BOBP/REP/82

REPORT OF THE REGIONAL WORKSHOP ON THE PRECAUTIONARY APPROACH TO FISHERIES MANAGEMENT

25-28 February, 1997
Medan, Indonesia

BOBP For Fisheries Management
BAY OF BENGAL PROGRAMME

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1999

PREFACE

This document reports on the proceedings and decisions of a four-day regional workshop on the "Precautionary Approach to Fishery Management" (referred to in the text as PA2FM), held from 25 February to 28 February, 1997, in Medan, North Sumatra, Indonesia. It was organized by the Directorate-General of Fisheries, Indonesia, and supported by the FAO and the Bay of Bengal Programme (BOBP).

The workshop was meant to clarify and discuss the implications of PA2FM and show how such an approach to management enables sustainable development of fisheries resources in BOBP member-countries and beyond. The workshop was expected to endow participants with practical skills and knowledge on PA2FM methods. The workshop was attended by 18 representatives from member-countries of the BOBP, and seven resource persons from within and outside the region.

The BOBP is a multi-agency regional fisheries programme which covers seven countries around the Bay of Bengal – Bangladesh, India, Indonesia. Malaysia, Maldives, Sri Lanka, Thailand. The Programme plays a catalytic and consultative role in developing coastal fisheries management in the Bay of Bengal to improve the conditions of small-scale fisherfolk in member- countries.

The BOBP is sponsored by the governments of Denmark and Japan. The executing agency is the FAO.

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CONTENTS

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1. WORKSHOP SUMMARY

(Reproduced from Buy of Bengal News, March 1997)

Some 25 experts from member-countries and the FAO took part in a Regional Workshop on the Precautionary Approach to Fisheries Management in Medan, Indonesia, held 25-28 February 1997. Here's a report on what the workshop discussed and decided

Don't wait for evidence ofoverfishing to promote fisheries management. Initiate management measures right away, even in the absence of documented evidence! That in sum is what the precautionary approach to fisheries management is all about.

The Medan Workshop on the Precautionary Approach to Fisheries Management was inaugurated by the Governor of North Sumatra Province. Speakers at the inaugural session included the Governor; the FAO Representative in Indonesia; Ms Ennie Soetopo of the Director-General of Fisheries; and Dr Kee-Chai Chong, BOBP's Programme Coordinator. An illuminating keynote address by Dr Serge Garcia of FAO was the highlight of the inaugural session.

Sessions that followed featured country presentations on fisheries management by representatives of the member countries, plus lively presentations by resource persons. Participants discussed many aspects of artisanal, commercial and industrial fisheries in the context of the precautionary approach to fisheries management.

The discussion made it clear that management arrangements for many of the region's fisheries are inadequate. Further, several coastal fisheries had in the past operated under traditional management systems. These had suffered decline and were no longer visible, but new arrangements had not been put in place. New fisheries management regimes effectively using the precautionary approach need to be formulated.

The point was made that better fisheries management is not synonymous with precautionary fisheries management. Management can be improved without following the precautionary approach.

There was some discussion on the basic question: *" What qualifies a fisheries management strategy, as precautionary?"* Participants agreed that at least some of the following characteristics should be present in a precautionary strategy:

- limited fishing access and allocation of user rights;
- production targets set lower than the maximum sustainable yield;
- formal fisheries management plans that include pre-arranged management responses to the achievement of targets or the surpassing of catch limits in the fishery;
- carrying out pilot projects or step-wise development rather than rapid, massive expansion;
- institution of adequate fishery research and monitoring systems, and feedback of data from these systems into the management process;
- learning from development mistakes of the past; learning from other countries.

Three working groups were formed to discuss these issues and in particular:

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- how best to promote the precautionary approach;
- operationalisation of fisheries management;
- implications of the precautionary approach for small-scale fisheries.

The consensus of opinion among the three groups is summed up under three heads in what follows

Promoting the precautionary approach

Q. *Who takes decisions on precautionary management ?*

A: Government, whether Central, Regional or Provincial, is the main decision-maker.

Q: *What triggers the decision-making process ?*

A: The process is generally triggered by a Parliamentary initiative which in turn may be promoted by parliamentarians, fisheries associations, NGOs, fishery consultative committees, or day-to-day interaction between administrators and the fisherfolk community.

Q. *How do you introduce PA2FM? How do you convince decision-makers about the need for it? How can fishermen also be convinced?*

A: Some suggestions:

- Improve the information available and submitted to policy-makers;
- Use all opportunities of contact with management authorities to promote PA2FM. Examples: fisheries or resource crisis, rehabilitation projects, development planning etc.
- Use the media to advertise and publicise issues and reach parliamentarians.
- Promote longer-term concerns among fishery sector operators. Example: introduce fishing rights and allocations. This promotes secure access to resources. Long-term licensing is an option for industrial fisheries. These rights could be recognised by purely legal means (e.g. statutory local reef ownership) or by a system of paying nominal user fees for the right to fish. This would instill among fishers some feeling for the value of their ownership rights and make them defend of stand up for such rights.
- Where resources are depleted and coastal conflicts occur, community projects could seek to introduce PA2FM by

(a) devices such as artificial reefs to keep large-scale fishing out;

(b) organising local enforcement;

(c) strengthening local community organizations;

(d) integrating community support toward clean water supplies, alternative job creation etc. Such projects could create a climate receptive to PA2FM. Introducing such an approach before resources are degraded would be precautionary. A cap on fishery capacity should also be established.

Q: *What kind of information is required to convince decision-makers?*

A: Research concerning promotion of PA2FM is insufficient at present. Such research should address not only biological topics but also economics and social sciences. It should not only assess fisheries resources, deal with risk assessment and look at management options, but should also produce relevant and timely forecasts. The information produced should be systematically supplied to decision-makers and industry.

Systematic development ofmanagement plans will help institutionalise the information process. Such management plans should preferably be organized by area or by species groups, particularly for multi-species fisheries.

In the case of shared and trans-boundary stocks, problems and solutions are similar. But the Government then has an even more important role than it has with natural resources.

Q. *What are the analytical tools needed to generate the needed information?*

A: The role of fisheries models including bio- and socio-economic parameters, dealing with micro- and macro-economics, is important. The results generated by these models should be conveyed in a simple and effective way to decision-makers.

lnstitutionalising Fisheries Management

Q: Could you cite rome successful fisheries management initiatives in your countries?

A: Three major areas have been identified for these initiatives:

- Banning non-eco-friendly fishing gears and methods;
- Strengthening legal frameworks to support management needs;
- Sound communication systems between government and the fishing communities.

Q: Are there innovative easy-to-implement management methods?

A: Difficulties in the way of management were identified.

