	(in ten thousands)		
Tokyo	764	33	503
Yokohama	114	9	123
Kyoto	121	5	42
Nagoya	133	1	10
Osaka	254	11	63
Kobe	98	5	95

As to landing centres, the following shows only a few representative places on a large, medium and small scale and the number

and capacity of freezing plants located in these places :—

Landing Centres		Estimated fish-catches	No. of plants	Capacity (Ts. per day)
(in ten thousand tons)				
Large scale	Yaizu	11	21	309
	Nagasaki	22	7	156
Medium scale	Onagawa	4	11	146
	Hamada	6	—	—
(in thousand tons)				
Small scale	Kushimoto	4	2	6
	Hedate	5	2	35

Fishermen's cooperatives own 180 freezing plants and 796 are owned by commercial firms. Approximately 37% of the total freezing plants have combined ice-making and cold storage facilities.

It is considered that the improvement of the quality of frozen fish as well as the publicity, would bring about more consumption of frozen fish. Besides the private firms investing in this field, the Government assists, by means of loans, in the construction of freezing plants, particularly by fishermen's cooperatives.

Korea

In 1961, there were 34 freezing plants which are wholly or partly used for freezing fish. The total capacity is 821 tons per day. The types of freezing are cold air freezing, air-blast and contact freezing and few of brine freezing.

The main consuming centres and freezing facilities located there are shown below :—

Place	Fish Landing Centres No. of Plants	Capacity (Ts. per day)
Pusan	10	167
Inchon	2	30
Yosu	2	5.6
Mokpo	2	42
Masan	3	412
Chung mu	2	40
Kunsan	1	20

Place	Fish Consuming Centres No. of plants	Capacity (Ts. per day)
Seoul	8	117
Dae Jeon	1	6
Cheong Joo	1	20

Fishermen's cooperatives own 5 freezing plants and 20 are owned by commercial firms.

Approximately 60% of the total freezing plants have combined ice-making and cold storage facilities.

Besides the private firms investing in this field, the Government assists, by means of loans and subsidies in the construction of freezing plants, particularly to fishermen's cooperatives.

Federation of Malaya

There are two freezing plants which are wholly or partly used for freezing fish, one at Penang (Malayan Marine Industries Ltd.) and one at Ipoh (Malayan Fisheries Ltd.). Their freezing capacity is 7 tons and 2 tons of fish per 24 hours respectively. The amount of fish frozen by the former was estimated at 1,070 tons in 1961. The latter commenced operation only at the end of 1961.

The main factor which prevents more extensive consumption of frozen fish is considered to be consumers eating habits. The

consumption of all types of frozen foods including fish, has not met with success due mainly to the availability of fresh food. However, there are indications that frozen foods are becoming popular.

North Borneo

There is only one freezing plant in Sandakan owned by the Sabah Fishing Company. The type of freezing is contact (horizontal plate freezer) and has a capacity of 8,000 lbs. per day. The plant has combined ice plant and cold storage facilities.

There is a plan to build another freezing plant in Sandakan in the near future.

The use of a freezing plant is new and it is used solely for freezing prawns for export trade.

Pakistan

There are 6 freezing plants which are wholly used for freezing fish (mainly prawns) and all of them are located in Karachi. Their total freezing capacity is approximately 65 tons per day. All of them have cold storage rooms, the capacity ranging from about 60 to 350 tons.

There is freezing plant located on a trawler named "Al-Kaukab", 70 gross tons, which generally remains in the Karachi Fish Harbour. The capacity is 1,000 lbs. of fish per day by blast freezing.

Philippines

According to the Public Service Commission, there are no public utilities classified as freezing plants. Therefore, although some utilities have freezers they are officially reported as cold storage units.

Singapore

There is one experimental freezing plant owned by the Government. The type of freezing is blast and the capacity is half a ton per day.

U.S.A. (Trust Territory of the Pacific Islands)

Marshalls District

There is one freezing plant owned by the Trust Territory Government in Majuro. The type of freezing is contact and the capacity is 4 tons per day. The cold storage unit which is mentioned earlier, is combined with this freezing plant.

Truk District

There is one freezing plant owned by the Trust Territory Government which is plate freezer and has a capacity of 1½ tons per day.

Yap District

There are two freezing plants owned by the Trust Territory Government. These are contact freezers and have a capacity of 2 tons per day. Only a small proportion of the capacity (2%) was used for freezing fish in 1960 and 1961. Pending establishment of the fishing industry, present facilities are adequate.

Caroline Islands

One freezing plant (coil contact blast) of the Trust Territory Government is nearing completion. The plant is combined with the cold storage unit with a capacity of 25 tons which was mentioned earlier.

Ponape District

There is one freezing plant with half a ton capacity per 24 hours, owned by the Trust Territory Government. In 1961, 40 tons of fish were frozen, constituting some 50% of the total frozen food.

Viet-Nam

There is one freezing plant in Saigon operated by the South Seas Shrimp Company. It has a capacity of freezing 30 tons of fish per day, and is mainly used for freezing shrimp for export trade.

Marketing of Dried and Salted Fish

1. Production of Dried and Salted Fish

Australia

The production of dried and salted fish is of little importance in Australia. Of the

three processes being examined in the present study, smoking is the only one which is carried out in Australia, and the volume of production of smoked fish has decreased

sharply over recent years. Details of production are given in the following table, where also a comparison is made between the volume of fish smoked and the total catch:

*Australian Production of Smoked Fish as Percentage
of Total⁽¹⁾ Fish Production⁽²⁾
1956/57 to 1960/61*

Year	Smoked Fish		Total Production (000 lb.)	Smoked (2) as Percentage of Total Production
	Amount Produced (000 lb.)	Estimated Live Weight (000 lb.)		
1956/57	487	812	117,638	0.69
1957/58	439	732	114,382	0.64
1958/59	286	477	126,309	0.38
1959/60	296	493	134,117	0.37
1960/61	252	420	135,715	0.31

(1) Includes crustaceans and molluscs.

(2) Live weight.

Hong Kong

The salt and dried fish industry in Hong Kong is an old traditional trade. In spite of the simple and well-known brining and sun-drying techniques being used in the Colony, the trade is, to a considerable extent, of a specialized nature. The skill of the processor consists chiefly in his ability to control the degree of fermentation of the fish which provides the distinctive flavour of the product. This skill has placed the processor on the South China Coast in rather a special position among processors in Asia and, as a result, his products are in considerable demand not only in this region but also by Chinese communities in many western countries.

The total local production in the financial year 1961/62 was 4,773 tons of which 1,000 tons were exported.

The main production centres of salted and dried fish in the Colony are at Aberdeen and Shaukiwan on the Island of Hong Kong and on the Island of Cheung Chau. From these

three main production centres and also from several smaller fishing villages in outlying districts (mainly producing unsalted dried fish), the partly cured fish is sent to the Wholesale Fish Market at Aberdeen. Here, these products are purchased by 151 merchants registered as buyers at the market and whose main functions are to process their purchases at the market and to distribute the finished products.

The main species marketed dried and unsalted were Golden Sardine (*Sardinella*) and Anchovies (*Stolephorus*). The species used mainly in the production on salted dried fish include Carangoid Fish (Carangidae), Croakers (Sciaenidae), White Herring (*Ilisha*) and Lizard Fish (*Saurida tumbil*). Types usually sold at the wholesale markets as wet salted fish include Green Pilchard (*Clupea* or *Harengula*) and Mackerel (*Scomberomorus*).

Some 2,500 fishing vessels in Hong Kong are engaged either wholly or seasonally in the production of fish for the salted and dried fish industry. The sizes of the vessels vary

considerably as do their annual catches. Many of the vessels engaged in landing fish for the industry market their catches in a fresh condition for a part of the year. The types of vessels landing the largest catches of good grade salt dried fish are wind-driven. These vessels market some $\frac{1}{2}$ to $\frac{3}{4}$ ton of wet salted fish at each landing.

Japan

Dried fish and salted fish have constituted very important items of Japanese

fisheries products since old days. Now more than 300,000 tons are produced in a year.

There are many processing plants, mostly of medium or small scale, in fishing villages and ports, where a great number of people are working. These processing plants are greatly contributing towards the stabilization of price of fish landed in the producing center.

The following table shows the recent production of dried fish and salted fish:

(in tons)					
Year	Total	Fish dried in the shade	Salted and dried fish	Boiled and dried fish	Salted fish
1959	377,541	60,956	103,203	125,987	87,395
1960	366,959	51,819	107,720	117,543	89,877

Note: Smoked fish and other processed fish in "fushi" form are not included.

Korea

1. Volume of production

Dried and Salted Fish constituted important position in Korean fisheries products since ancient times.

These products have been produced in small and medium scale plants throughout the country. In 1959, 52,937 metric tons of Dried and Salted products were produced.

Among the dried fish, dried squid is one of the most important products in Korea.

Frozen dried Alaska Pollack and dried anchovy are also a important products in Korea. The recent production of dried and salted fish are shown in the following tables.

Production Table
(Unit M/T)

	1959	1960	1961
Sun-dried	12,710	11,985	20,182
Salt-dried	1,818	626	725
Salt-fermented	18,038	8,157	13,116
Salted	10,429	7,269	9,914
Boil-dried	9,942	13,541	9,580

2. Organization of Production

The most fishermen earn not only from fresh, fish but from dried fish and or salted fish. It is hard to estimate that how many fishermen or producers are producing the cured products in Korea.

Federation of Malaya

1. Volume of Production

No dried unsalted fish is produced.

The total production of salted and dried fish amounted to 21,602 metric tons in 1961, including salted/dried fish, manure fish and prawns:

Salted/dried fish	10,783	metric tons
Salted/dried manure fish ..	8,453	„ „
Salted/dried prawns	2,366	„ „

Main types of salted/dried fish are kembong (*Rastrelliger kanagurta*), tamban (*Clupea* spp.), Selar kuning (*Selaroides leptolepis*), selayang (*Decapterus russellii*), merah (*Lutianus* spp.), gelama (*Sciaemidae*) and bilis (*Stolephorus* spp.).

Other salt-cured products, not dried were as follows:

Fish boiled in brine	3,165 metric tons
Belachan (shrimp paste)	2,430 " "
Chinchalo (pickled shrimp).	31 " "
Budu (fermented anchovy).	265 " "

Fish boiled in brine consists entirely of kembong (*Rastrelliger kanagurta*).

2. Organization of Production

On the west coast of the country, pro-

cessing of fish is mostly done by fishermen themselves. Salted/dried fish wholesalers in the large towns occasionally cure fish; raw fish supplies are obtained from fresh fish dealers and consist usually of small quantities of unsold fish.

On the east coast the bulk of the supplies of salted/dried fish is produced by processors. The following are examples of prices in Malayan currency paid by processors to fishermen in Pahang and Trengganu:

	Pahang	Trengganu
Kembong (<i>Rastrelliger kanagurta</i>)	11 cents per lb.	11-15 cents per lb.
Tamban (<i>Clupea</i> spp.)	4½ " " "	4½-6 " " "
Selar Kuning (<i>Selaroides leptolepis</i>)	6 " " "	11-15 " " "
Bilis (<i>Stolephorus</i> spp.)	11 " " "	25-40 " " "
Gelama (<i>Sciaenidae</i>)	7½ " " "	22½-26 " " "
Selayang (<i>Decapterus russellii</i>)	4½ " " "	4-7½ " " "

As far as possible, fishermen prefer to dispose of their catches in the fresh markets. Curing is only resorted to for the following reasons:

- lack of demand in fresh fish markets, e.g. talang (*Chorinemus* spp.);
- consumer preference for cured form, e.g. bilis (*Stolephorus* spp.), merah (*Lutianus* spp.);
- surplus catches over requirements of fresh fish markets, e.g. kembong (*Rastrelliger kanagurta*) in Perak;
- prohibitive marketing costs on cheap price fish, e.g. tamban (*Clupea* spp.), selayang (*Decapterus russellii*) and selar kuning (*Selaroides leptolepis*) on the east coast;
- poor quality of fish due to deterioration.

The majority of fishermen process fish themselves, with the help of the family.

Large fishing establishments employ two or three assistants.

As to processing by fishermen's cooperatives, fishermen members hand over their fish catches to their cooperatives for curing and eventual sale.

Curers are employed by cooperatives. Prices paid to fishermen by cooperatives are based on current market prices on the day of sale.

Philippines

No data available on the volume of production but the production is organized as follows:

Except in Manila where fishermen channel their fish at the landing place through their authorized brokers, who are actually middlemen, raw fish pass directly from fishermen to processors. In the provinces, processors are supplied regularly by fishermen who find this method a more convenient way of disposing of their catch.

Fish processing establishments for salting and drying fish are located near or within landing places. Processors buy their raw fish direct from the fishermen at wholesale prices of 50 to 70 cents for small fish and 60 cents to ₱1.00 for medium-size fish.

Small fish such as anchovies, small gobies and sardines are dried without salting at all. The fish as they arrive at the processors are washed and spread out in thin layer in the sun on split-bamboo racks. At frequent intervals the operator stirs the fish to promote even drying.

Herring (4 to 7 inches) when fresh has no commercial value in the market; but, as salted and dried products, is very much in demand. Of the medium-size (7-10 inches) fish, the chub-mackerel is the most common of the commercially valued species which is salted and dried. The fish are split down the back leaving the belly wall intact. Entrails and gills are removed, the fish are washed and salted in piles for 3 to 6 hours, then washed in concentrated brine solution and sun-dried for about two days until hard.

Fish such as anchovies, slipmouths and other small fish of little economic importance

in the retail market are usually purchased from the fishermen and fermented (salt-cured) into fish paste.

Most fishermen in the Visayas and Mindanao regions who operate fishing vessels of less than three tons gross process their catch by drying or salting. This is practised in municipalities which are far from consuming centres, where cold storage facilities are not available and transportation facilities do not warrant the marketing of fish in a fresh state.

Singapore

The production of dried and salted fish is practically nil. All locally caught fish are marketed in the fresh condition.

Singapore mainly serves as entrepot for dried and salted fish.

Thailand

1. Volume of Production

No dried unsalted fish is produced. All dried fish in Thailand are salted or slightly brined.