- Political decisions inconsistent with technical advice;
- conflicts between large-scale and small-scale sectors;
- a lack of awareness on the need for resource management;
- non-compliance by fishers with fisheries laws and regulations;
- inadequate enforcement of laws;
- conflicting development / management objectives within Government;
- inadequate Government structures for management;
- inadequate legal instruments or frameworks to allow management;
- lack of credible information from statistical services;
- inadequate international co-operation to deal with trans-boundary problems.

Q. *Who manages fisheries? Who identifies the need for management?*

A: Government fisheries departments.

Q. *Who develops fisheries management policy?*

A: Fisheries departments with occasional external inputs.

Q. *How is the policy converted into laws, rules and regulations and by whom?*

A: Policies are given to legal drafting systems (Attorney General's Dept.) who convert departmental requirements into legal language. Laws have to be passed by government. Ministers and departments implement the regulations passed.

Q. *How are fishers and other stakeholders made aware of the needs, benefits and methods of fisheries management?*

A: Fisheries Department extension services are usually responsible for this. The approach followed is still top-down. Public awareness campaigns are launched, using media considered appropriate. It includes printed literature, comics, posters, radio. TV, video etc.

Q: *How are stakeholders involved in the process of fisheries management?*

A: Most answers reflected the top-down nature of fisheries management in the region. Stakeholder involvement is in broad terms minimal. But there have been instances of particular groups playing a part.

Newer fisheries (less established) tend to have greater stakeholder involvement in their development and management.

Q. *Could you recommend changes in the process of institutionalising of fisheries management?*

A: The group suggested that action was needed in the following areas:

* Public education and awareness – a multi-media campaign to alert the entire public (not just fisheries) to the value of marine resources and the way in which they are being misused or could be better used;

* Cost/benefit analysis of what might happen if no action is taken, and the management system is allowed to drift;

* The subject of traditional user rights generated heated discussion. Opinions varied. But the need was recognized to formalize traditional user rights, either by purely legal means (statutory local reef ownership) or by token or nominal payment for the right to fish.

Implications of PA2FM for Small-Scale Fisheries

A fishery can be broadly understood as small-scale if it has a reasonable number of the following characteristics:

- fishers have a good understanding of their ecosystem
- occupation is ecosystem-based

- simple technology
- low capital investment
- high skill intensity
- low occupational mobility
- multi-species/multi-gear fisheries
- highly seasonal occupation
- linked to agricultural and other coastal occupations
- dispersed habitats
- household level of activity
- owner/operators and labourers in others' boats
- near-shore fishing
- traditional fishers for several generations and recent arrivals

The technologies that small-scale fisheries have evolved over time would tend to be management-oriented because they are tuned to the local ecosystem; they are simple, with relatively low efficiency; they would be eco-friendly, because they have existed for generations without destroying the system. Thus small-scale fisheries are already in a way practising PA2FM, and should therefore be open to the idea.

Q: *Is there sufficient justification for promoting PA2FM among small-scale fisheries ?*

A: Small-scale fisheries are increasingly under stress and are displaying symptoms of stock stress, even depletion. There is reason from a resource management point of view to promote PA2FM.

More importantly, PA2FM is a subset of the Code ofconduct for Responsible Fisheries (CCRF) which all countries in the region have adopted. This code requires that we concern ourselves not only with the resources but also with people who work the resource. A section of the code obliges us to protect the artisanal sector.

Given the crowded nature of coastal areas and the intensity of small-scale fisheries in the region. the only real management option seems to be to reduce fishing effort. Whose effort needs to be reduced – small-scale, large-scale or both? Applying the principles of equity, fairness and right to livelihood, governments should require large-scale tisheries to move further off-shore – or even get out of fisheries and switch to non-fishery investment options.

But merely reducing the effort in the large-scale tisheries adjacent to the small-scale sector would not solve all problems. There would still be a need to promote PA2FM in the small-scale sector.

Given the scattered and dispersed nature ofsmall-scale fisheries and the difficulties ofenforcing management, the only feasible option would be to involve stakeholders in small-scale fisheries directly in decision making, monitoring, implementation and enforcement of management measures. This would require devolution of powers. But stakeholders, including government, should clearly decide what powers should be devolved and then spell out the rights and responsibilities of stakeholders.

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Coastal areas are often treated like extended garbage bins, with everything finally finding its way to the coast. Given the dependence of fishers on the coastal ecosystem, they ought to have a say in coastal zone development and management.

Integrated coastal area management (ICAM) measures need to be introduced in a precautionary way. Small-scale fisheries too could use the precautionary approach to demand a key role in ICAM for fisheries and fishers.

Some Ideas on Follow-up Action Concerning PA2FM

The workshop identified follow-up actions concerning PA2FM for each country. They are as follows:

Bangladesh

- National-level studies and research, possibly with international donor support, to make management of certain fisheries more precautionary;
- Awareness-building workshops with stakeholders, assisted by BOBP.
- Greater effort to involve the private sector, especially the many high-calibre NGOs of Bangladesh, in fishery management efforts;

  Briefings for ministers and policy-makers on the need for fisheries management, and the benefits and means of the precautionary approach.

Indonesia

- Better coordination **among** the various Government departments involved in fisheries management, or whose activities have an impact on fisheries;
- More effort to manage fisheries on the basis of economic and social factors rather than simple production targets such as maximum sustainable yield.

India

- Communicate the idea of precaution in fishery management to State Governments and other Government departments;
- Further study the relationship between newly-mechanised and traditional fisheries in order to develop better means of conflict resolution through improved management;
- Introduce management arrangements in all fishery-related sectors, particularly inland fisheries, that are seriously impacted by irrigation, power generation and other schemes that divert water courses.

Thailand

- Make greater use of public hearings and other forms of consultation to develop and manage fisheries;
- Revise fishery regulations and laws with a view to incorporating more precautionary aspects;

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- Reduce fishing effort in coastal areas by confining larger vessels to offshore zones, or through vessel buy-back schemes;
- Use inter-departmental committees to promote more responsible attitudes in other sectors that impact fisheries;
- Incorporate the precautionary approach into rehabilitation programmes for damaged fisheries.

Sri Lanka

- Take advantage of new enlightened attitudes and policies throughout Government to introduce the precautionary approach into general thinking;

  Make better use of new environmental laws to mitigate damage to habitats by development projects in the coastal zone;
- Introduce precautionary ideas among youth associations in order to raise awareness of responsible fisheries use among them, and influence the thinking of older generations.

Maldives

- Incorporate precautionary concepts into manpower training activities;

  Conduct surveys and pilot projects in support of fisheries development;

  Promote inter-sectoral cooperation;

  Improve data collection systems. Strictly enforce provisions by which fishing vessels provide catch data.
- Promote the concept of a broad stock assessment programme to look at the resources of the Indian Ocean, with emphasis on shared resources.

Malaysia

- Conduct seminars to explain the precautionary approach to fisheries extension staff and State Governments. BOBP assistance is required.
- Develop marine education kits for school children;

  Discuss the idea of strengthening regional cooperation in this area by incorporating a strong precautionary thrust into a possible next phase of the Bay of Bengal Programme.

– S. R. Madhu.

2. WORKSHOP PROSPECTUS

Workshop Rationale

Unmanaged fisheries exploitation cannot continue unchecked if fisheries are to be protected for future generations of fisherfolk. Of the 200 fisheries monitored by the FAO's Department of Fisheries, a third has been overfished or depleted. The overfishing problem was first highlighted in developed countries: It spread during the 1960s - 1980s to many of the world's oceans. The problem also plagues the seas of developing countries where no entry restrictions are in force, where development objectives are not explicitly related to resource potential and sustainability, and where deficiencies in production statistics make accurate monitoring of stocks difficult.

In most countries, no serious attempt has been made to contain fishing effort and fish processing capacity. In addition, demand for fish continues to rise because of population increases and improved standards of living. By the year 2010, there will be a demand-supply shortfall of at least 30 million tons. The promise of aquaculture in supplementing this supply is uncertain. Environmental problems, technology and limits ofcarryingcapacity require that aquaculture be managed sustainably. The gap between supply and demand will continue to drive prices up and aggravate the pressures on resources. In all recent international fora on fisheries, countries have agreed that overfishing should be avoided and corrected when it occurs. But they recognize that there are definite constraints to improving fisheries management under the present fisheries exploitation and management regimes.

Countries have also recognized that fisheries management cannot take place in a vacuum. It has to have the active support and commitment of the people, especially the fishing communities and other stakeholders – those who need fisheries for their survival as well as those who have capital and wield political clout.

The Precautionary Approach to Fisheries Management (PA2FM) requires that fisheries should and must be managed, no matter how much information is available. It seeks to compensate for lack of information by associating people more forcefully in the decision-making process. It also recognises that the status quo is not an acceptable option. It is indeed the status quo that has resulted in the present overfishing. Nor should one wait for evidence of overfishing to initiate management. To put it in another way, the status quo calls for management only in the event of demonstrated overfishing; PA2FM urges fisheries management right now, even in the absence of documented evidence of overfishing.

Governments in the Bay of Bengal region are addressing the problem of overfishing, if not as satisfactorily, at least for inshore fisheries. The "precautionary approach" may apply primarily to offshore resources -where several fishery administrations believe that significant under-exploited resource potential exists, and consequently promote new investment.

It may be even more important to apply the precautionary approach to protection of the fishery habitat and access to responsible fisheries technologies.

People's Participation Needed

Poverty and deprivation among small-scale fishing communities in the coastal zone are as bad as ever. In fact, their circumstances are worsening in spite of four decades ofdevelopment intervention. People's

participation in decision- making and implementation is recommended for improved management for at least two reasons: 1) Management will be implemented better and have a better chance of success, with "people's participation". 2) The Workshop is about the "precautionary approach": It is likely that people concerned with fisheries will think "precautionally" – they would want to conserve resources and opportunities for their children and grandchildren.

It is hoped that the Workshop helps to improve the capacity of participants to address ways and means to meet basic necessities of the fishing community for a decent standard of living, while considering explicitly the realism of the assumptions made above. The maintenance of a civil society, community stability, and law and order depends on a just or equitable distribution of benefits of development from a growing economy, within the present generation (intra-generational equity) and between generations (inter-generational equity). The Workshop should help clarify these concepts and, hopefully, translate them into operational guidelines. It is significant that small-scale fishermen, interviewed over time, seem averse to their children following in their footsteps; they are trying their best to educate their children to enable them to leave the fisheries.

Purpose

The purpose of the Workshop is to clarify and discuss the implications of the PA2FM and show how such an approach to management, and to sustainable development of the fisheries resources in BOBP member countries and beyond, will work. It is expected that the familiarization made possible during the Workshop will endow the participants with practical skills and knowledge on the methods of PA2FM.

Orientation and Procedures

Country papers will highlight and review each country's experiences, and lessons learned from their past, and ongoing programmes in fisheries management. The papers will in particular identify the sources of uncertainty about the fisheries and their potential impact. They will match the characteristics of the present management systems about the fisheries with the guidelines on PA2FM prepared by FAO, the Government of sweden and other international bodies. Their presentations will also deal with the levels ofawareness of their fishing communities about fisheries management, including their trust or confidence in governments' managdment effort.

Before arriving for the Workshop, participants would have already worked through the series of questions 'sent out to them by the Workshop organisers.

On the basis of equal time for presentation and discussions, the Workshop will introduce, clarify and deliberate on the Precautionary Approach to Fisheries Management during the first two days. Emphasis will be given to drawing out the short-and long-term implications of the PA2FM and the ensuing dilemma between current and deferred/delayed production and consumption. Can the interests of the present and future generations be balanced and harmonized? The use of discount rates in resource development investments that harm or promote sustainability will also be highlighted.

The&third day is open for Workshop participants to discuss the practical implications of PA2FM in the context of each individual country's fisheries situation. How can the PA 2FM be adapted to each country? Various scenarios will be presented of the likely fisherfolk population, ranging from growth to decline.

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On the fourth day, participants will be given opportunities to present their views on their government's interests and commitment to implement PAZFM in their respective country and how it can be applied to ongoing projects. Participants are requested to bring case studies to the Workshop.

Participants will analyse the operational implications of PAZFM, and difficulties in implementing it, and how the fisherfolk community will respond to the more rigorous participatory management initiatives they will introduce. Other participants will be requested to react, and suggest creative ways to resolve these difficulties. They will similarly help to identify the roles ofgovemments and fishing communities in managing their resources.

Participants

National staff responsible for fisheries management and enforcement of fisheries at the national and local grassroot levels, Interested NGOs can also send their staff to the Workshop at their own cost. The number of participants is limited to 30.

outputs

I. Country programmes on PA2FM and creative strategies to promote the PA2FM idea with respective governments.

2. Acquired skills and knowledge on
   - strategy to implement PA2FM
   - promoting stakeholder and community involvement in FM
   - factors that can influence the successful implementation of PA2FM.

3. Meeting the participating governments' major national and regional needs for a workable fisheries management scheme, regime or mechanism.

4. Developed sense of entitlement and ownership on the part of fishers of the waters and aquatic resources they have exploited for generations and relied on for livelihood security.