The production of salted and dried marine fish in 1959 was as follows:

Species	Volume tons	East Coast tons	South Coast tons
Chub mackerel	4,853	1,055	3,798
Shark	1,226	255	971
Other fish	10,243	2,360	7,883
Shrimps	1,065	300	765
Crabs	176	40	136
Molluscs	1,602	320	1,282
Total	19,165	4,330	14,835

Production of salted and dried fresh water fish in 1959:

Species	Volume tons	Main production center
Serpent head	4,587	Eighty-five percent of total output were produced in Central Thailand. The rest were produced in the North, North East, and South (inland area) of the country.
Cat fish		
Perch		
Carps		
Other fish		
Prawn	465	
	1,109	
	66	
Total	6,226	

2. Organization of Production

There are approximately 202 fish salting plants maintained by processors. About 1,700 fishermen produce, in a small scale, salted and dried fish themselves at their fishing centers.

Middlemen or wholesalers do not produce dried and salted fish.

*II. Marketing and Distribution of Dried and Salted Fish***Hong Kong**

At the Wholesale Fish Market at Aberdeen, dried and salted fish are purchased by 151 merchants registered as buyers at the market. The functions of these merchants are to process their purchases at the market and to distribute the finished products. These merchants are also retailers, as well as importers and exporters of salted and dried fish products. In the financial year 1961/62, local production of salt dried fish marketed through the Aberdeen Wholesale Fish Market constituted some 400 tons of dried unsalted fish, 2,000 tons of salted dried fish and about 2,350 tons of wet salted (brine pickled) fish. With the exception of the dried unsalted fish and part of the quantity of salted dried fish, the remainder was reprocessed by the merchants who purchased these products at the market.

The average price paid by salt dried fish merchants at the Aberdeen Wholesale

Market in the financial year 1961/62 was HK\$840 per ton.

Most of the wet salted fish marketed at the Aberdeen Wholesale Fish Market is landed directly by wind-driven fishing vessels. Dried unsalted fish, however, is to a large extent, transported to the market under the agency of 65 middlemen operating in the various fishing villages. The functions of the middlemen are to take over catches of fresh marine fish from fishermen either by direct purchase or on an agency basis, to dry the fish and to make the necessary arrangements for the fish to be sold at the market. These middlemen principally deal in the cheaper grades of inshore fish for which the fishermen received from HK\$200 to HK\$420 a ton. Fairly substantial quantities of wet salted inshore fish are sold direct by fishermen as bait to long liner fishermen, usually at higher prices than the fresh fish sold to middlemen for drying.

The price received by fishermen who produce fish for the salted and dried fish industry varies considerably with the types of fish landed and the degree of preservation prior to sale. The larger wind-driven trawlers, marketing fishermen receive from HK\$100 to HK\$200 per ton for wet salted fish, HK\$800 to HK\$1,000 for dried salted fish and from HK\$2,000 to HK\$2,350 per ton for sun-dried unsalted fish.

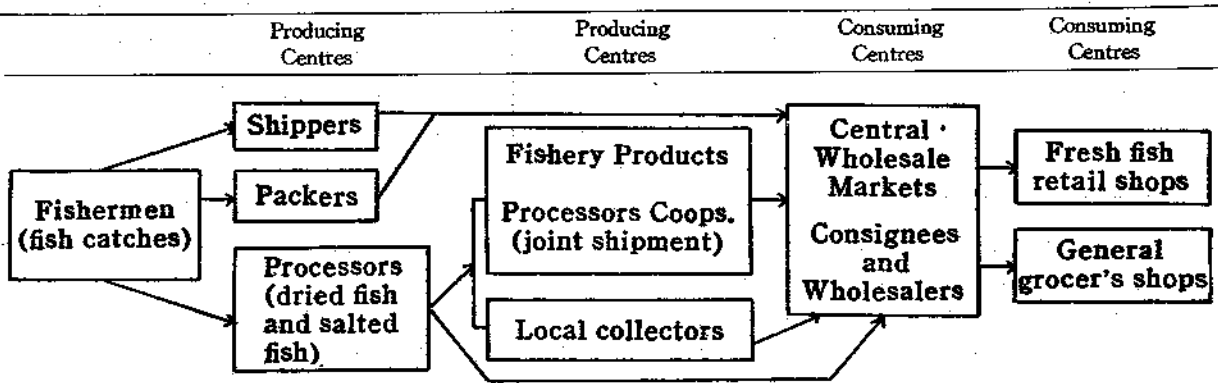
The retailing and salt dried fish is undertaken by nearly 9,000 retail shops and market stalls throughout the Colony. The

retailers obtain their goods from the whole-sale merchants.

Hong Kong has no problems with regard to the transportation of salt dried fish. The transportation is mainly by road at the cost of HK\$5 to HK\$16 per ton depending on the destination. Adequate cold storage facilities are available.

Japan

In consuming centres in Japan, dried fish and salted fish are sold mostly at fresh fish retail shops and general grocer's shops. The diagram of their marketing structure is shown as follows :-



Korea

Distribution

The marketing channel of dried and salted fish in Korea is the following :

- Fishermen — Processors — Fisheries Cooperatives—Auction—Exporters—Whole Salers—Central Wholesale Markets—Retailers—Retail Shops—Peddlers

Transport

The dried and salted fish are transported by rail and trucks to consuming centers. These products are favorably consumed by inland farmers.

Federation of Malaya

Domestic Distribution

Out of the total production of 13,149 metric tons of salted/dried fish and prawns, 2,745 metric tons were exported leaving 10,404 metric tons for domestic consumption.

Producers in the fishing centres consign their products to wholesale agents in the big towns. Retailers obtain their supplies from these wholesale agents for sales to consumers.

The majority of wholesalers also do retail sales to consumers.

With respect to particulars of various agents concerned with dried and salted fish marketing, it is not possible to indicate the respective number of producers, wholesalers or retailers.

For reasons mentioned earlier, fishermen, at some time or other, take up fish curing. The volume of production of dried and salted fish by individual producers is dependent on catches and the quantity that is not sold in the fresh fish markets.

Wholesalers are found mainly in large consuming centres, viz. Penang, Ipoh, Kuala Lumpur, Malacca, Muar, Johore Bahru, Kota Bharu, Kuala Trengganu and Kuantan.

Retailers include stall holders in the markets as well as sundry-shop keepers who are found practically in every town, however small, in the country.

Wholesalers receive their supplies of salted/dried fish mainly from producers in the fishing centres. Their turn-over varies according to the size of their capital investment in the way of loans to fishermen. As regards the turn-over of retailers, those in the big towns, especially the stall holders

and sundry-shop keepers concentrated in the markets, are able to sell more than their counterparts in the small towns. The estimated average turn-over of these two groups is 50 to 60 lbs. per day for big town

retailers and 10 to 15 lbs. per day for small town retailers.

Comparative average wholesale and retail prices in Malayan currency of salted/dried fish for 1961 are as follows:—

	<u>Wholesale</u>	<u>Retail</u>
Kembong (<i>Rastrelliger kanagurta</i>)	40 cents per lb.	45 cents per lb.
Tamban (<i>Clupea</i> spp.)	29 " " "	34 " " "
Selar Kuning (<i>Selaroides leptolepis</i>)	46 " " "	51 " " "
Selayang (<i>Decapterus russellii</i>)	29 " " "	35 " " "
Merah (<i>Lutianus</i> spp.)	71 " " "	79 " " "
Gelama (<i>Sciaenidae</i>)	36 " " "	41 " " "
Bilis (<i>Stolephorus</i> spp.)	84 " " "	93 " " "

Transport

(a) Road transport by trucks is the most common system in the country. Rail is normally used for the transport of salted/dried fish from Kelantan on the East coast to consuming centres on the West coast. Boat transport is necessary to producers in

isolated fishing centres which are not accessible by road; in this case fish are carried to landing points from where they are loaded on to trucks for onward transport to markets.

(b) The following are examples of transport costs on salted/dried fish from producers to consuming centres:—

<u>From</u>	<u>To</u>	<u>Distance</u>	<u>Transport Rate</u>
Kuantan	Kuala Lumpur	171	1-1½ cents per lb.
Kuala Trengganu	" "	313	1½ " " "
Pangkor	" "	201	2½ " " "
"	Malacca	310	3½ " " "
"	Alor Star	185	2 " " "

Storage

There are 53 ice factories in the country of which 34 are installed with cold storage facilities with a total capacity of 4,250 metric tons for fish including fresh and cured. Besides these facilities, there are also other storage units not attached to ice factories, some of which are rented by salted/dried fish dealers. Some of the larger dealers in the big towns also operate their own cold storage units.

the processed products are consumed domestically.

There are two different channels of distribution:—

Philippines

Domestic Distribution

Except for a small quantity of dried and fermented (salt-cured) fish exported, all

(a) Big producers—wholesaler—retailer—consumer: Established producers of dried and salted fish distribute their products through their regular wholesale buyers who operate in the consuming centres. It is transported by ship, train or bus. Dried and salted-and-dried fish are packed in wooden crates, cardboard boxes, big rattan baskets or jute sacks; fermented (salt-cured) fish, in 55 gallon drums or 20 gallon cans. The wholesalers sell the dried and salted-and-dried

fish to the retailers by the kilogram; the fermented (salt-cured) fish, by the 20 gallon cans. The consumers buy dried fish from the retailers by the kilogram or by piece; the fermented products by tin cans, bottles or smaller quantities.

(b) Small producers—middlemen—wholesalers—retailer—consumer; since small producers (fishermen) are scattered all over the region and the marketing of their products will take them away from their work, or the quantity of processed products do not warrant profitable individual marketing, middlemen or their agents accumulate all these products at greatly reduced prices. These are in turn, delivered to wholesalers in consuming centres.

Storage

With respect to storage facilities, processors of dried fish and fermented (salt-cured) fish stock their products in open sheds which are well ventilated. But in consuming centres like Manila and other cities where storage facilities are limited, wholesalers keep the dried fish products in closed, crowded rooms. Since the products are not adequately packed, the condition is conducive to the growth of micro-organism. The fermented products in drums and cans which are not completely sealed are left in the open.

Singapore

The volume directed for domestic consumption corresponds to the difference between imports and exports. This was 1,700 tons in 1960, 2,800 tons in 1959 and 2,000 tons in 1958.

The fish imported by wholesalers are either auctioned or sold by agreement to retailers who in turn will market the fish in shops, market stalls or road side stalls.

There are about 100 wholesalers and 1,000 retailers dealing with domestic distribution.

Thailand

Approximately 21,000 tons of salted and dried fish are directed for domestic consumption. Salted and dried fish is produced by fishermen or by processors (fish salting plants) and the products go through collectors, wholesalers, wagon jobbers and retailers to reach consumers. The average annual production per plant of the 202 fish salting plants is 107 tons. The average annual production of individual owner/operator fishermen is 2.25 tons and the average price received per kilogram of salted and dried chub mackerel is 3 bahts. (21 bahts equivalent to US\$1.00).

There are a total of 210 wholesalers, the average turn-over per wholesaler being approximately 500,000 bahts. The average price received per kilogram of salted and dried chub mackerel is 4 bahts.

There are 6,000 retailers, the average turn-over per retailer being 10,000 bahts. The average price received per kilogram of salted and dried chub mackerel is 5 bahts.

Salted and dried fish is transported by road and rail as well as by boat. The average rates per 100 kilograms from Bangkok to the city of Nakornsawan (distance of 281 kilometers) are as follows:—

By truck	20.20 Bahts
By freight train	5.80 Bahts
By steamboat	15.00 Bahts

Wooden cases and bamboo baskets are used as containers and there are adequate storage facilities at every marketing channel.

III. Foreign Trade

Australia

Imports of smoked or dried, and of salted fish are quite important, as shown in the following Tables. Some such imports are distributed direct to retailers by importing firms, but in most cases, wholesale and distributing firms enter the distribution line. Prices of these forms of fish are rarely published, but at almost the lowest prices asked for fish in any form.

Volume and Value of Australian Imports of Smoked or Dried Fish
by Country of Origin—1958/59 to 1960/61*

Country of Origin	1958/59		1959/60		1960/61	
	Volume	Value	Volume	Value	Volume	Value
	(000 lb.)	(£000)	(000 lb.)	(£000)	(000 lb.)	(£000)
United Kingdom	1,054	88	1,749	158	1,456	133
Canada					15	8
Hong Kong	6	3	12	5	14	9
New Zealand	95	8	250	19		
Other Commonwealth Countries			37	4	44	6
Union of South Africa	4,815	333	6,873	473	6,890	495
Federal Republic of Germany			29	7		
Japan	48	13	31	9		
Denmark	13	6				
Norway	156	25	112	16	132	19
Netherlands	65	6	89	8	105	10
Other Foreign Countries	32	9	23	5	39	12
TOTAL	6,284	491	9,205	704	8,695	692

* Including Frozen Smoked; excluding Salted.

Volume and Value of Australian Imports of Fish (not otherwise recorded)
by Country of Origin—1958/59 to 1960/61*

Country of Origin	1958/59		1959/60		1960/61	
	Volume	Value	Volume	Value	Volume	Value
	(000 lb.)	(£000)	(000 lb.)	(£000)	(000 lb.)	(£000)
United Kingdom	267	19	269	21	379	30
Other Commonwealth Countries	2	1	10	1	22	2
Federal Republic of Germany	308	49	314	43	61	5
Japan	19	5				
Norway	111	10	131	15	116	15
Netherlands	282	14	642	20	367	19
Spain	410	40	554	48	1,575	56
Other Foreign Countries	66	10	47	9	77	12
TOTAL	1,465	148	1,967	157	2,597	139

* For the year 1958/59, the statistics refer to salted fish only; in later years they include other form.

Minor quantities of smoked or dried, and of salted fish were exported, (324 tons in 1959/60 and 96 tons in 1960/61). Some of these shipments were re-exports of imported products.

Hong Kong

Out of the total local production of 4,773 tons in the financial year 1961/62, 1,000 tons was exported. Imports in the same year totalled 10,078 tons of which 1,433 tons were re-exported.

Korea

Export

Among the dried fish, dried squid is one of the most important export products in Korea.

They are caught and processed along the East Coast and exported to South East Asian countries. Dried shrimp and oyster are also exported to South East Asian countries and to the United States of America. Salted fish were exported until 1957.

Export Table

(Unit : M/T and \$)

	1959		1960		1961	
	Qunty	Value	Qunty	Value	Qunty	Value
Dried Fish	—	—	—	—	—	—
Shrimp	44	27,952	82	76,304	117	128,367
Anchovy	4	1,992	7	3,427	6	4,817
Oyster	62	44,271	30	30,485	62	61,442
Squid	1,130	405,844	3,517	1,052,868	6,852	2,470,858
Others	290	129,251	34	25,951	382	248,020
Total	1,530	619,310	3,670	1,189,035	7,419	2,913,504
Salted Fish	none	„	„	„	„	„

Federation of Malaya

The following figures are compiled from the Department of Statistics :—

Exports

Destination	SALTED/DRIED			
	Fish	Crustacea	Mollusc	Total
	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)
Singapore	2,439 (1,721,800)	272 (506,000)	20 (25,100)	2,731 (2,252,900)
Thailand	— (—)	— (—)	16 (17,400)	16 (17,400)
Sumatra	32 (21,800)	— (—)	6 (8,200)	38 (30,000)
Others	1 (1,000)	1 (200)	— (—)	2 (1,200)
TOTAL	2,472 (1,744,600)	273 (506,200)	42 (50,700)	2,787 (2,301,500)

Exports are handled by large producers themselves or by wholesalers.

Export prices are estimated approximately as follows:—

Salted/dried fish	Malayan \$ 620 per metric ton
„ „ crustacea	„ 1,860 „ „ „
„ „ mollusc	„ 1,240 „ „ „

Imports

Sources	SALTED/DRIED			
	Fish	Crustacea	Mollusc	Total
	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)	Metric tons (\$ Malayan)
Singapore	2,597 (3,506,500)	93 (257,100)	1,091 (1,504,800)	3,781 (5,268,400)
Thailand	889 (486,300)	— (—)	— (—)	889 (486,300)
Sumatra	412 (237,400)	695 (1,573,500)	— (—)	1,107 (1,810,900)
China	52 (88,900)	— (—)	556 (639,200)	608 (728,100)
Japan	48 (55,400)	— (—)	36 (198,300)	84 (253,700)
Korea	— (—)	— (—)	938 (997,600)	938 (997,600)
Hong Kong	21 (30,200)	— (—)	248 (288,800)	269 (319,000)
Others	16 (39,400)	6 (15,000)	6 (5,000)	28 (59,400)
TOTAL	4,035 (4,444,100)	794 (1,845,600)	2,875 (3,633,700)	7,704 (9,923,400)

Imports are handled by wholesalers and distributed through retailers.

Import prices are estimated as follows:—

Salted/dried fish	Malayan \$1,101 per metric ton
„ „ crustacea	„ 2,324 „ „ „
„ „ molluscs	„ 1,263 „ „ „

Philippines

Exports

Exporters of dried and wet-salted products, which are usually native delicacies, are the producers themselves. They supply the Filipino communities abroad. For export dried fish are sealed in cellophane bags and

the fermented fish paste, in sealed bottles or tin cans.

Imports

A very small quantity of dried and salted fish is imported by foreign commercial houses to cater for the needs of foreigners and eating places which specialize in foreign dishes.

Singapore**Export (in Long Tons)**

(a)	Volume	Total Volume
1955	6,882.00	1958 9,282.37
1956	8,779.69	1959 7,340.27
1957	11,637.32	1960 9,593.15

Data on volume by type of products not available.

(b) Destination

Union of South Africa
Burma
Brunei
North Borneo
Ceylon
Hong Kong
Sarawak
Thailand
Macao, Timor Deli, etc.
Riouw and Lingga
Borneo
Java
Sumatra
Other Islands in Indonesia
Federation of Malaya

(c) Organization of export

The wholesalers import from neighbouring countries. The fish is then sorted out in Singapore, graded according to quality, re-dried and repacked and then exported to destinations in (b) above.

(d) Export price

Data not available.

Import (in Long Tons)

(a)	Volume	Total Volume
1955	9,981.05	1958 11,302.88
1956	10,480.88	1959 10,146.70
1957	12,944.43	1960 11,282.05

Data on volume by products not available.

(b) Countries from which the products are imported

India
Pakistan

North Borneo
Hong Kong
Cambodia
Sarawak
China
Japan
Vietnam
Thailand
United Kingdom
Denmark
Netherlands
Portuguese East Africa
Other British Countries in Africa
Riouw and Lingga
Other Indonesian Islands
Federation of Malaya

(c) Organization of import and further distribution

The wholesalers import from (b) above neighbouring countries. The fish is then sorted out in Singapore, graded according to quality, re-dried and repacked and then exported to destinations in (b) above (Export).

(d) Prices paid by importers

Data not available.

Thailand**Export****(a) Volume and type of products**

Salted and dried mackerel	893 tons
Salted and dried other fish	3,236 tons
Salted and dried mussel	127 tons

(b) Destination

British North Borneo, India, Malaya, Singapore, Laos, Vietnam, Burma, Indonesia, Netherlands, Penang.

Indonesia and Singapore are respectively the first and second principal foreign markets for the Thai salted and dried fish.

(c) Export price

Average F.O.B. export price per ton of first grade mackerel

(1,000 fish weigh 36-39 kilograms)	— £90
Other fish	— £45
Salted and dried mussel	— £134

Export is carried out by firms engaged in salted and dried fish exporting. For export, the moisture content of salted and dried chub mackerel should not exceed 40 percent and salted content 17 percent.

Import

(a) Volume and type of products

Salted and dried cuttle fish
1,917 tons
Processed fish: dried,
salted and preparation 1,243 tons

(b) Countries from which the products are imported

Penang, Hong Kong, Singapore, Malaya, Japan, South Korea, United Kingdom, Denmark, Germany, Netherlands, Sweden, Australia, U.S.A.

Import is carried out by general goods importers and foodstuffs importers and the imported dried and salted fish are further distributed by wholesalers, wagon jobbers and retailers.

IV. Consumption

Australia

No studies have been published of Australian consumer preference of various forms of dried and salted fish or for such products in comparison with other fish or other foods.

Hong Kong

As a food and the manner in which it forms part of the local diet, the salted and dried fish produced in Hong Kong is not as sensitive to price fluctuations of competitive fresh food commodities which include fresh marine fish, fresh water fish, beef, pork and poultry, etc., as these fresh foods are in relation to each other.

Japan

Dried and salted fish has met people's conventional demand for a long time. Now, however, there is a declining trend in the demand for the fish indicated in the following table:—

Estimated Consumption of Fishery Products per capita by Cities and Farm Villages

(in grams in terms of fresh fish)

	1958	1959	1960
<i>Cities</i>			
Total	39,672 g	40,379 g	41,499
Fresh fish	19,603	19,324	19,528
Salted and dried fish	10,527	10,697	10,715
Smoked fish	8,120	8,723	9,410
Other Processed fish	691	792	896
Canned fish	731	843	950
<i>Farm villages</i>			
Total	25,196	26,124	—
Fresh fish	13,010	13,839	—
Salted and dried fish	7,041	7,030	—
Smoked fish	3,424	3,348	—
Other processed fish	990	1,069	—
Canned fish	731	840	—

The improved standard of living and change in the eating habits of Japanese people have created an active demand for highly processed products such as canned fish and fish sausage, whereas the demand for dried and salted fish, which are processed mainly for preservation, has gradually declined. There are still many cases, however, where dried and salted fish are used as materials for secondary processing.

The change in people's tastes is noticeable. For example, with regard to salted fish, a slightly salted one is preferred. Dried fish of better quality which is prepared ready for the table, is meeting people's favour. Under such circumstances, quick vacuum drying of fish is being studied.

The consumption trends of dried fish and salted fish are summarized as follows:—

(a) *Fish dried in the shade*

Dried squid and dried cod belong to this type. Demand for dried squid does not increase though several technical studies are being made on manufacturing secondary products from this item. With regard to dried cod, its demand is barely maintained through secondary processing by which dried cod is seasoned with sweet and acrid flavours.

(b) *Salted and dried fish*

The main items of processed fish of this type are sardine, horse mackerel, saury, mackerel and cod. The consumers' liking for these items is gradually declining. For the purpose of recovery and increase of consumer's demand for these items, it is essential to improve their flavour, shape and packing. Generally speaking, very salty

products which used to be common, are now losing the popularity of the consumers while the slightly salted products are being developed. Half-dried and slightly salted products have the best flavour, but they deteriorate easily. Measures are therefore being taken to improve packing methods and cold storage facilities.

(c) *Boiled and dried fish*

The main items of this type are sardine, sandlance, shrimp, ligaments of shellfish and abalone. Since many of these items have special demand as condiments, there is no sign of decrease in their consumption now. However, in order to maintain the demand, it is necessary that measures be taken to improve processing and handling methods.

(d) *Salted fish*

Salted sardine, mackerel, salmon, atka mackerel and saury are the main products. Since consumers preference has changed and they more and more prefer slightly salted products, cold storage has become one of the essential marketing facilities.

Korea

Dried fish and salted fish are the Korean peoples favorite foods since old times. Especially these are easily available to farmers.

Since, the dried or salted fishes are cheaper than other highly processed products and there are no suitably located cold storage facilities inland.

However, with change of taste and improvement of living standard, it is noticed that people prefer highly processed products and canned fish.

Consumption

(Unit : M/T)

	Total output	Domestic consumption	Export
1959	57,937	56,407	1,530
1960	41,578	37,908	3,670
1961	53,517	46,098	7,419

Federation of Malaya

Main consumption centres of salted/dried molluscs are in the big towns of Penang, Ipoh, Kuala Lumpur, Klang, Seremban, Malacca and Johore Bharu where there are heavy concentrations of Chinese. In the case of salted/dried fish and prawns, consumption is well distributed between urban and rural areas.

With respect to consumers' preference, Malays have a particular fancy for such types of salted/dried fish as bilis (*Stolephorus* spp.) and talang (*Chorinemus* spp.) the latter being not in demand by the Chinese. Due to their low economic position they also have a preference for the cheaper types such as tamban (*Clupea* spp.), selar kuning (*Selaroides leptolepis*), selayang (*Decapterus russellii*) and gelama (*Sciaenidae*). Among the Chinese, who are generally more prosperous, the more expensive types of salted/dried fish such as merah (*Lutianus* spp.) and kurau (*Polynemus* spp.) are favoured though bilis (*Stolephorus* spp.) and gelama (*Sciaenidae*) are also popular.

With respect to competitive commodities, fresh fish is still the most in demand by the population in general; salted/dried fish is not a regular commodity of food as fresh fish is and is consumed mainly as a variety to the regular diet.

The consumption of boiled fish is well established among the Chinese, particularly in the rural areas where fresh fish is not so easily obtainable and also comparatively expensive.

Canned fish is popular among Malays, especially of the east coast during the North-East Monsoon months when fresh fish is scarce. Among the rest of the population canned fish are consumed not so much as a regular food but as a variety.

The average retail prices of the various types of meat in 1961 compiled from the Department of Statistics are as follows:—

Beef (meat only)	Malayan \$1.51 per lb.
Pork (lean and fat)	" 1.13 " "
Mutton (Australian)	" 1.28 " "
Hen (local)	" 1.31 " "

These prices are high in comparison with those for salted/dried fish generally and are a limiting factor on the amount of meat that an average family can afford. Besides the price factor, on religious grounds beef is not eaten by most Buddhists nor pork by Muslims.

Philippines

The main consuming centres in the country are the cities. Some of the leading ones are Manila, Cebu City, Iloilo City, Pasay City, Quezon City, Basilan City, Zamboanga City and Davao City.

The types and species which are preferred by consumers are the following:—

Dried unsalted fish: anchovies, squids, gobies.

Salted and dried fish: herring, round scad.

Wet salted: herring.

Consumers preference depends on the prices of the products but it can be said that consumers prefer fresh fish and pasted (fermented) fish to dried, salted and smoked fish. Fermented fish is a necessity in the preparation of food for most people in the country.

Singapore

Whilst fresh fish, boiled fish and meat are very popular with the consumers in Singapore, salted and dried fish still retain its position as an important item of food among the consumers in Singapore because they have developed a taste for it.

Polynemus spp., *Lutianus* spp. and *Scomberomorus* spp. are among the more costly types. *Stolephorus* spp., *Rastrelliger* spp., *Caranx* (*Selar*) spp. are very popular.

Thailand

In the inland regions of North and North East Thailand, fish as food is scarce. The regional production of inland fish is substantially inadequate for domestic consumption in both regions. In the rural sectors where fresh fish are inaccessible, or accessible with a very high marketing cost, the people's primary preference is on boiled fish (mainly chub mackerel), and their secondary preference on salted and dried fish of comparatively low prices.

Successive consumers' preferences with respect to species of fresh marine fish are as follows: white pomfret, sea bass, crabs, shrimps, threadfin, Spanish mackerel, barracuda, cuttle fish, black pomfret, red snapper, arc shell, chub mackerel, mussel, hairtail, bonito.

With respect to salted and dried marine fish: shrimps, threadfin, Spanish mackerel, leather skin, red snapper, *Caranx*, chub mackerel.

Successive consumers' preferences with respect to species of fresh water fish are as follows: prawn, catfish (*Pangasius* spp., and *Clarias* spp.), eel, serpent head, carps, perch.

With respect to salted and dried fresh water fish: sepat siam, serpent head.

The rural people, about 85% of the total population of Thailand, belong to low income bracket. These people prefer salted and dried chub mackerel and *Caranx* due to their comparatively cheap price, and also other species but to a much smaller extent, to be eaten along with steamed rice which is their staple food. Their additional daily dishes, usually, are boiled or fried egg, boiled or fresh vegetables, some kinds of soup, and often cooked beef, pork or chicken. The way they prepare salted and dried fish for their meal is to barbecue or fry them, and thereafter apply lemon juice, sugar, sliced onion and sliced fresh chilli.

Other species are more expensive than salted and dried chub mackerel and *Caranx*. Such species are largely consumed by urban and rural people of middle and higher income groups. Practically, the fish are prepared more as appetizers supplementary to spiced meal which is a common daily diet for most Thai people.