Duration : 25-28 February 1997

Proposed Venue : Medan, North Sumatra, Indonesia

Possible Resource Persons

1. Dr Serge Garcia, Director, Fishery Resources Division, FAO, Rome, Italy.
2. Dr Robert Gillett. USA.
3. Dr Chris Francis, National Institute of Water and Atmospheric Research, New Zealand
4. Dr John Kurien, Associate Professor, Centre for Development Studies, Trivandrum, India
5. Dr Kee-Chai CHONG, Programme Coordinator, BOBP, FAO, India

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Proposed Workshop Content

Session I: Recent Perspectives and Trends in Fisheries Management (after 1990) in BOBP Member Countries

This session will present recent perspectives and trends in fisheries management in BOBP member and non-member countries. It will also review emerging trends and new developments in the respective national fisheries management plans and regimes. The session will cover

- Identification of Problems
- Conflicts in Fishing
- Conventional Fisheries Management Systems
- Successes (Benefits) and Weaknesses/Failures (Costs) of Fisheries Management
- Recent Perspectives, Emerging Trends and New Developments in Fisheries Management
- Management Criteria and Targets under Conventional Fisheries Management System

Session II: Promoting Responsible Fisheries

This session will introduce the need for fisheries management, and benefits and approaches that would flow from a more responsible approach to fisheries management. In particular, reference will be made to the Code of Conduct for Responsible Fisheries. Topics to be covered are:

- Role and Presentation of Scientific Advice on the Precautionary Approach to Fisheries Management
- Practical Implications for a Precautionary Approach to Fisheries Management
- Assistance to BOBP Member and Non-Member Countries in Applying the Code of Conduct on Responsible Fisheries and Technical Guidelines on the Precautionary Approach to Fisheries Management
- Fisheries in Integrated Coastal Area Management

Session III: Data Requirements to Implement the Precautionary Approach to Fisheries Management

This session will present the data needed to implement the Precautionary Approach to Fisheries Management. It will consider the practical problems and implications of decision-making in a data-poor setting. This session will highlight:

- Management Guidelines and Reference Points
- Sources of Risk and Uncertainty
- Time Horizon for Precaution.

Session IV: Guidelines for the Practical Implementation of the Precautionary Approach to Fisheries Management.

This session will elaborate on the following topics:

- Identification of new issues in fisheries management, local, national and regional
- Concept of Precautionary Approach
- Requirements for Precaution
- Economic Implications of Precaution
- Operationalizing the Precautionary Approach to Fisheries Management (Practical Implications)
- Intra- and Inter-Generational Equity.
- Management Criteria and Targets under PA2FM
- Management Reference Points
- Control Rules and Conservation Safeguards
- Strategies for Precautionary Approach to Fisheries Management
- Access to Responsible Fisheries Technologies
- Control on the Development and Proliferation of Irresponsible Fisheries Technology
- Management Mechanisms and Practices – Management Councils/Panels/Bodies

3. AGENDA

Day One: 25 February 1997 (Tuesday)

08.00 – 09.00	Registration
09.00 - 10.00	**Opening Ceremony**
09.00	Welcome Address by Dr Kee-Chai Chong, Programme Coordinator, BOBP/FAO
09.15	Objectives of the Regional Workshop by Ms Ennie Soetopo, Chief, Sub-Directorate of Programme & Project Aid, Directorate-General of Fisheries, Indonesia
09.25	Address by FAO Representative in Indonesia – Dato'Wahid Abdul Jalil
0940	Inaugural Address by Bapak Raja Inal Siregar, Governor of North Sumatra
10.30 - 12.00	"Uncertainty and Risk in Fisheries and their Management : A New Challenge" – Keynote Address by Dr Serge Garcia, Director, Fishery Resources Division, FAO Rome
Session I	**Presentation of Country Papers**
13.00 - 13.30	Bangladesh
13.30 - 14.00	India
14.00 - 14.30	Indonesia
14.30 - 15.00	Malaysia
15.30 - 16.00	Maldives
16.00 - 16.30	Sri Lanka
16.30 - 17.00	Thai land
17.00 - 18.00	Discussion
20.00 - 23.00	Dinner Reception and Cultural Show hosted by Governor of North Sumatra

Day Two: 26 February 1997 (Wednesday)

Session II	**Recent Perspectives and Trends in Fisheries Management in Asia** *(Chair: Mr John Fitzpatrick)*
80.30 - 09.00	Overview of Fisheries Management in Indonesia, Past Present and Future Mr Sukotjo Adisukresno, Director, Directorate of Resources Management, DGF, Indonesia

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09.00 - 09.30	Government Decision-Making under Uncertainty: A Case for Fisheries Management – Dr Yohanes Widodo, Scientist, Central Research Institute for Fisheries, AARD, Indonesia
09.30 - 10.00	Overview of Fisheries Management in Asia : Past, Present and Future – Dr Nik Mustapha Raja Abdullah, Associate Professor/Head, Department of Natural Resource Economics, Universiti Pertanian Malaysia
10.30 - 11 .00	U.S. Experience in Implementing Precautionary Approach to Fisheries Management – Dr Stanly Wang, National Marine Fisheries Service, USA.
Session III	**Promoting Precaution and Responsibility in Fisheries** *(Chair.. Dr Serge Garcia)*
11 .00 12.00	Overview and Practical Implications of Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries to Small-Scale Fisheries Dr Garry Preston, Gillett and Preston Associates, Noumea, New Caledonia
13.00 14.00	Operationalisation and Implementation of Code of Conduct for Responsible Fisheries – Dr John Kurien, Associate Professor, Centre for Development Studies, Trivandrum, India
14.00 - 15.00	Plenary Discussions and Clarifications
15.30 - 17.30	Group Discussion (Worksheets/guidelines to be provided)
20.00 - 23.00	Dinner reception hosted by BOBP-FAO/UN

Day Three: 27 February 1997 (Thursday)

Session IV	**Data and information Requirements to Implement the Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries** *(Chair: Dr John Kurien)*
08.00 - 08.45	Management Guidelines and Reference Points in Fisheries Management – Dr Kee-Chai Chong, Programme Coordinator, BOBP
08.45 - 09.20	Role and Presentation of Scientific Advice on Operationalization and Implementation of the Code of Conduct for Responsible Fisheries: Mr John Fitzpatrick, FAO, Rome, Italy
09.30 - 10.15	Supporting Fisheries Management in Asia : Information and Research Network – Ms Yong-Ja Cho, Information Consultant, Bangkok, Thailand.
10.45 - 11.30	Identification of Unresolved and New Issues in Fisheries Management Dr John Kurien, CDS, India and Dr Kee-Chai Chong, BOBP, India.
11.30 - 12.30	Plenary Discussions and Clarifications