Retail prices for various types of fish products and competitive commodities are indicated as follows:—

Types and species of fish products and some animal meat	Retail price per kilogram
<i>Fresh fish</i>	Baht
(a) <i>Marine fish</i>	
White pomfret	20
Sea bass	11
Crabs	7
Shrimps	24
Threadfin	10
Spanish mackerel	9
Barracuda	9
Black pomfret	8
Red snapper	6
Chub mackerel	6
Hairtail	4
Bonito	4
Cuttle fish	9
Arc shell	2.50
Mussel	9

Table (continued)

Types and species of fish products and some animal meat	Retail price per kilogram
	Baht
<i>(b) Fresh water fish</i>	
Prawn	22
Catfish: (1) <i>Pangasius</i> spp.	8
(2) <i>Clarias</i> spp.	11
Serpent head	10
Eel	12
Carps	5
Perch	5
<i>Salted and dried fish</i>	
<i>(a) Marine fish</i>	60
Shrimp	20
Threadfin	16
Leather skin	12
Spanish mackerel	8
<i>Caranx</i>	7
Chub mackerel	9
Mussel	
<i>(b) Fresh water fish</i>	
Sepat siam	25
Serpent head	25
<i>Boiled fish</i>	
Chub mackerel	10
<i>Canned fish products</i>	
Sardines in tomato sauce:	
U.S. products	26
Holland's products	16
Fillets of mackerel	57
Mackerel in tomato sauce	42
<i>Some land animal meat</i>	
Beef	12
Pork	17
Chicken	12

Middle and high income class consumers' preferences in priorities on some types of fish products in relation to dried and salted fish: Fresh fish, canned fish, boiled fish, smoked fish, salted and dried fish, pasted fish.

With respect to some meat to dried and salted fish in priorities of preferences: Beef, pork, chicken, fresh marine and fresh water fish (same level), and next to salted and dried fish.

V. Government Policy and Measures

Australia

No Governmental price regulations are currently in force on dried or salted fish, no subsidies or special export aids have been

granted on them, and no special measures have been taken to improve and control quality. However, Australian production enjoys the protection of the import duties listed below:—

Type of Product	Rate of Duty			
	British Preferential	Most Favoured Nation	General	Special
Smoked or Dried Fish per lb.	1d.	1d.	1½d.	New Zealand Produce is free of duty
Salted Fish per cwt.	5s.0d.	5s.0d.	6s.0d.	

Hong Kong

Apart from the enforcement of certain basic health regulations which are applicable in the handling of food generally, the Hong Kong Government does not operate any legislation specifically designed to regulate the salt fish industry other than the first wholesale of salt/dried fish products. All marine fish, whether fresh or processed, must be marketed through the Fish Marketing Organization although, in the case of imported salted or dried fish, wholesaling by the importer himself is allowed under permit. In many cases, however, the importer prefers to market imported goods at the Aberdeen Wholesale Fish Market.

Korea

The Government granted subsidies for salting tanks of Fisheries cooperatives during past few years.

The Government has appropriated a considerable amount of subsidies and loans for construction of semi-mechanical drying plants of Fisheries Cooperatives along the east coast. Five plants will be constructed in 1962.

Federation of Malaya

There are no measures concerning price regulation and no subsidies given to the dried and salted fish industry. There is no quality control of dried and salted fish but investigations are being conducted by the Fisheries Division on the keeping quality of salted/dried fish in cold rooms.

Singapore

The Government encourages the entrepot trade of dried and salted fish based at Singapore as a free port. There are, however, no particular measures for prices or quality control.

Thailand

Measures for promotion of export of salted and dried fish: In June 1955, rules and regulations on the inspection and certification of standard quality and origin of salted chub mackerel (*Rastrelliger*) for export from Thailand by sea-going vessels had been issued by the Minister of Agriculture, with the consent of the salted fish exporters. The mentioned inspection and certification have been conducted by the Department of Fisheries, with the cooperation of the Bangkok Wholesale Fish Market Organization, since June 1955.

B. SESSION REPORT

Fishery Credit

Having reviewed the credit facilities available at present to the fishing industries, particularly to fishermen, in member countries in the region, and having regard to the increasing importance of credit in the development of fisheries, Council believes that credit facilities to the fishing industries should be strengthened by Member Government wherever possible.

Council notes that ordinary banks are reluctant to extend loans to fishermen because of the risks involved and inadequate security, and that many of the Member Governments extend loans to fishermen, either direct or through fishermen's cooperatives. Council is, however, of opinion that to strengthen the credit facilities available to fishermen, Member Governments might consider the possibility of establishing fishery banks which would meet special requirements of the industry. Such banks would be institutions intended solely to assist the fishing industries, but Governments might consider, if such a scheme is not appropriate to the local situation, the possibility of establishing special semi-governmental banks intended for both agriculture and fisheries, in which a division responsible for fishery development would be created and funds set aside specifically for the fishing industries.

Arising from the discussion on the strengthening of fishery credit facilities, Council notes that the inadequacy of the security which could be offered by fishermen, is one of the main difficulties. It is learned that some Governments are extending loans on the fishermen's character or their business prospects alone. In many cases cooperatives serve as channels of government loans, offer guarantees of repayment by fishermen, and ensure repayment by collecting a certain proportion of the proceeds when fish is marketed through them. Council however feels that lack of adequate insurance facilities for fishing boats and gear is a hampering factor in developing credit for fishermen, and

recommends that a study be made by FAO on the mutual insurance system now in vogue in various countries of the world with a view to establishing such system in the countries of the Region. In this connection Council requests the delegate of Japan to provide Member Governments with detailed information on mutual fishing-boat and gear insurance activities in Japan. Council further notes that suitable facilities for fishermen's life worker's compensation and accident insurance are also lacking in many countries in the Region. Having regard to the importance of such forms of insurance in promoting the welfare of fishermen, Council recommends to Member Governments that they consider the desirability of ensuring that suitable facilities are available to fishermen.

The Council holds the view that, as credit schemes for fishermen develop, it will become more and more necessary to train qualified personnel to administer such schemes. While Council recognizes that such training will primarily be the responsibility of the respective Member Governments, it considers that international seminars on administration and management of credit schemes will be useful for such purposes. Council therefore, recommends that FAO consider the possibility of organizing such seminars for the Region. Such seminars will not only serve the purpose of training personnel dealing with fishery credit in the member countries, but also of facilitating exchange of information in relation to the experience of different countries and of discussing ways and means of improving fisheries financing practice.

Fishery Statistics

Council notes with interest the new developments in the field of fishery statistics in the Region, and learns with special satisfaction the measures taken in Australia in order to unify the collection of statistics in the several states of the Commonwealth. Council agrees that the report prepared by

the Special Committee set up for this purpose can be a useful guide to Member Governments.

Council feels the Member Governments should endeavour to improve methods of collecting fishery statistics by improving techniques, including sampling methods, and to attempt to strengthen statistics collecting activities by increasing staff funds, where necessary.

Council notes that in many Member countries fishermen are reluctant to furnish statistics of catch, for fear that the information they furnish may be made available to taxation authorities. As it is of the utmost importance that accurate figures be available to fisheries administrations. Council recommends to Member Governments that laws be made to ensure that all such statistics be kept entirely secret. Council notes that in Japan the statistics law includes necessary provisions, and that in Western Australia the Department of Fisheries refuses any request for information by taxation Authorities.

Council notes with interest the development in the North Atlantic Region of a uniform reporting system of fisheries statistics to international organizations. Council recommends to FAO that when staff and funds permit, a preliminary survey be made on the state of development of fishery statistics in the Region, with a view to improving statistics in Member countries as well as to introducing uniform reporting systems to international organizations as is being done in the North Atlantic Region.

Fishermen's Cooperatives

Council has reviewed recent developments in the field of fishermen's cooperatives, and notes that in Korea, a new Fisheries Cooperatives Law has recently been enacted, with the result that the former fishermen's associations have been replaced by the new cooperatives, which are purely business organizations.

Council also learns that in India the Central Government has issued a directive to

state Governments setting up a pattern of organization, activities, and financial assistance, with a view to consolidating Fishermen's cooperatives.

Arising from the study of activities of Fishermen's cooperatives, Council notes that the success of these cooperatives depends largely on efficient management. Council therefore stresses that Member Governments should assist cooperatives with management aid, such as the organization of an audit team, as is being done in Hong Kong, training managers in cooperative training schools, and granting subsidies for managerial expenses during the initial stages, as practised in India.

Council notes that in many countries middlemen still exist and often exploit fishermen, and recommends that in order to free fishermen from middlemen control, the Member Governments should encourage fishermen's cooperatives to take up fish wholesale marketing of member's catches, together with other activities, such as granting credit and supplying stores and fishing requisites. It is believed however that financial and technical assistance by Governments will be indispensable in order to make cooperative marketing successful.

Council notes that the International Cooperative Alliance has established a regional Office in New Delhi, and several projects for training cooperative personnel are planned for the Region. Council feels that FAO should establish and maintain close contact with this body with a view to developing projects with respect to training personnel for fishermen's cooperatives wherever possible.

Fishery Development Planning and Fisheries Administration

Council learns with much interest the details and the fisheries development program included in the Third Five Year Plan of India and notes that the fisheries sector has received much more attention and greatly increased funds for fisheries development.

Council agrees that when formulating economic development programs Member Governments should give prior consideration to the development of fisheries which are considered to offer the greatest development potential. Member Governments might also consider that adequate administration and planning should be undertaken to implement any such program. When formulating research programs in connection with development planning, due consideration should, it is believed, be given to biological, technological and economic aspects, and to the coordination of all aspects of research.

Council notes that FAO proposes to organize a seminar on Fisheries Development Planning and Administration in 1963 for the Region. The Council recommends Member Governments to send participants to make full use of the Seminar, and also recommends that a national seminar be held, wherever possible, prior to the Regional Seminar so that the participants may be fully aware of the problems in their own countries. Council further recommends that a country report be prepared by the respective countries as background material for the Regional Seminar. It is suggested that FAO prepare an outline of the subjects which might be included in such country reports, and also a model organizational chart of fishery Administration, to facilitate the work to be done by the countries.

Fish Marketing

Council notes that the structure of fish marketing differs from country to country and is of opinion that, when considering reorganization and improvement of fish marketing, Member Governments should make a careful study to determine the merits and demerits

of existing agencies which have been engaged in marketing at different levels. Member Governments might consider the possibility of assimilating certain existing agencies into cooperative associations, with a view to improving their services for the benefit of fishermen and consumers.

Council notes that a handbook on fish wholesale markets and port terminals, containing descriptions of organization and operations in some twenty wholesale markets in various parts of the world, is being prepared by FAO. Council believes that this document will be very useful for study by Member Governments, particularly where the erection of fish wholesale markets is contemplated and hopes that the handbook will be published without undue delay.

Council believes that market information services could be useful in facilitating orderly marketing and in ensuring fair prices for fishermen. It notes that, while in some countries information services of this nature are already in existence or are being introduced, there exist in some countries difficulties such as the large number of small fishing boats without any means of communication. Council however desires to recommend to Member Governments that consideration be given to the introduction of such services wherever possible.

Council notes with satisfaction that a study on ice-plants, cold storage and freezing facilities has been carried out during the intersessional period. Noting further that a study on the trade of dried and salted fish in the Region has been initiated, Council desires that Member Governments assist the study by providing information wherever available.

CHAPTER VI RECOMMENDATIONS

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The Council's resolutions and recommendations, arising from its review of procedure and the intersession and session activities of its Technical Committees and Sub-Committees are given in full in preceding chapters.

The following is a brief review of these resolutions and recommendations stripped of unessential phrasing and with cross references to the full texts as approved by the Council, and requiring intersession action.

A. TO MEMBER GOVERNMENTS

i. Library Requirements

Requests Member Governments to assist in providing publications for the libraries of the Fisheries Experiment Station and the Fisheries College at Pusan. (Res. VI/62, Ch. I, p. 13-14)

ii. Conservation and Management of Stocks

Invites the attention of Member Governments to the urgency of introducing measures for proper management and conservation of marine resources. (Res. VII/62, Ch. I, p. 14)

iii. Stock Assessment

Invites Member Governments to furnish detailed sets of data with respect to the exploitation of some particular stock or set of stocks. (Ch. II C, p. 45)

iv. Bibliographies

a) Requests individuals and institutions who prepare specialist bibliographies to communicate them to FAO. (Ch. II C, p. 48)

b) Recommends that Member Governments assist the CBASF programme by ensuring that the attention of its annotators is drawn to all fisheries papers published in their countries. (Ch. II C, p. 49)

v. Limnology

Urges Member Governments to give greater recognition to the importance of limnological research. (Ch. II C, p. 52)

vi. Rastrelliger

Urges Member Governments to continue the programme of investigation on Rastrelliger. (Ch. II C, p. 53)

vii. Molluscs

Requests Member Governments to furnish information on present status of pearl oyster fisheries. (Ch. II C, p. 54)

viii. Demersal Stocks

Recommends Member Governments to consider the importance of collecting catch and effort statistics of their demersal fisheries. (Ch. II C, pp. 54-55)

ix. Fish Diseases

Recommends that Member Governments report to FAO occurrences of fish diseases and parasites. (Ch. II C, pp. 55-56)

x. Surf Boats

Recommends that interested Member Governments communicate directly with FAO on this subject. (Ch. III C, p. 197)

xi. Plastic-Fibre Glass Boats

Recommends Member Governments and FAO to explore the possibility of obtaining such a fishing vessel for testing under tropical conditions. (Ch. III C, p. 197)

xii. Fuel Oil

Recommends Member Governments to study the feasibility of reducing the cost of fuel oil for fishery purposes by abolishing import taxes or granting subsidies. (Ch. III C, p. 197)

xiii. Outboard Engines

Recommends Member Governments to make an assessment of the economics of outboard v. inboard engines for fishing purposes. (Ch. III C, p. 198)

xiv. Fish Finding

Urges Member Governments to test the feasibility of fish detection by echo sounding and echo ranging. (Ch. III C, p. 198)

xv. Synthetic Materials for Fishing Gear

Recommends Member Governments to facilitate the import and use of synthetic materials by subsidies or exemption from import duties and taxes; to explore the possibility of indigenous production of such materials; to establish facilities for testing these materials and to disseminate to the industry the results of such tests. (Ch. III C, p. 198)

xvi. Monofilament Synthetic Fibre Nets

Recommends that Member Governments introduce such nets on a trial basis. (Ch. III C, p. 198)

xvii. Weather Forecasting Services

Recommends Member Governments to develop such services where these do not exist. (Ch. III C, p. 198)

xviii. Ice Supplies

Recommends Member Governments to facilitate the supply of ice at minimum prices to the fishery industry and where feasible to subsidize this supply. (Ch. IV B, p. 247)

xix. Care, Handling and Transportation

a) Recommends Member Governments through their extension services to distribute pamphlets describing proper methods and where prejudice exists to iced fish, to publicize the wholesomeness of these products. (Ch. IV B, p. 247)

b) Recommends Member Governments to provide improved facilities. (Ch. IV B, p. 248)

xx. Fish Driers

Recommends Member Governments to experiment with the use of solar energy for the artificial drying of fish. (Ch. IV B, p. 248)

xxi. Fish Processing

a) Recommends Member Governments to consider the feasibility of instituting research to shorten the time required in preparation of fermented fish products. (Ch. IV B, p. 248)

b) Recommends Member Governments to advise the industry on correct methods of handling and processing aquatic products. (Ch. IV B, p. 248)

c) Invites Member Governments to consider reduction of taxes and granting of subsidies on tin plate and other packaging materials. (Ch. IV B, p. 248)

d) Invites Member Governments to consider the possibilities of producing fish sausage from low-priced varieties of fish. (Ch. IV B, p. 249)

xxii. Fish Meal and Fish Protein Concentrates

Urges Member Governments to study the feasibility and economics of the problem before permitting the installation of fish meal plants. (Ch. IV B, p. 249)

xxiii. Fish Protein Concentrates

Invites Member Governments to consider the possibility of introduction of fish protein concentrates closely resembling traditional fishery products, be considered where feasible subject to economic production and consumer acceptance. (Ch. IV B, p. 249)

xxiv. Fish Oil

Invites the attention of Member Governments to the use of refined fish oils in the food processing industry. (Ch. IV B, p. 249)

xxv. Seaweeds

Recommends Member Governments to initiate research in the use of seaweeds where such programmes do not exist. (Ch. IV B, p. 249)

xxvi. Fishery Credit

Recommends Member Governments to consider the establishment of Fishery Banks to strengthen credit facilities for the industry. (Ch. V B, p. 327)

xxvii. Insurance

Recommends Member Governments to consider the setting up of insurance facilities for fishermen. (Ch. V B, p. 327)

xxviii. Fishery Statistics

a) Urges Member Governments to consider improvements to present methods of collection of fishery statistics. (Ch. V B, p. 327)

b) Recommends that Member Governments consider appropriate legislation to ensure secrecy of statistical returns submitted by operatives of the industry. (Ch. V B, p. 328)

xxix. Fishery Cooperatives

Urges Member Governments to assist fishery cooperatives by management aid. (Ch. V B, p. 328)

xxx. Fisheries Administration

Urges Member Governments to participate in the proposed FAO Seminar on Fisheries Development and Planning. (Ch. V B, p. 329)

xxxi. Fish Marketing

a) Invites Member Governments to consider the possibility of assimilating certain marketing agencies into cooperative associations. (Ch. V B, p. 329)

b) Recommends Member Governments to consider the establishing of market information services. (Ch. V B, p. 329)

xxxii. Dried Fish

Requests Member Governments to assist in current FAO studies on the trade in dried and salted fish. (Ch. V B, p. 329)

xxxiii. Research Programmes

a) Recommends Member Governments to undertake a study of "The Impact of the Introduction of Mechanised Fishing Craft and Improved Fishing Techniques on the Socio-Economic status of Fishing Communities". (Ch. I, p. 11)

b) Recommends to Member Governments that biological, technological and economic research programmes be closely integrated. (Ch. I, p. 11).

B. TO F.A.O.

i. Intersession Meetings of Sub-Committees

Requests the Director-General of FAO to explore the possibility of providing funds to cover the cost of one meeting of such Sub-Committees during the forthcoming intersession period. (Res. V/62, Ch. I, p. 13)

ii. Bibliographies

a) Requests FAO to prepare bibliographies on fish genetics and on the induction of spawning of fish. (Ch. II C, p. 48)

b) Requests FAO to inquire whether the ASRC would be able to prepare a biennial list of literature, with detailed indexes, relating to the Indo-Pacific Region. (Ch. II C, p. 48-49)

iii. Rastrelliger

Requests active steps be taken to organize a second Rastrelliger Training Center. (Ch. II C, p. 53)

iv. Non-indigenous Fish

Requests FAO to examine the possibility of establishing a "genetic register" of stocks of a selected range of important species imported into various countries. (Ch. II C, p. 55)

v. Fish Culture in Rice Fields

Recommends that the Director-General of FAO appoint a full time consultant to review the literature and render a first-hand assessment of the value of the practice and identify the problems relating to it. (Ch. II C, p. 56)

vi. Training and Education

a) Recommends FAO or UNESCO be requested to prepare a basic manual of information on fishery principles, suitable for use in secondary schools. (Ch. I, p. 10)

b) Requests FAO to prepare a list of fishery educational institutions available for training various categories of personnel. (Ch. I B, p. 11)

c) Requests FAO to explore the possibility of holding regional training centers for:

1. Instructors in Boatbuilding
2. Masterfishermen
3. Engineers and Mechanics.
(Ch. I, p. 10)

vii. Plastic-Fibreglass Vessels

Recommends that Member Governments and FAO explore the possibility of obtaining such a fishing vessel for testing under tropical conditions. (Ch. III C, p. 197)

viii. Craft and Gear Technician

Requests FAO to approve as soon as possible a fulltime Craft and Gear Technician to the Far East Regional Office. (Ch. III C, p. 198)

ix. Research on Craft and Gear

Requests FAO to explore ways and means to ensure the exchange between countries of research data and information. (Ch. III C, p. 198)

x. Freight Rates

Requests FAO to circulate to Member Governments a questionnaire as a preliminary step to preparing a comprehensive report. (Ch. IV B, p. 247)

xi. Liver Oil

Requests FAO to compile and disseminate available data on comparative studies on synthetic Vitamin A and fish liver oil. (Ch. IV B, p. 249)

xii. Fisheries Products Manual

Requests FAO to publish this Manual as soon as possible. (Ch. IV B, p. 249)

xiii. Seminar on Credit Schemes

Requests FAO to consider the possibility of organizing Seminars on Fishery Credit Administration and Management. (Ch. V B, p. 327)

xiv. Fisheries Statistics

Requests FAO to conduct a preliminary survey on the status and development of fishery statistics systems in the region. (Ch. V B, p. 328)

C. TO EXECUTIVE COMMITTEE

i. Amendments to the Agreement

To investigate in accordance with Article VIII and Rules XV and XVI the suggested amendments to the Agreement and Rules (IPFC/C62/WP 32) in order that this matter may be included in the Provisional Agenda for the 11th Session. (Res. 1/62 (part), Ch. I, p. 9)

ii. Subsidiary Bodies

Secretary to ensure that provision of Rule X(2) be observed. (Res. 1/62 (part), Ch. I, p. 9)

iii. SEASCO

Secretary to establish close contact and to collaborate with the staff of SEASCO in

- (a) organization of training courses
- (b) establishment and development of national reference collection
- (c) preparation and distribution of plankton identification sheets
- (d) preparation and distribution of bibliographies. (Res. 11/62, Ch. I, p. 12)

iv. Exchange of Publications

Secretary to prepare and distribute a list of governmental and private institutions within the IPFC region desiring to enter into an exchange of publications. (Res. VI/62, Ch. I, p. 13)

v. Host Country Problems

Executive Committee to provide, at the 11th Session on appropriate period for consideration of those fishery problems of the host country which it may wish to bring forward. (Res. VIII/62 Ch. I, pp. 15-16)

vi. Sub-Committees on Fishery Oceanography and Stock Assessment

Secretary to communicate with Member Governments to seek nominations to these Sub-Committees. (Ch. I, p. 12)

vii. Rastrelliger Data

Secretary to compile sets of data on *Rastrelliger* for distribution. (Ch. II C, p. 53)

viii. Chanos

Secretary to consult Member Governments on practicability of establishing a research group and on their views as to the relative importance of research on *Chanos* in the marine environment compared to that in confined waters. (Ch. II C, pp. 53-54)

ix. Demersal Fisheries

Secretary to promote active collaboration between Governments in the exchange of information relating to studies of demersal fish. (Ch. II C, p. 54)

x. Fish Culture in Rice Fields

Secretary to circularize Member Governments, by a suitable questionnaire, to obtain all available information. (Ch. II C, p. 56)

D. TO TECHNICAL COMMITTEES

1. Technical Committee I

i. Stock Assessment

(a) Technical Committee I to select some particular stock or set of stocks in respect of which it should at the next session, attempt an assessment. (Ch. II C, p. 45)

(b) Technical Committee I to draw the attention of Member Governments to recent advances in methods of studying and assessing fish population. (Ch. II C, p. 49)

(c) Technical Committee I to establish a Sub-Committee on Stock Assessment. (Ch. II C, p. 45)

(d) Technical Committee I to draw the attention of Member Governments to the special problems of the resources of coastal waters. (Ch. II C, pp. 52-53)

ii. Host Country Problems

Technical Committee I to participate actively in the proposed host country study. (Res. VIII/62, p. 16, and Ch. II C, p. 46)

iii. Fishery Oceanography

Technical Committee I to establish a Sub-Committee on Fishery Oceanography. (Ch. II C, p. 51)

iv. Shrimps & Prawns

Technical Committee I to give consideration to convening a Symposium on this subject in 1966. (Ch. II C, p. 54)

2. Technical Committee II

i. Surf Boats

Recommends that this subject be no longer pursued. (Ch. III C, p. 197)

E. TO INTERNATIONAL ORGANIZATIONS

To UNESCO

a) Inland Aquatic Sciences

Requests UNESCO to consider setting up a programme in the field of inland aquatic sciences, in particular, assistance to universities and research laboratories in the study of fish diseases and parasites. (Res. II/62, Ch. I, p. 12)

To IOC Secretariat

Kuroshio Study

Requests the IOC Secretariat to explore the possibility of convening, through SEASCO, planning meetings for the Kuroshio study. (Res. III/62, Ch. I, p. 13)

To UNESCO

b) Library Requirements

Requests UNESCO to assist in providing publications for the libraries of the Fisheries Experiment Station and the Fisheries College at Pusan. (Res. VI/62, Ch. I, p. 13)

c) Training and Education

Recommends FAO or UNESCO be requested to prepare a basic manual of information on fishery principles, suitable for use in secondary schools. (Ch. I, p. 10)

APPENDIX I
LIST OF DELEGATES AND OBSERVERS

<i>Government</i>	<i>Name</i>	<i>Designation</i>	<i>Address</i>
Australia	Dr. G.L. Kesteven (Delegate)	Assistant Chief	CSIRO, Division of Fisheries and Oceanography, P.O. Box 21, Cronulla, N.S.W., Australia.
	Mr. A.J. Fraser (Adviser)	Director	Fisheries Dept., Perth, Western Australia.
	Mr. C. Hogue (Adviser)	3rd Secretary	Australian Embassy, Seoul, Korea.
Ceylon	Dr. A.C.I. Weerakoon (Delegate)	Assistant Director of Fisheries (Research)	Fisheries Department, P.O. Box 531, Colombo, Ceylon.
France	Mr. M.P. Legaud (Delegate)	Marine Biologist	Laboratoire d'Océanographie Institut Français d'Océanie, B.P. 4, Noumea, New Caledonia.
India	Mr. K. Gopinatha Pillai (Delegate)	Fisheries Dev. Adviser	Ministry of Food and Agriculture, New Delhi, India.
Japan	Mr. T. Nakamura (Delegate)	Chief, Data and Statistics Section	Survey and Research Division, Fisheries Agency, Tokyo, Japan.
	Dr. K. Onodera (Alternate)	Chief, River Division	Fresh Water Fisheries Research Laboratory, Hinomachi, Minamitama-gun, Tokyo, Japan.
Korea	Mr. Min, Choong Shik (Delegate)	Assistant Vice Minister for Operation	Ministry of Agriculture and Forestry, Seoul, Korea.
	Mr. Kim, Myung Nyun (Alternate)	Director	Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
	Mr. Lee, Bong Nae (Expert)	Director	Central Fisheries Experiment Station, Pusan, Korea.
	Mr. Chung, Moon Ki (Adviser)	Adviser	FAO Korean Association, 110 Nae-Su-Dong, Chongro-Ku, Seoul, Korea.
	Mr. Chi, Choul Keun (Adviser)	President	Dae Yang Fisheries Inc., Hae-Nam Building, Tai-Pyong Ro, Seoul, Korea.
	Mr. Yang, Jae Mok (Adviser)	Dean	Pusan Fisheries College, Pusan, Korea.
	Mr. Park, Young (Adviser)	2nd Secretary	Ministry of Foreign Affairs, Seoul, Korea.
	Dr. Bae, Dong Hwan (Expert)	Chief	Marine Resources Section, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
	Mr. Kim, Kyun Hyun (Expert)	Senior Fishery Officer	Aquiculture Section, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
Mr. Shin, Kwang Yoon (Expert)	Chief	Marine Resources Section, Central Fisheries Experiment Station, Seoul, Korea.	

<i>Government</i>	<i>Name</i>	<i>Designation</i>	<i>Address</i>
Korea	Mr. Chung, Tae Yong (Expert)	Professor	Pusan Fisheries College, Pusan, Korea.
	Mr. Kim, Kye Oh (Expert)	Chief	Fishing Development Section, Central Fisheries Experiment Station, Seoul, Korea.
	Mr. Chang, Hee Un (Expert)	Chief	Utilization and Food Technology Sec., Central Fisheries Experiment Station, Pusan, Korea.
	Mr. Ro, Jai Dong (Expert)	Senior Fisheries Officer	Fisheries Processing Sec., Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
	Mr. Lee, Kuk Won (Expert)	Director	Central Fisheries Inspection Station, Seoul, Korea.
	Mr. Han, Shin Wook (Expert)	Chief	Fisheries Processing Sec., Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
	Mr. Chung, Bu Kwan (Expert)	Senior Fisheries Officer	Marine Investigation Sec., Central Fisheries Experiment Station, Pusan, Korea.
	Mr. Lee, Soong Soo (Expert)	2nd Secretary	Ministry of Foreign Affairs, Seoul, Korea.
	Mr. Lee, Sang Hoon (Expert)	Administrative Officer	Ministry of Foreign Affairs, Seoul, Korea.
Netherlands	Dr. J.J. Schuurman (Delegate)	Lecturer in tropical brackish and fresh water fish culture at the Agriculture University at Wageningen	Van Iddekingeweg 56, Groningen, Netherlands.
Philippines	Mr. S.B. Rasalan (Delegate)	Chief	Marine Fisheries Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.
Thailand	Mr. Tuanthai Bamrajarnpai (Delegate)	Chief	Fisheries Investigation Division, Thai Fisheries Department, Rajadamnern Av., Bangkok, Thailand.
	Mr. Chertchai Amatayakul (Alternate)	Senior Technical Fisheries Officer	Thai Fisheries Department, Rajadamnern Av., Bangkok, Thailand.
	Dr. Thep Manasaveta (Adviser)	Foreign Agency Liaison Officer	Thai Fisheries Department, Rajadamnern Av., Bangkok, Thailand.
U.K.	Dr. G.A. Prowse (Delegate)	Director	Tropical Fish Culture Research Institute, Batu Berendam, Malacca, Federation of Malaya.
(for Hong Kong)	Mr. Chu Chun Yuen (Expert)	Assistant Research Officer	Cooperative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.
	Mr. Shum Yung (Expert)	Craft Technician	Cooperative Development and Fisheries Dept., Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.