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Session V	**Guidelines for the Practical Implementation of the Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries** *(Chair: Dr Kee-Chai Chong)*
	Panel Discussion
	Requirements and Strategies for Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries
14.00 - 14.20	Overview of New Issues in Fisheries Management Dr Serge M Garcia, FAO, Rome, Italy
14.20 - 14.40	Role of Communication and Awareness-Building in Fisheries Management – Mr Rathin Roy, Sr Communication Adviser, BOBP
14.40 - 15.00	Practical Implications of the Precautionary Approach to Fisheries Management and Code of Conduct for Responsible Fisheries for Small-Scale Fisheries Dr Gary Preston
15.00 - 15.20	Access to Responsible Fisheries Technology Mr John Fitzpatrick, FAO, Rome, Italy
16.00 - 16.20	Do Fisheries Statistics Give the Full Picture? Indonesia's Non-Recorded Fish Problem – Dr Nick Willoughby, Team Leader, Marine Resource Evaluation/Planning Project, FRIFI, AARD, Indonesia
16.20 - 18.00	**Open** Forum, Wrap-Up and Closing Ceremony

Day Four: 28 February 1997 (Friday)

06.30 - 16.30	Optional Field Trip Cage Culture Operations in Langkat

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5. KEYNOTE ADDRESS

THE PRECAUTIONARY PRINCIPLE : ITS IMPLICATIONS IN CAPTURE FISHERIES MANAGEMENT*

by S.M.Garcia
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Dr Serge Garcia 's keynote address was deliveredextempore, and illustrated with a number of overhead slides he hadpreparedfor the workshop. Since no record of his extempore address is available, we are reproducing a paper on "Theprecatrtionaty principle "prepared by Dr Garcia for the journal "Ocean and coastal management", with the kind permission of both Dr Garcia and the publishers of the magazine. We are also reproducing a few of the overhead slides Dr Garcia used at the workshop.

Conservation and management both stem from value judgements made by society, not science.
R.L. Edwards (1988)**

Abstract

This paper attempts to clarify the research, management and legal implications of a potential application of the precautionary principle to capture fisheries, particularly in the international context. In the process, the paper also looks at related issues such as the burden of proof, the use of best available scientific evidence and technology, the reliance on prior scientific consensus, assimilative capacity and acceptable levels of impacts. etc., in the fishery context. It is argued that, if narrowly interpreted, the precautionary principle could lead to socio-economic havoc. If reasonably interpreted, however, the Principle offers a golden opportunity to progress towards sustainable fisheries development. Suggestions are made for the implementation of precautionary approaches in fisheries management.

1. Introduction

Fisheries management practice has evolved slowly during the last halfcentury, constantly lagging behind theory. Progress achieved since the first FAO Technical Committee on Fisheries in 1945 has been insufficient largely due to competition and expansion in an open access context as well as inadequate research and institutions.' While traditional management practice has still to improve, new aspects related to environmental conservation are emerging which many require an acceleration of the process of evolution of fisheries management and a broadening of its scope to take non-fishery user concerns into account.

Part XII of UNCLOS, "Protection and preservation of the marine environment", does not contain detailed instruments for implementation of the conservation of the marine ecosystem, but it stresses that States have the duty to protect and preserve the environment from pollution, Burke stresses however that if

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* *Based on a paper published in "Ocean and Coastal Management ". No. 22 (1994).*

** *Former Director of the National Marine Fisheries* Service, *Northeast* Fisheries *Center, Woods Hole. Massachusetts. USA.*

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ecosystem conservation requires measures for the fisheries sector under Article 192. States will have to apply such measures as provided by the fisheries provisions of UNCLOS and to strike a balance between the environmental and fisheries provisions to ensure sustainable exploitation.

Environmental concern has increased drastically in fisheries with the World Conference on Human Environment, Stockholm, 1972, the work of the 'Brundtland' Commission from 1984 to 1987[3] and the preparation for the UN Conference on Environment and Development, Rio de Janeiro, 1992. This concern which was already apparent in the FAO Technical Conference of Fishery Development and Management, Vancouver, 1973, and the FAO World Conference of Fisheries Management and Development Rome, 1984, was exacerbated by the international conflict on large-scale pelagic driftnet fishing in the high seas at the end of the 1980s and the related Resolution 44/225 of the UN General Assembly in December 1989.

There is a worldwide trend towards preventive approaches to management of renewable resources (of IUCN[4]) and such approaches have been advocated in the past for fishery management,s but rarely implemented. As the global concern for the environment is gaining momentum in fisheries, one can expect that the principles adopted at the international level for environmental protection, such as the Precautionary Principle, may be progressively forced on fisheries systems. The wide adoption of the Principle could change drastically the state ofaffairs in marine living resources conservation and could offer an opportunity to improve fisheries management and ensure sustainable fisheries development. Its careless generalization to fisheries could, however, lead to economic and social chaos in the fishing industry.

The purpose of this paper is, therefore, to review the available information on the Precautionary Principle, to clarify the implication of its potential application to fisheries and its relationships with conventional management approaches. The paper addresses this issue mainly in the context of international fora but many of the implications are also relevant at national level. The following section will : (1) describe the Precautionary Principle : (2) analyse its scientific, technical and legal implications for fisheries : and (3) propose elements for precautionary fisheries management strategies.

2. The Precautionary Principle

The Precautionary Principle seems to have existed for a long time in national laws related to human health and for instance, in the regulations of pharmaceutical industries. It seems to have been then progressively invoked in relation to pollution and its impact on human health and later its impact on the environment. As environmental concern and conscience grew, preoccupation for human safety has been progressively extended to the human environment and to other animal species and from a national to an international context. This has led to a growing reference to the Principle, often without much analysis of the practical implications.

In the international environmental softlaw, the Precautionary Principle emerged as a recognition of the uncertainty involved in impact assessments and management and in particular, in the determination of the future consequences (and associated costs) of present decisions. It is related to the central issues of inter-generational equity-our responsibility towards future generations and long-term discount rates and is particularly relevant when uncertainty is high and potential consequences of decisions could affect the survival of humanity.[6] By comparison, traditional fisheries management deals with intragenerational equity — and allocation of resources between the present users. The Principle was

apparently referred to in relation to pollution prevention in the early 1980s in Germany, ('Vorsorgeprinzip", and applied to issues related to the ozone layer, the greenhouse effect and the conservation of nature. It has touched indirectly on fisheries through the International Conventions on Dumping at Sea (Paris and Oslo Convention, Marpotl) in relation to pollution by fishing vessels.