<i>Government</i>	<i>Name</i>	<i>Designation</i>	<i>Address</i>
U.S.A.	Mr. J.C. Marr (Delegate)	Area Director	Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, P.O. Box 3830, Honolulu, Hawaii.
	Mr. R.W. Harrison (Adviser)	Fisheries Adviser	USOM, Seoul, Korea.
Vietnam	Mr. Vu Khac Thu (Observer)	Third Secretary	Embassy of Vietnam, Seoul, Korea.

OBSERVER ORGANIZATIONS AND NON-MEMBER GOVERNMENTS

<i>Observer Organizations</i>	<i>Name</i>	<i>Designation</i>	<i>Address</i>
G.F.C.M.	Mr. W.A. Dill (Observer)	Chief, Inland Resources Section	Biology Branch, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.
P.S.A.	Mr. J.C. Marr (Observer)	Area Director	Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, P.O. Box 3830, Honolulu, Hawaii.
P.S.E.	Mr. M.P. Legand (Observer)	Marine Biologist	Laboratoire d'Océanographie Institut Francais d'Océanie, B.P. 4, Noumea, New Caledonia.
UNESCO	Dr. R. Serene (Observer)	Scientific Officer	UNESCO Science Cooperation Office for Southeast Asia, Djl. Diponegoro 76, P.O. Box 231, Djakarta, Indonesia.
Liberal Arts and Science College, Seoul National University.	Mr. Lee, In Kee	Dean	c/o President, Seoul National University, Dong Seun-Dong, Chongro-Ku, Seoul, Korea.
Engineering College, Seoul National University.	Mr. Kim, Yae Keun	Professor	c/o President, Seoul National University, Dong Seun-Dong, Chongro-Ku, Seoul, Korea.
Liberal Arts and Science College, Ewha Women's University.	Mr. Lee, Hun Koo	Dean	Liberal Arts and Science College, Ewha Women's University, Daihyun-Dong, Seudaimoon-Ku, Seoul, Korea.
The Korean National Commission for UNESCO.	Mr. Kim, Sung Il	Director	The Korean National Commission for UNESCO, No. 39, 2ka Taipyungro, Chung-Ku, Seoul, Korea.
Korea FAO Association.	Mr. Cha, Suk Kyun	Director	Korea FAO Association, No. 88-1, Chuckseun-Dong, Chongro-Ku, Seoul, Korea.
Central Meteorological Office.	Mr. Kook, Chai Pyo	President	Central Meteorological Office, No. 1, Songwoel - Dong, Seudaimoon - Ku, Seoul, Korea.

<i>Observer Organizations</i>	<i>Name</i>	<i>Designation</i>	<i>Address</i>
The Central Federation of Fisheries Cooperatives.	Mr. Eyun, Choon Keun	President	The Central Federation of Fisheries Cooperatives, Myung-Dong, Chung-Ku, Seoul, Korea.
Korea Ship-Building and Engineer Corporation.	Mr. Lee, Jeong Jin	President	Korea Ship-Building and Engineer Corporation, Bongnai-Dong, Pusan, Korea.
Ministry of Commerce and Industry.	Mr. Kim, Kwang Won	Staff Engineer	Ministry of Commerce and Industry (Division of Boat Building), Seoul, Korea.
Office of Rural Development.	Mr. Chung, Nam Kyu	Director	Office of Rural Development, No. 190, Seusuen-Dong, Seuwon City, Kyunggi-Do, Korea.
Zoological Society of Korea.	Mr. Choi, Ki Chul	President	Zoological Society of Korea, c/o Liberal Arts and Science College, National University, Dongseun-Dong, Chongro-Ku, Seoul, Korea.
Botanical Society of Korea.	Mr. Lee, Min Jae	President	Botanical Society of Korea, c/o Liberal Arts and Science College, National University, Dongseun-Dong, Chongro-Ku, Seoul, Korea.
VISITORS	Dr. A.M. Rapson	Chief	Division of Fisheries, Department of Agriculture, Stock and Fisheries, Port Moresby, Papua, New Guinea.

FOOD AND AGRICULTURE ORGANIZATION

<i>Name</i>	<i>Designation</i>	<i>Address</i>
Dr. D.B. Finn	Director	Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.
Mr. H. Kristjonsson	Chief, Fishing Gear Section	Fisheries Technology Branch, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.

IPFC SECRETARIAT

<i>Name</i>	<i>Designation</i>	<i>Address</i>
Mr. J.A. Tubb	Secretary of IPFC	Regional Fisheries Officer, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.
Mr. W.A. Dill	Technical Secretary, Technical Committee I	Chief, Inland Resources Section, Biology Branch, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.

<i>Name</i>	<i>Designation</i>	<i>Address</i>
Dr. G.N. Subba Rao	Technical Secretary, Technical Committee II (Panels A and B)	Assistant Regional Fisheries Officer, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.
Mr. Y. Miyake	Technical Secretary, Technical Committee II (Panel C)	Fisheries Economist, Economics Branch, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.
Mr. J.O. Traung	Rapporteur, Symposium	Chief, Fishing Boat Section, Fisheries Technology Branch, Fisheries Division, FAO of the United Nations, Viale delle Terme di Caracalla, Rome, Italy.
Mrs. A. Soulier	Conference Officer	Technical Assistant, Fisheries Division, FAO Regional Office for Asia and the Far East, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.
Mr. H. Chevalier	Interpreter	19 rue du Mont-Cenis, Paris 18 ^e , France.
Mr. G. Piquemail	Interpreter	6 Rue Anche Colle de Boeuf, Paris 16 ^e , France.
Mr. J. Herbert	Interpreter	Hadeyah Vandoeuvres, Geneva, Switzerland.
Miss H. Bourgain	Interpreter	9 Rue Joseph de Maistre, Paris 18 ^e , France.

ORGANIZING COMMITTEE

<i>Name</i>	<i>Title</i>	<i>Address</i>
Mr. Kim, Chong Dai	Chairman	Vice-Minister, Ministry of Agriculture and Forestry, Seoul, Korea.
Mr. Woonsang, Choi	Vice-Chairman	Director, Bureau of International Relations, Ministry of Foreign Affairs, Seoul, Korea.
Mr. Kim, Myung Nyun	Member	Director, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.
Mr. Bong, Hyeun Chin	Member	Director, Bureau of Budget Economic Planning Board, Seoul, Korea.
Mr. J. Lee	Member	Director, Bureau of Public Information, Ministry of Information, Seoul, Korea.
Mr. Im, Seung Il	Member	Director, Tourism, Highway and Aviation Bureau, Ministry of Transportation, Seoul, Korea.
Mr. Paik, In Han	Member	Chief, Protocol, Ministry of Foreign Affairs, Seoul, Korea.
Mr. Hong, Woong Sun	Member	Director, School Affairs Bureau, Ministry of Education, Seoul, Korea.
Mr. Suk, Kyun Choo	Member	Chairman, Korea FAO Association, Seoul, Korea.
Mr. Bong, Nae Lee	Member	Director, Central Fisheries Experimental Station, Pusan, Korea.
Mr. Yoon, Chun Kun	Member	Director, The Central Federation of Fisheries Cooperatives, Seoul, Korea.
Mr. Jai, Mok Yang	Member	Dean, Pusan Fisheries College, Pusan, Korea.

STEERING COMMITTEE

Chairman : Mr. Kim, Myung Nyun, IPFC Administrative Correspondent, Director, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.

EXECUTIVE GROUP

Executive Secretariat : Dr. Bae, Dong Hwan, Chief, Marine Resources Division, Fisheries Bureau, Seoul, Korea.

Ass. Secretariat
and Liaison Officer of

the 10th IPFC Session : Mr. Ro, Jai Dong, Fisheries Processing Section, Fisheries Bureau, Seoul, Korea.

APPENDIX II

IPFC NOMINATIONS FOR THE PERIOD BETWEEN 10TH & 11TH SESSIONS

Where Member Governments have not supplied new nominations to the Technical Committees and Sub-Committees, those submitted at the 9th Session have been carried over.

ADMINISTRATIVE CORRESPONDENTS

AUSTRALIA

The Secretary, Australian National FAO Committee, Department of External Affairs, Canberra, A.C.T., Australia.

BURMA

The Secretary, Ministry of Agriculture and Forests, Rangoon, Union of Burma.

CAMBODIA

Monsieur Dom-Saveun, Directeur du Service des Peches, Phnom-Penh, Cambodge.

CEYLON

Director of Fisheries, Department of Fisheries, P.O. Box 531, Colombo 3, Ceylon.

FRANCE

Le Directeur General, Office de la Recherche Scientifique et Technique Outre Mer, 24, rue Bayard, Paris 8^e, France.

INDIA

Mr. K. Gopinatha Pillai, Fisheries Development Adviser, Ministry of Food and Agriculture, New Delhi, India.

INDONESIA

Mr. Soepanto, Koesoemowinoto, Chief, Foreign Relation Section, Sea Fisheries Service, 12, Djalan Kerapu, Djakarta, Indonesia.

JAPAN

Mr. Shun-ichi Yamanaka, Chief, Economic and Social Section, United Nations Bureau, Ministry of Foreign Affairs, Kasumigaseki, Chiyoda-ku, Tokyo, Japan.

KOREA

Mr. Kim, Jae Shik, Director, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.

FEDERATION OF MALAYA

Principal Assistant Secretary, Ministry of Agriculture and Cooperatives, Kuala Lumpur, Federation of Malaya.

NETHERLANDS

PAKISTAN

Dr. M.R. Qureshi, Director, Marine Fisheries Department, Fish Harbour, Karachi-2, Pakistan.

PHILIPPINES

Dr. H.R. Rabanal, Chief, Section of Fresh Water Fisheries, Inland Fisheries Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.

THAILAND

Mr. Prida Karnasut, Director-General, Department of Fisheries, Rajadamnern Avenue, Bangkok, Thailand.

U.K. (for Singapore, Hong Kong, North Borneo and Sarawak)

U.K. Liaison Officer, British Embassy, Bangkok, Thailand.

U.K. (for Hong Kong)

Commissioner for Co-operative Development and Fisheries Department, Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Road, Central, Hong Kong.

U.S.A.*

VIETNAM

S.E. Le Secretaire d'Etat a l'Economie Nationale, 59, Boulevard Gin-Long, Saigon, Vietnam.

*No Administrative Correspondent has been designated but copies of correspondence etc. relating to policy and operations should go to:-

- (1) Dr. R.W. Phillips, Director of International Organization Affairs, Foreign Agriculture Service, Department of Agriculture, Washington 25, D.C., U.S.A.
- (1) Agricultural Attache, American Embassy, Bangkok, Thailand.
- (1) Mr. H.G. Ainsworth, Counselor of Embassy for Economic Affairs, Liaison Officer, U.S. Embassy, Rome, Italy.
- (12) Mr. H.A. Vogel, Regional Representative, FAO Regional Office for North America, 1325 C, Street Southwest, Washington 25, D.C., U.S.A.

(Reference FAO Manual, Chapter VI, Section 615)

IPFC TECHNICAL COMMITTEE I

<i>Member Government</i>	<i>Technical Committee I</i>	<i>Sub-Committee on Stocks Assessment</i>	<i>Sub-Committee on Fisheries Oceanography</i>
Australia	Dr. G.L. Kesteven (Chairman), Asst. Chief, CSIRO, Division of Fisheries and Oceanography, P.O. Box 21, Cronulla, N.S.W., Australia.	Dr. G.L. Kesteven (Ch.a.i.) Asst. Chief, CSIRO, Division of Fisheries and Oceanography, P.O. Box 21, Cronulla, N.S.W., Australia.	Mr. D. Vaux, Principal Research Officer, Division of Fisheries and Oceanography, P.O. Box 21, Cronulla, N.S.W., Australia.
Burma	-	-	-
Cambodia	M. Dom Saveun, Directeur du Service des Peches, Phnom Penh, Cambodia.	M. Dom Saveun, Directeur du Service des Peches, Phnom Penh, Cambodia.	M. Sao-Leang, Chef du Cantonnement des Peches du Mekong, Direction du Services des Peches, Phnom Penh, Cambodia.
Ceylon	Dr. A.C.J. Weerakoon, Asst. Director (Research), Department of Fisheries, P.O. Box 531, Colombo-3, Ceylon.	-	-
France	Mons. J. Lemasson, Centre Technique Forestier Tropical, 45 bis, avenue de la Belle Gabrielle, Nogent/S/Seine (Seine), France.	-	-
India	Dr. B.S. Bhimachar, Director, Central Inland Fisheries Research Institute, Barrackpore (Via Calcutta), India.	Shri R. Valappan Nair, Research Officer, Central Marine Fisheries Research Institute, Mandapam Camp, South India.	Dr. R. Raghu Prasad, Deputy Director, Central Marine Fisheries Research Institute, Mandapam Camp, South India.
Indonesia	Mr. Hasanuddin Saamin, Chief, Directorate of Fisheries, Department of Agriculture and Agrarian Affairs, 16 Salemba Raya, Djakarta, Indonesia.	-	-
Japan	Dr. Z. Nakai, Chief, Faculty of Oceanography, Tokai University, 1431-Yoyogi-Tonigaya, Shibuya-ku, Tokyo, Japan.	-	-
Korea	Dr. Bae, Dong Hwan, Chief, Marine Resource Division, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.	Dr. Bae, Dong Hwan, Chief, Marine Resource Div., Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.	Mr. Shin, Kwang Yun, Chief, Marine Resources Section, Central Fisheries Experiment Station, Seoul, Korea.
Federation of Malaya	Mr. Soong Min Kong, Director of Fisheries, Ministry of Agriculture and Cooperatives, Kuala Lumpur, Malaya.	Mr. D. Pathansali, Fisheries Research Officer, Fisheries Division, Ministry of Agriculture and Cooperatives, Kuala Lumpur, Malaya.	Mr. Soong Min Kong, Director of Fisheries, Ministry of Agriculture and Cooperatives, Kuala Lumpur, Malaya.
Netherlands	Dr. J.J. Schuurman, Fresh and Brackish Water Fisheries Expert, Van Iddekingeweg 56, Groningen, Netherlands.	-	-
Pakistan	Dr. Nazir Ahmad, Director of Fisheries, Government of West Pakistan, Lahore, West Pakistan.	Dr. Nazir Ahmad, Director of Fisheries, Government of West Pakistan, Lahore, West Pakistan.	Mr. S.Q. Mohiuddin, Marine Production Officer, Marine Fisheries Department, Government of Pakistan, Karachi, Pakistan.

<i>Member Government</i>	<i>Technical Committee I</i>	<i>Sub-Committee on Stocks Assessment</i>	<i>Sub-Committee on Fisheries Oceanography</i>
Philippines	Mr. G.J. Blanco, Chief, Inland Fisheries Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.	Mrs. Priscilla Cases-Borja, Ichthyologist, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.	Mr. I.A. Ronquillo, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.
Thailand	Mr. Chertchai Amatayakul, Chief, Division of Inland Fisheries, Department of Fisheries, Rajadamnern Av., Bangkok, Thailand.	Dr. Deb Manasveta, Fisheries Biologist, Department of Fisheries, Rajadamnern Av., Bangkok, Thailand.	Comdr. Swang Chareonphol, R.T.N., Senior Fisheries Officer, Department of Fisheries, Rajadamnern Av., Bangkok, Thailand.
U.K. (for Hong Kong)	Senior Research Officer, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Road, Central, Hong Kong.	-	Mr. J.D. Bromhall, Senior Research Officer, Fisheries Research Station, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Road, Central, Hong Kong.
(for Sarawak)	Chief Secretary, Secretariat, Kuching, Sarawak.	-	-
(for N. Borneo)	-	-	-
U.S.A.	Mr. John C. Marr, Area Director, Bureau of Commercial Fisheries, Fish and Wildlife Service, P.O. Box 3830, Honolulu, Hawaii.	Mr. John C. Marr, Area Director, Bureau of Commercial Fisheries, Fish and Wildlife Service, P.O. Box 3830, Honolulu, Hawaii.	Mr. John C. Marr (Ch.a.i.), Area Director, Bureau of Commercial Fisheries, Fish and Wildlife Service, P.O. Box 3830, Honolulu, Hawaii.
Vietnam	Monsieur Le-van-Dang, Inspecteur des Peches, Chef du Service de Pisciculture, 116 Phandinh-Phung, P.O. Box 340, Saigon, Vietnam.	-	-

IPFC TECHNICAL COMMITTEE II

Member Government	Technical Committee II	Sub-Committee on Craft and Gear	Sub-Committee on Food Technology	Sub-Committee on Socio-Economics and Statistics
Australia	Mr. C.G. Seiter, Director of Fisheries, Department of Primary Industry, Canberra, A.C.T., Australia.	Mr. P.D.A. Lorimer, Technical Adviser, Fisheries Division, Department of Primary Industry, Canberra, A.C.T., Australia.	Dr. J.R. Vickery, Chief, Division of Food Preservation, P.O. Box 43, Ryde, N.S.W., Australia.	Mr. A.G. Bollen, Assistant Director, Fisheries Division, Department of Primary Industry, Canberra, A.C.T., Australia.
Burma	-	-	-	-
Cambodia	-	-	-	Monsieur Sao-Leang, Chef du Cantonnement des Peches du Mekong, Direction du Service des Peches, Phnom-Penh, Cambodge.
Ceylon	Mr. L.F. Tisseverasinghe, Deputy Director, Department of Fisheries, P.O. Box 531, Colombo-3, Ceylon.	Mr. L.F. Tisseverasinghe, Deputy Director, Department of Fisheries, P.O. Box 531, Colombo-3, Ceylon.	Mr. C.E. St. C. Gunasekera, Research Unit, Department of Fisheries, P.O. Box 531, Colombo-3, Ceylon.	Mr. V.L.C. Pietersz, Asst. Director of Fisheries, Department of Fisheries, P.O. Box 531, Colombo-3, Ceylon.
France	Mons. R. Serene, Marine Taxonomy Expert, UNESCO South Asia Science Cooperation, P.O. Box 2313, Djakarta, Indonesia.	-	-	Mons. J. Domard, Veterinaire Inspecteur, Chef du Service de Peches, Pappete, Tahiti (Polynesie Francaise).
India	Dr. C.V. Kulkarni, Director of Fisheries, Maharashtra Govt., Bombay, India.	Mr. K. Chidambaram, Director of Fisheries, Govt. of Gujarat, New Mental Hospital, Annes, Asarwa, Ahmedabad, India.	Dr. A.N. Bose, Director, Central Institute for Fisheries Technology, Ernakulam, India.	Dr. G.N. Mitra, Director of Fisheries, Orissa Govt., Cuttack, India.
Indonesia	Mr. Amiruddin Nasution, Chief, Sea Fisheries Service, 12 Djalain Kerapu, Djakarta-Kota, Indonesia.	Mr. J. Pattinasarany, Chief, Division of Fishing Tech., Sea Fisheries Service, 12 Djalain Kerapu, Djakarta-Kota, Indonesia.	Mr. Soenjoto Darmoredjo, Technologist, Institute for Food Technology, Paser Minggu, Djakarta, Indonesia.	Mr. F.W. Waworontoe, Senior Officer, Sea Fisheries Service, 12 Djalain Kerapu, Djakarta-Kota, Indonesia.
Japan	Mr. T. Nakamura, Chief, Data and Statistics Section, Fisheries Agency, Kasumigaseki, Chiyoda-ku Tokyo, Japan. (<i>Chairman</i> : Socio-Economics and Statistic Sub-Com.)	Mr. S. Takayama, Chief, Fishing Gear and Method Division, Tokai Regional Fisheries Research Laboratory, Tsukishima, Chuo-ku, Tokyo, Japan.	Dr. H. Higashi, Chief, Marine Product Utilization Division, Tokai Regional Fisheries Research Laboratory, Tsukishima, Chuo-ku, Tokyo, Japan.	Mr. N. Oka, Chief, Fisheries Statistics and Survey Division, Ministry of Agriculture and Forestry, Kasumigaseki, Chiyoda-ku, Tokyo, Japan.
Korea	Mr. Lee, Bong Nee (<i>Chairman</i>) Director, Central Fisheries Experiment Station, Yongdo-ku, Pusan, Korea.	Mr. Kim, Keh Oh, Chief, Fishing Division, Central Fisheries Experiment Station, Yongdo-ku, Pusan, Korea.	Mr. Chang, Hee Un (<i>Chairman</i>) Chief, Fish Processing Section, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.	Mr. Ro, Jae Dong, Marine Res. Division, Fisheries Bureau, Ministry of Agriculture and Forestry, Seoul, Korea.

Member Government	Technical Committee II	Sub-Committee on Craft and Gear	Sub-Committee on Food Technology	Sub-Committee on Socio-Economics and Statistics
Federation of Malaya	Mr. V. Selavarajah, Fisheries Research Officer, Fisheries Research Laboratory, Glugor, Penang, Federation of Malaya.	Mr. J. Carralho, Principal Marine Fisheries School, Glugor, Penang, Federation of Malaya.	Mr. V. Selavarajah, Fisheries Research Officer, Fisheries Research Lab., Glugor, Penang, Federation of Malaya.	Inche Abdul Halim Abu Yamin, Fisheries Administrative Officer, Fisheries Research Lab., Glugor, Penang, Federation of Malaya.
Netherlands	-	-	-	-
Pakistan	Dr. A.R.K. Zohairi, Director of Fisheries, Govt. of East Pakistan, Dacca, East Pakistan.	Mr. S.A. Burney, Deputy Director, Marine Fisheries Dept., Karachi, Pakistan.	Mr. S.H. Chowdhury, Technologist, Marine Fisheries Dept. Chittagong, East Pakistan.	Mr. S.A. Jaleel, Deputy Director, Marine Fisheries Dept., Fish Harbour, Karachi-2, Pakistan.
Philippines	Mr. S.B. Rasalan, Chief, Marine Fisheries Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.	Mr. P. Dinglasan, Chief, Section of Technological Services, Marine Fisheries Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.	Mr. S.V. Barsamin, Chief, Section of Technological Research, Fisheries Research Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.	Mr. J.R. Montemayor, Chief, Section of Statistics and Socio-Economics, Fisheries Research Division, Philippine Fisheries Commission, Diliman, Quezon City, Philippines.
Thailand	Mr. Tuanthai Bamraj-Ariapai, Chief, Division of Fisheries Investigation, Department of Fisheries, Rajadamnern Avenue, Bangkok, Thailand. (<i>Chairman: Craft and Gear Sub-Comm.</i>)	Cndr. Swang Charernphol (R.T.N.), Senior Fisheries Officer, Department of Fisheries, Rajadamnern Avenue, Bangkok, Thailand.	M.C. Kosol Suriyathit Suriyong, Senior Technical Fisheries Officer, (Acting) Head, Technology Section, Department of Fisheries, Rajadamnern Avenue, Bangkok, Thailand.	Mr. Padh Tavaranusorn, Senior Fisheries Officer, Department of Fisheries, Rajadamnern Avenue, Bangkok, Thailand.
U.K. (for Hong Kong)	Fisheries Officer, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.	Fisheries Officer, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.	Marketing Officer, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.	Marketing Officer, c/o Co-operative Development and Fisheries Department, Li Po Chun Chambers, 11th Floor, Connaught Rd., Central, Hong Kong.
(for Sarawak)	Chief Secretary, Secretariat, Kuching, Sarawak.	Chief Secretary, Secretariat, Kuching, Sarawak.	Chief Secretary, Secretariat, Kuching, Sarawak.	Chief Secretary, Secretariat, Kuching, Sarawak.
(for N. Borneo)	-	-	-	-
U.S.A.	Mr. H.E. Crowther, Assistant Director, Bureau of Commercial Fisheries, Fish and Wildlife Service, U.S. Department of Interior, Washington 25, D.C., U.S.A.	-	-	-
Vietnam	Dr. Ngo-ba-Thanh, Directeur, Direction des Peches, P.O. Box 340, Saigon, Vietnam.	M. Ha-khac-Chu, Chef du Bureau Technique, P.O. Box 340, Saigon, Vietnam.	Dr. Ngo-ba-Thanh, Directeur, Direction des Peches, P.O. Box 340, Saigon, Vietnam.	Mr. Nguyen-van-Tich, Chef du Bureau Socio-Economique, Direction des Peches, P.O. Box 340, Saigon, Vietnam.

APPENDIX III LIST OF DOCUMENTS

INCIDENTAL PAPERS:

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	5	IPFC Nominations for the period between 10th and 11th Sessions.
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	6	Chung Pyung Fish Hatchery and Cheill Fish Net Plant Inspection Tour.
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	8	Sight-seeing Tour—Seoul City.
	9	Programme of Opening Ceremony, Oct. 16, 1962.
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	17	A proposal concerning the Council's subsidiary bodies.
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	18	Draft Resolution submitted by Delegate for USA.
	18A.	Order of the Day, Friday, Oct. 19.
	19	Draft Resolution prepared by Technical Committee I.
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WORKING PAPERS:

IPFC/C62/WP	1	Provisional Agenda—10th Session of the IPFC.
	1 Fr.	" " " " " " (in French)
	1 Rev. 1	" " " " " "
	1 Rev. 1 (Fr.)	" " " " " " (in French)
	1 Rev. 2	Agenda.
	2	Report of the Executive Committee.
	3	Report of Technical Committee I (Hydrology and Biology) IPFC, Inter-sessional period, 1961-62.
	4	Report on the Inter-sessional Activities (1961-1962), of Technical Committee II (Technology), to the 10th Session of IPFC.
	5	Technical Committee II—Some notes on the election of office bearers of Technical Committee II.
	6	Technical Committee II—Provisional Agenda.
	7	Council Procedure.

- IPFC/C62/WP 8 Marketing of dried and salted fish in the Indo-Pacific Region. Progress Report presented by the Chairman, Technical Committee II, IPFC.
- 9 Ice plants, cold storage and freezing facilities in the Indo-Pacific Region. (Draft). Presented by the Chairman, Technical Committee II, IPFC.
- 10 Report from the Chairman of Technical Committee II, IPFC, on the recent developments in the field of socio-economics, statistics and marketing.
- 11 Check list of Activities of Fishery Cooperatives (Revised Draft).
- 12 Second World Fishing Gear Congress, 1963.
- 13 Extract from the Report on the FAO 6th Regional Conference for Asia and the Far East.
- 14 Resolutions approved by the World Scientific Meeting on the Biology of Tunas and related species, La Jolla, California, USA. 2-14 July, 1962.
- 15 Technical Committee II (Technology). Some notes on the work of the Working Party.
- 15 (Add. 1) Technical Committee II. Technical Papers concerning socio-economics, statistics and fish marketing.
- 16 Technical Committee I—Provisional Agenda.
- 17 Recommendations and Conclusions with respect to socio-economics, statistics and fish marketing—9th Session IPFC, Karachi, 1961.
- 18 Notes on Topics (Craft, Gear & Processing) for discussion by Technical Committee II.
- 19 Technical Committee II—Elections.
- 20 Report of the Expert Meeting on Fishery Statistics in the N. Atlantic Area, 22-29 Sept. 1959, Edinburgh, Scotland.
- 21 Background Papers for discussion at Technical Committee II, Panel C and Fish-Marketing Sub-Committee.
- 22 Resolution—(Technical Instruction)
- 22 (Rev. 1) Resolution—(Technical Instruction)
- 23 Program of Work for Technical Committee II.
- IPFC/C62/WP 24* Technical Committee I.
(Draft) Survey of National Activities in the field of responsibility of Technical Committee I, in the Indo-Pacific Region in the period 1961-62, compiled from reports from Member Governments and FAO.
- 24 (Rev. 1) Ditto revised.
- 25 Topics of discussions Panel C. Technical Committee II and Fish-Marketing Sub-Committee.
- 26 Technical Committee II. Report of the editorial working group.
- 27 IOC Resolution No. 15 on the Cooperative study of the Kuroshio and adjacent regions.
- 28 Report on the response during the Inter-sessional period, 1961-62, to the recommendations made by the 9th Session of IPFC having reference to the work of Technical Committee I or to subjects within its field. Submitted by Technical Committee I (Hydrology and Biology) IPFC.
- 29 A note on International Oceanographic Commission.
- 30 Outline—10th Sessional Report of Technical Committee I.
- 31 Revised outline for country reports (on Work Programme) to Technical Committee I, IPFC.
- 32 Subsidiary bodies of the Council.
- 33 Oceanography in relation to fishery biology. A note by John C. Marr.
- 34 Editorial Report of Technical Committee II.
- 35 Technical Committee II, 11th Session Symposium.