It has been recently addressed for fisheries in relation to the actual or suspected impacts of the activity, on coastal habitats and ecosystems. endangered species, genetics and biodiversity. In most cases this was done only implicitly. Of particular relevance is the implicit emergence of this Principle in the discussions of the Preparatory Commissions of the UN Conference on Environment and Development on Oceans and particularly in the three Action Programmes on costal areas high seas and marine living resources. The International Conference for the Protection of the North Sea (London, November 1987: The Hague, March 1990) used it explicitly in decisions regarding coastal States, jurisdiction, habitats. species and fisheries including pollution from ships.

In order to understand better its potential implications for fisheries, the terms of its declaration could be adapted to fisheries -for illustration, replacing the word 'substances' by 'fishing practices' and deleting specific reference to the North Sea. (Such 'transposition' from environmental to fisheries softlaw which may be considered abusive to some readers is unfortunately what is presently happening). This Precautionary Principle would read as follows :

> Accepting that in order to protect a marine area from possibly damaging effects of the most dangerous fishing practices and gears a precautionary approach is necessary which may require

Fisheries Today :
Positive aspects

- 100 million tons of food produced
- 200 million tons of people's livelihood
- EEZs established
- Threats to sustainability identified
- International instruments agreed
- National policies improving
- Species diversity still largely maintained
- People being more aware and involved
- Concern for small-scale fisheries expressed

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> action to control fishing activities even before a causal link has been established by absolutely clear scientific evidence . . . .
>
> States accept the principle of safeguarding the marine ecosystem by reducing dangerous fishing practices, by the use of the best technology available and other appropriate measures. This applies especially when there is reason to assume that certain damage or harmful effects on the living resources are likely to be caused by the such fishing practices and technologies, even where there is no scientific evidence to prove a causal link between practices and effects (the principle of precautionary action).

The UN Resolution 44/225 on large-scale pelagic driftnet fishing in the high seas (December 1989) gives an example of expression of the Precautionary Principle for international fisheries. Although not as stringent as the original proposals put forward by the countries promoting it, the Resolution is a good example of the type of approach which might be internationally agreed to in the future. It is also likely that the strategy and principles behind this resolution will be used again in the future, both in the high seas and inside EEZs. After having expressed concern about the importance of the fleets, the length of the nets, their mode of operation, their potential impact on anadromous and highly migratory species, their by-catch, and the concern of coastal countries on the state of resources close to their EEZs, the Resolution recommends that :

(a) A moratorium should be imposed on all . . fishing... by 30 June 1992; (b) immediate action should be taken to reduce progressively... fishing activities in the South Pacific region with a view to the cessation of such activities by July 1991 and (c) further expansion..in the North Pacific and all other high seas areas...should cease immediately.

> . ..Such a measure will not be imposed in a region or, if implemented, can be lifted, should effective conservation and management measures be taken, based upon statistically sound analysis to be made jointly by the parties concerned...

The Resolution recommended immediate action on the basis of 'concern', in the absence of convincing evidence or scientific consensus and assuming therefore that driftnets have undesirable impacts unless shown otherwise.

A major property of the Principle is that it inverses the course of action, requiring that measures are taken first and, subsequently, relaxed if research demonstrates convincingly that they are not necessary. It affects the relationship between science and policy and between management and development by :

(a) focusing the spotlight on scientific uncertainty and related risk in decision-making;

(b) reverting the burden of proof on industry; and

(c) giving priority to preventive management on crisis solving.

The Principle is a reaction to a situation that environmentalists regard as unbalanced and loaded in favour of short-term gain. If narrowly interpreted, without reference to social and economic considerations, it could reverse the situation in favour of the environment and of non-consumptive users, giving them the benefit of the doubt and safeguarding all their interests even in the worst case assumption. The latter would imply that all risks are to be taken by economic activities.

The problem is not new to fisheries. James* wrote that the managers' dilemma was that 'by always leaning backwards in regulation, *giving to the resources the benefit of the doubt* (emphasis added), he

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might come up with reasonable assurance of protecting the resource, except that the economic survival of thousands of individuals, hundreds of communities and dozens of countries may be affected by the administrative action taken'.

In the following sections, distinction should be made between the Precautionary Principle and precautionary approaches or measures. The 'Principle' will refer to the 'hard line' rule proposed for management of highly polluting activities. The 'approaches' will refer to practical ways and sets of measures which are precautionary in nature but may lead to more realistic application in fisheries.

3. Implications of the Precautionary Principle

3.1 Implications for Research

3.1.1. Best scientific evidence

The Kristiana Conference in 1901, just before the creation of the International Council for the Exploration of the Sea, endorsed the principle of scientific enquiry as basis for rational exploitation of the sea. The same principle was also agreed on at the International Conference on the Conservation of the Living Resources of the Sea, hosted by FAO in Rome in 1955. It was finally integrated with the United Nations Convention for the Law of the Sea, adopted in 1982. Prior scientific consensus (on cause-effect relationships and potential consequences ofaction) has been the basis for action in international fisheries management and will remain one of the most neutral and peaceful ways to reduce costs of interaction between nations and user-groups.

Fisheries Today :
Negative aspects

- 60-70% of stocks require urgent intervention
- 30-40% overcapacity & $50 billion of losses
- Collapses of stocks & 20 million tons of discards
- Risk of technology dumping and more overfishing
- Potential threat to biodiversity
- Coastal environments degrading land based industries
- Social unrest & civil disobedience increasing
- Industrial threat to traditional fisheries

In modern fishery management systems, scientists are asked to :

(1) determine the theoretical potential production of a stock (usually equated to MSY):

(2) calculate the corresponding level of fishing effort, as a benchmark level not to be surpassed;

(3) determine the appropriate size at fist capture before which fish should not be caught in significant numbers;

(4) recommend ways in which the above can be achieved (mesh sizes, closed areas, closed seasons) and the bio-economic and technical trade-offs involved;

(5) assess the effects of fishing and forecast impacts of management options.

Despite its level of development, particularly in the northern hemisphere, fishery science has played only a limited and advisory role in the complex decision-making process of fisheries development.' The limitations of the data, models and paradigm are being progressively recognized[10] together with the uncertainty unavoidably attached to any scientific assessment. Raising the research standard further to model ecosystem behaviour under combined environmental and fishing stress and considering socio-economic effects implies data, understanding and financial and human resources which, in many instances, would be unrealistic. However, research can contribute substantially to the reduction of management uncertainty by :

- Improving the statistical power of the methods used for assessing biological and economic parameters, testing their sensitivity to data errors and systematically producing estimates of bias and precision in the derived parameters."
- Expanding the range of available models towards multispecies and ecosystem models, taking environmental variability into account.
- Testing the sensitivity of models used for fisheries and ecosystem management to uncertainties in their parameters and in their functional structure. In particular, testing routinely the impact of such uncertainties on the performance of management.
- Analysing a range ofpossible options with a range of models showing the likely direction and, if possible, the magnitude of the biological and socio-economic consequences of these options as well as the level and direction of the uncertainty (risk assessment).
- Experimenting with management systems as advocated by Walters and Hilborn[5] many years ago."
- Improving fishing gear and practices. Work must be done not only on better ways to use gears but on the development of better gear (square mesh trawls, turtle and by-catch excluder devices, biodegradable nets and pots, etc...) with better selectivity and less environmental impact.