* Limited distribution.

TECHNICAL PAPERS: Note: Where Abstracts and/or Summaries have been provided these have been embodied in the paper.

		Subject	
IPFC/C62/TECH	1	A preliminary report on the combination of Plachon (<i>Ophicephalus striatus</i> Bloch) and Tilapia (<i>Tilapia mossambica</i> Peters) in Thailand by S. Tongsanga	Fish culture
	2	The use of seaweeds directly as human food in the Indo-Pacific Region by G.N. Subba Rao	Food Technology
	3	Boiled fish in South-east Asia and the Far East Edited by Technical Secretary, IPFC Technical Committee II	Food Technology
	4	Morphological differences among the fry of the three species of catfish, <i>Pangasius sutchi</i> , <i>Pangasius larnaudii</i> and <i>Pangasius micronemus</i> by U. Pongsuwana and V. Varikul	Biology
	5	Induced spawning in catfish (<i>Clarias macrocephalus</i> Gunther) by pituitary hormone injection by S. Tongsanga, A. Sidhimunka and D. Menasveta	Fish Culture
	6	Pearl Culture in Japan by M. Tange	Fish Culture
	7	Sources of credit for the fishing industry in Hong Kong by D.M.I. Thomas	Socio-economics
	8	Recent advance of population dynamics of the Japanese anchovy, <i>Engraulis japonica</i> (Houttuyn) by S. Hayashi	Biology
	9	Monosex culture of <i>Tilapia mossambica</i> in Ponds at Man Hing Farm, Keningau District, North Borneo by Chin, Phui Kong	Fish Culture
	10	Containers used for transport of fresh fish in the Indo-Pacific Region edited by Technical Secretary, IPFC Technical Committee II	Food Technology
	11	Observations on the biology and fishery of the Hilsa, <i>Hilsa ilisha</i> (Hamilton) of River Godavari by S.R. Pillay and K.V. Rao	Biology
	12	Preliminary report on the tagging of Hilsa, <i>Hilsa ilisha</i> (Hamilton) by S.R. Pillay, K.V. Rao and P.K. Mathur	Biology
	13	A comparative study of the populations of the Hilsa, <i>Hilsa ilisha</i> (Hamilton) in Indian waters by T.V.R. Pillay, S.R. Pillay and K.K. Ghosh	Biology
	14	The method and technique of using anhydrous ammonia for aquatic weed control by V. Ramachandran	Fish Culture
	15	Preliminary experiments on the relative manurial values of some aquatic weeds as composts by S.B. Singh	Biology
	16	Induced spawning of the Chinese Grass carp, <i>Ctenopharyngodon idellus</i> (C. & V.) and the silver carp, <i>Hypophthalmichthys molitrix</i> (C. & V.) in ponds at Cuttack, India by K.H. Alikunhi, K.K. Sukumaran and S. Parameswaran	Fish Culture
	17	Preliminary experiments and various field applications of fish pumps by S. Kawata	Fishing Gear

		Subject	
IPFC/C62/TECH	18	Neglected aspects of fish culture by G.A. Prowse	Fish Culture
	19	Storage characteristics of prawns held in crushed ice and chilled sea water by M.R. Nayar, K.M. Iyer, P.N. Appukuttan and S. Jacob	Food Technology
	20	Improvement in quality and storage life of pickled fish by means of Propionic acid by S.V.S. Rao and A.P. Valsan	Food Technology
	21	Some observations on the nitrogenous losses in the wet reduction processes by P.V. Kamasastri and D.R. Rao	Food Technology
	22	Investigations on dehydration of some commercial fish in India . . . by P.V. Prabhu, M. Swaminathan, R. Venkataraman and A.N. Bose	Food Technology
	23	Studies on Frozen Storage of Prawns by (Miss) A. Lekshmi, T.K. Govindan, (Miss) A. Mathew and V.K. Pillai	Food Technology
	24	Design and operation of the so-called "Thangu-Vala", a single boat seine by G.K. Kuriyan, V.C. George and T.R. Menon	Fishing Gear
	25	Design and operation of "Kollachi vala", a two boat seine for Gar fishes by S.D. Deshpande and V.C. George	Fishing Gear
	26	An account of 'Dara' (<i>Polydactylus indicus</i> Shaw) Fisheries of the Bombay Coast with particular reference to the fishing method by bottom-drift nets by S.D. Deshpande	Fishing Gear
	27	Certain methods of preservation of cotton fishing net twines by G.K. Kuriyan and S.G. Nayar	Fishing Gear
	28	Commercial prawn trawling gear of Cochin (India) by A.V.V. Satyanarayana, G.K. Kuriyan and R.S. Nair	Fishing Gear
	29	Recent Development in trawl-fishing for shrimps from small mecha- nised boats on the West Coast of Peninsular India by H. Miyamoto, S.D. Deshpande and N.A. George	Fishing Gear
	30	Fisheries Credit by P. Tavaranusorn	Socio-economics
	31	Fisheries Cooperatives in Thailand by P. Tavaranusorn	Socio-economics
	32	Planning for fisheries development and fisheries administration . . . by P. Tavaranusorn	Socio-economics
	33	Fisheries statistics in Thailand by S. Suwananonta	Statistics
	34	Progress of rice field fish culture in Thailand by U. Pongsuwana	Fish Culture
	35	Effect of storage on the keeping quality of fish scrap meals by S.V. Bersamin and L.G. Salcedo	Food Technology
	36	Preliminary studies on the methods of extraction and determination of Vitamin A content of liver oils of common Philippine market fishes by S.V. Bersamin, L.G. Salcedo and G. Guevara	Food Technology

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IPFC/C62/TECH	37	Studies on the effect of calamansi (<i>Citrus mitis</i>) juice on the preservation of suae or shrimps (Genus <i>Penaeus</i>) by S.V. Bersamin, A.S. Legaspi and N.G. Macalincag	Food Technology
	38	Model experiment of the trawler "Yamato-maru" in the regular waves by Cheung Hun Kim	Fishing Craft
	39	Proposed Steel Construction of Stow netter by Zae Geun Kim	Fishing Craft
	40	Information on prawns from Indian waters—Synopsis of biological data by Central Inland Fisheries Institute, Barrackpore, India (Editor—B.S. Bhimachar)	Biology
	41	Chilling of fish in Thailand by M.C. Kosol Suriyathit Suriyong, P. Nitayachin and G.N. Subba Rao	Food Technology
	42	Fishery Co-operative of Gujarat by K. Chidambaram	Socio-economics
	43	Fish marketing in Gujarat by K. Chidambaram	Socio-economics
	44	Major shellfish culture, (excluding oysters) in Korea by Kim, Kyun Hyun	Fish Culture
	45	Production of oysters in Korea by Kim, Kyun Hyun	Fish Culture
	46	Notes on the plankton and its collection in the seas adjacent to Korea by Hue, Jong Soo	Biology
	47	A summary report on some major marine fisheries resources of Korea by Bae, Dong Hwan	Biology
	48	Present status of fish culture in Korea by Han, Hack Soo	Fish Culture
	49	Government financial assistance schemes for fishery industry by Ro, Jai Dong	Socio-economics
	50	Mechanisation of fishing in Andhra Pradesh by S.N. Rao and V.S. Devara	Fishing Craft
	51	Preliminary survey of marine plankton found in the Gulf of Thailand by A. Lursinsap	Biology
	52	Report on tagging experiments of chub-mackerel (<i>Rastrelliger neglectus</i>) in the Gulf of Thailand, 1961 by C. Chirastit	Biology
	53	Preliminary results of fish egg industry in the Gulf of Thailand . . by U. Boonprakob	Biology
	54	The elevation of a swampland based on the tidal datum and the importance in selecting sites for chanos fish ponds projects by H.R. Rabanal	Fish Culture
	55	Studies concerning fish and use of rubber-tyre fish containers by Jai Dong Ro	Food Technology
	56	Progress of mechanization of fishing boats in West Pakistan	Fishing Gear
	57	Studies on the Rearing of larvae and juveniles and culturing of adults of <i>Macrobrachium rosenbergi</i> (de Man) by S.W. Ling	Fish Culture

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IPFC/C62/TECH	58	A note on the pond-culture of <i>Puntius javanicus</i> Blkr in the Federation of Malaya by M.K. Soong
	59	Culture of Kuruma-shrimp (<i>Penaeus japonicus</i>) by M. Fujinaga
SYMPOSIUM: Subject: Development of mechanized fishing fleets in the IPFC Region.		
IPFC/C62/SYM	1	Prospectus IPFC 10th Session Symposium. Development of mechanized fishing fleets in the IPFC Region.
	2	Development of mechanized fishing fleets in the Indo-Pacific Fisheries Council Region. by K. Chidambaram.
	3	Engine beds for small fishing boats. by E. Estlander.
	4	Maintenance of small marine engines. by E. Kvaran.
	5	Selection of marine engines under 50 H.P. by E. Kvaran.
	6	Development of mechanized fishing fleets in the Indo-Pacific Region. The mechanization of existing wind-driven boats in Hong Kong. by W.D. Orchard.
	7	The development of mechanized fishing in Mysore. by Department of Fisheries, Mysore State, India.
	8	Korean stow netters and their mechanization. by Keuck Chun Kim and Kwang Won Kwon.
	9	Model test of Korean stow netter. by Zae Geun Kim.
	10	Propeller selection for small fishing vessels. by R.L. Roy Choudhury.
	11	Development of mechanized fishing boats. by P. Gurtner.
	12	Mechanization of Fishing fleets in Japan. by S. Takayama.
	13	Summary Report on Symposium.

CONTRIBUTED PUBLICATIONS: *Note:* The following publications have been made available to the Council in limited supply. These have been distributed as widely as possible. When numbers of copies have been small, distribution has been limited to heads of delegations only.

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- 8 FAO Catalogue of Fisheries Publication and Documents. (FID/C) 1962, 48 pp.
- 9 A developing aquatic sciences information retrieval system. by J.O. Conner and S.B. Salla. Reprint, Trans. Amer. Fish. Soc., 91(2) 151-154.
- 10 The fresh-water fishes of North Borneo by R.F. Inger and Chin Phui Kong. Chicago Nat. Hist. Mus. Fieldiana: Zool., 45, 1962, 268 pp; 120 Figs.
- 11 Report on FAO/EPTA Regional Training Centre in Fish Processing Technology (Provisional edition), Quezon City, Philippines. 6 March-14 April, 1961. FAO Fish. Rept. No. 4 (Flt/R4), 376 pp.
- 12 Experimental trawl fishing in the Gulf of Thailand and its results regarding the possibilities of trawl fisheries development in Thailand by K. Tiews. Veröffentlichungen des Instituts für Küsten-und Binnenfishcherei, No. 25, 1962, Hamburg. 83 pp.
- 13 Investigation of the decomposition of organic matter in natural waters, by R. Krause. FAO Fish. Biol. Rept 34, 1962. 14 pp. 6 Figs.
- 14 List of marine institutions in the tropics (30°N to 30°S)—FAO Fish. Biol. Tech. Paper 20, 1962, 9 pp.
- 15 The effects of current eddies on the distribution of plaice eggs by T. Laevastu. FAO Fish. Biol. Tech. Paper 21, 1962, 4 pp. 10 Figs.
- 16 Fisheries Oceanography by D.H. Cushing. FAO Fish. Biol. Tech. Paper 24, 1962, 11 pp.
- 17 The influence of temperature on the behaviour of fish by I. Hela and T. Laevastu. FAO Fish. Biol. Tech. Paper 22, 1962, 103 pp.
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- 25 Abstract of Statistics on Japanese Fisheries. Fish Agency, Tokyo, 11 pp.
- 26 Recent Fisheries Statistical Surveys of Japan. Fish. Agency, Tokyo, 10 pp.
- 27 Annual Report for fishery products inspections, 1961 Central Fish. Inspect. Station, Ministry of Agriculture and Forestry, Seoul, 144 pp.
- 28 Fisheries Statistics, 1961. Bureau of Fisheries, Seoul, 305 pp.
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Tuna Behaviour

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IPFC/C62/M

1. Minutes of the Opening Ceremony & first Plenary Meeting.
2. Minutes of the First Meeting, Technical Committee I.
3. Minutes of the Second Meeting, Technical Committee I.
4. Minutes of the Second Plenary Session.
5. Minutes—Second & Third Sessions of Technical Committee II.
6. Minutes of the Third Plenary Meeting.
7. Minutes of the Special Plenary Session.
8. Minutes of Third Meeting, Technical Committee I.

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9. Minutes of the 3rd & 4th Meetings of Technical Committee II.
 10. Minutes of the Fourth Plenary Meeting.
 11. Minutes of the Fourth Meeting, Technical Committee I.
 12. Minutes of the Fifth & Sixth Meeting, Technical Committee II.
 13. Minutes of the Sixth Meeting, Technical Committee I.
 14. Minutes of the Fifth Plenary Meeting.
 15. Minutes of the Seventh Meeting, Technical Committee II.
 16. Minutes of the Seventh Meeting, Technical Committee I.
 17. Minutes of the Fifth Meeting, Technical Committee I.
 18. Minutes of the Eighth Meeting, Technical Committee II. Panel C.
 19. Minutes of the Sixth Plenary Meeting.
 20. Minutes of the Eighth Meeting, Technical Committee I.
 21. Minutes of the Ninth & Tenth Meetings of Technical Committee II.
 22. Minutes of the Seventh Plenary Session.
 23. Minutes of the Twelfth Meeting of Technical Committee II.
 24. Minutes of the Tenth Meeting of Technical Committee II.
 25. Minutes of the Ninth Meeting, Technical Committee I.
 26. Minutes of the Eighth Plenary Meeting.
 27. Minutes of the 13th & 14th Meetings, Technical Committee II.
 28. Minutes of the 10th Meeting--Technical Committee I.
 29. Minutes of the 11th Meeting--Technical Committee I.
 30. Minutes of the Tenth Plenary Session.
 31. Minutes of the Ninth Plenary Session.
 32. Minutes of the Eleventh Plenary Session.
 33. Minutes of the Twelfth Plenary Session.
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