UNCLOS requires 'the best scientific evidence' when designing and adopting management and conservation measures. It provides that in EEZs it shall he taken into *account* (emphasis added) by the coastal State (article 62) and in the high seas, *measures are designed* on *it* (emphasis added) (Article 119). Although the obligation seems to be less stringent for the coastal States in its area of exclusive jurisdiction than for States co-operating in the high seas, the requirement for scientific evidence is clear. The discussion by Burke[2] of the UNGA 441225 in this respect highlights some of the problems. UNCLOS is satisfied with the 'best available evidence'. It does not define the quality of the evidence required in any quantitative manner and 'does not necessarily place a great or imposing burden that must be discharged

before the necessary conservation measures can be taken... The 'best available' standard even permits the use of poor evidcnce to justify conservation measures, if that evidence is the best available?[2] UNCLOS, however. also does not indicate what should be done if there is no scientific information available. One would assume that the spirit of the text is that such scientific information should be urgently collected but this does not preclude measures being taken in the meantime. UNCLOS does not provide criteria on how to decide what is the best scientific information if conflicting scientific results are available, nor does it give guidance on how to operate in the absence of the scientific consensus which UNCLOS implicitly assumes. In such case, the Precautionary Principle would ensure that action is not deferred sine die. (In the driftnet issue such a procedure was set up through international scientific monitoring but the consensus on the implication of the results of the programme was never reached.)

The UNGA Resolution 44/225 on large scale pelagic driftnet fishing recognizes in its preamble 'that any regulatory measures...should *take account* of(emphasis added) the best scientific evidence available and analysis', using for a high seas problem, the weaker wording that UNCLOS provided for EEZ resource management. The purpose of this might have been to avoid the constraint that measures would have to be based on (emphasis added) the evidence available.

The introduction of the Precautionary Principle in fisheries could appear, therefore, an attempt to 'fill the gaps' in UNCLOS, preventing the absence of scientific data or consensus opening a loophole leading to 'laissez-faire' management and development strategies. UNCLOS does not foresee, however, that an existing fishery could be closed if data are not available. The Precautionary Principle has been criticized by the GESAMP Steering Group on Scientifically Based Strategies for Marine Environmental Protection and Management[14] as 'the acceptance of suspicion rather than scientific *evidence* as sufficient to introduce controls'. Contrary to the usual rule for crime regulations, potential culprits are considered guilty pending proof to the contra?. It should be hardly debatable that, in fisheries, when scientific data are available together with a monitoring and management system, the basic requirement of UNCLOS should prevail, e.g. that decisions be taken on the basis of the best scientific evidence available.

3.1.2 Burden of proof

The burden of proof is traditionally on research and management, with the rare exceptions where scientific work has been used to limit the development programmes on new fisheries. They have to demonstrate that harm is being done to the stock before measures can be imposed on industry History has shown that, because of the continuous bargaining between management and industry (and related socio-economic pressures) the 'proofs' may be arguable and their impact on decisions often far from satisfactory. The adoption of the Precautionary Principle would imply a fundamental reversal of the burden of proof. placing on those actors (group of fishermen countries) who claim that no action is required the onus of proving that what they intend to do will not lead to 'unacceptable' effects on the resources.

As an example, in relation to the conditional reopening of the large scale pelagic driftnet fishery, it was proposed to the UN General Assembly in 1990" that :

> Unless joint assessments by all concerned...of sound scientific data from a specific large-scale driftnet fishery conclude that there are no unacceptable impacts by that fishery, the conditions for relief of the moratoria... are not met (the subjective words have been underlined by the present author).

This proposal puts on the fishing nations the burden to prove that. if allowed. driftnets would not have an unacceptable impact, leaving implicitly to the other nations the right to accept or not accept the

proof. This is in line with the Precautionary Principle which requires States to take preventive or corrective action even in the absence ofsufficient scientific evidence of a causal link behveen a suspected factor and the adverse effects observed (or even before any effect is observed at all).

This was confirmed by UNGA Resolution 4612 15 of December 1991 on large-scale pelagic driftnet fishing which called for action against this type of fishery on the basis that : 'the international community (which) have reviewed the best available data...have failed to conclude that this practice had no adverse impact...and that...evidence has not demonstrated that the impact can be fully prevented'.

Another example can be found in the EEC Council Regulation 345192 of 27/1/1 992 which regulates the use and the length of driftnets (limited to 2.5 km) in EEC waters. Article 9a grants a derogation until 3 1/ 12/1993 to some vessels allowing them. It states, however, that: 'the derogation shall expire on the above date, unless the Council, acting by a qualified majority on a proposal by the Commission, decides to extend it in light of the scientific evidence showing the absence of ecological risk linked thereto. This indicates clearly that, unless provided otherwise, driftnets of more that 2.5 km are considered harmful.

Finally, the form in which the ICES Advisory Committee on Fisheries Management (ACFM) delivers its advice gives another example of precautionary approaches: [6] for 'stocks where, at present, it is not possible to carry out any analytical assessment with an acceptable reliability, AFCM shall indicate precautionary TACs to reduce the danger of excessive efforts being exerted on these stocks'.

3.1.3. The role of statistics

The UNGA resolution 441225 requires 'sound statistical analysis' and this new terminology could be considered as an attempt to clarify the concept of best, equating it with 'statistically sound'. Relations between statistics and the Precautionary Principle have been discussed by Gray[12] who welcomed the adoption of the Precautionary Principle for environmental law but worried about the fact that it implies that it is no longer necessary to have scientific facts to back up environmental legislation as one can simply "have reasons to assume" that an effect can take place to justify a management decision. He warns about the risk for scientific objectivity if proper statistical procedures are not the basis for assessments. He concluded that the Precautionary Principle should not be part of science since, by definition, it does not rely on scientific evidence.

The advantage of referring to statistics is that it offers a way of using well-established mathematical techniques and tests to decide what information is 'best' on statistical grounds. Bringing statistics into the picture would force scientists and decision-making systems to recognize and measure explicitly the levels of uncertainty and the risks attached to the decisions.

There are, however, also problems with statistics. They are of many types (parametric, non-parametric, geostatistics). Statistics for spatial analysis are still to be improved. Biological distributions tend to be continuous (rarely random) and stratification is usually not fully satisfactory. Under these conditions, the use of many statistical tests is questionable. Separating the 'signal' from the 'blank noise' in a data set and distinguishing fishing effects from environmental ones is, in many instances, a nightmare. Obtaining a consensus on statistical analysis might therefore not always be easier than on scientific evidence. If such agreement on sound statistical analysis has to be obtained by consensus, a single country could easily block the process. The lack of international agreement on the results of the joint driftnet fishery research programme illustrates this diffticulty.

The Challenge of Responsible Fisheries
Changes in Objectives

FROM:	TO:
· Sustain stocks	· sustain ecosystems
· Max. annual catches	· Max. long-term welfare
· Max. employment	· Sustainable employment
· Full resources use	· Efficient use (no waste)
· Short-term interests	· Short/long-term interests
· Local concerns	· Local & global concerns

Achieved by Changes in Policy

FROM:	TO:
· Open access	· Right-based systems
· Free access	· User fees
· Sectoral policy	· ICAM, ICFM
· Command and Control	· + Macro-instruments
· Top-down approach	· Participative approach
· Risk-prone approach	· Precautionary approach

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3.2. Implications of management

Human beings are not 'prudent predators' because their intervention is disjointed, and the feedback controls that they respond to are in good part independent of the natural resource ecosystem.[9] Their activities, not sufficiently controlled by natural signals of resources stress, can continue despite environmental degradation with potentially irreversible effects. One should recognize, however, that fishermen whose livelihood depends on living resources are more sensitive to natural feedback control than most land-based activities. Notwithstanding, the hard facts demonstrate without any doubt that such feedback has been in many instances insufficient to avoid excessive stress on fisheries stocks, with severe ecological and economic consequences. Improvements are therefore necessary and the following sections will look at ways in which the Precautionary Principle could help.

Hey[17] states that a precautionary approach to environmental protection should be based on clean production methods and best available technology, comprehensive methods of environmental and economic assessment, scientific and economic research towards better understanding and analysis of options, appropriate legal, administrative and technical procedures. If taken out of their precautionary context, as described above, the elements of the approach look very traditional, at least to fisheries management specialists.

3.2. I. Management under uncertainty

It is obvious that fisheries management could certainly be improved. Many important stocks are too close or even below their MSY level, leading to instability. Many have ecologically or economically collapsed. The situation raises particular concern in the high seas ß but is far from satisfactory, in all EEZs[10] Management failure results essentially from the common property nature of fisheries and the lack of effective will to control fishing effort levels directly in the absence of an explicit allocation of resources. In a fishery system with an efficient resources allocation scheme, both research and management would have performed better. Allocation can, however, be achieved only through lengthy and politically difficult processes ofevolution ofproperty and user rights, and the resulting deficiencies and uncertainty must be faced.

Perrings[6] notes that 'there is no consensus on what the principle means for decision-making under uncertainty'. In general, the Precautionary Principle is invoked when a negative impact on man -and, by extension, on the ecosystem — is suspected and when the options or even the survival of future human generations are at stake. It should be obvious that fisheries do not threaten the future of humanity even though their mismanagement may severely affect the livelihood of coastal communities. There can be no doubt, however, that fisheries have an impact on the ecosystem and its species, if only by reducing target species abundance, age structure and reproductive potential. Some involuntary impacts on associated species will also occur. Impacts on habitats, although limited, cannot be excluded for some mobile gears (beach seines, trawls, etc.). A major difference, however, between fisheries and pollution (for which the Principle was created) is that the survival of capture fisheries and aquaculture is directly dependent on the state of the environment (including the biodiversity) they exploit. This is not the case for, say, chemical industries dumping sewage into the coastal areas.

The aquatic resources properties, their 'fluid' nature, the quality of the fishery data and limits of scientific understanding lead to the existence of a certain level ofuncertainty on the understanding of the ecosystem and on the scientific advice. This, in turn, implies some level of risk of error in management decisions

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aiming at maintaining the resources and the environment. The risk cannot be totally eliminated. One can easily assume that in a complex multi-resources and multi-user system the overall level of uncertainty in the parameters and the system itself is so high that a zero-risk strategy would imply no development at all. A strategy hardly viable.

If sustainable use is the objective, in order to produce a continuous flow of goods and services from the living aquatic resources the Precautionary Principle can only aim at reducing detrimental impacts below some acceptable threshold and not at eliminating them altogether. It follows that the judgement will have to be based on scientific evidence and advice on what levels of impacts are acceptable, taking into consideration the short-and long-term impacts and their socio-economic as well as ecological implications.

3.22. Assimilative capacity and acceptable levels of impact

The concept of assimilative capacity of the environment has generated heated debate. This concept implies that nature can absorb a certain quantity ofpollution without significant effect. For some industries it is important to estimate the assimilative capacity of the ocean and use it as a resource (i.e. for dumping wastes). According to Hey," the concept also implies that science can determine the assimilative capacity and that management will be efficient enough to prevent negative effects and abuse. She says that this concept depends too much on short-term economic considerations and is not precautionary. One can easily see the concern when the assimilative capacity is defined in terms of radioactive wastes, heavy metals and other non-reversible impacts.

Originality of PA2FM

- Fishing is harmful unless proven otherwise
- It considers risk for resources and people
- Increased people's participation is needed
- It is not limited to exceptional conditions
- It becomes an integral part of good practice
- Science has a central role, but
- A different science is called for
- It is compatible with UNCLOS and fills some gaps.

The problem is significantly different with fisheries. Their purpose is to impact the resource and capture part of the natural productivity in order to extract food and revenues. The resources do have an assimilative capacity in terms of the fishing mortality they can stand. In a way the Maximum Sustainable Yield could be considered a measure of the maximum assimilative capacity of a stock. The same concept can apply to a multispecies resource and to an ecosystem even though defining and measuring such capacity is not a trivial issue.

As the cause-effect relationship between fishing and the resources is obviously not questioned, the problem lies in (a) the degree of impact that could be allowed (e.g. the assimilative capacity) and (b) the discrimination of fishing impacts from environmental impacts -whether natural (normal year-to-year climate fluctuations) or resulting from human activities (degradation and global climate change).

3.2.3. Standards and criteria

The Precautionary Principle is not formulated in absolute terms and it offers little guidance on how to apply it in practice. Better quantification and qualification are required and words such as detrimental, substantial, significant, harmful, unacceptable, which are generally used in various expressions of the Principle, need a more accurate definition. There is a whole range of degrees in each of these and other terms currently used. One of the major tasks for research and management will be to develop the agreement on standards, criteria and critical thresholds on which to base decisions. Criteria will be needed to face the management requirements of the diversity of existing ecosystems and resources. Clarification is required, for example, on the concepts of sustainability (in a naturally variable context) and reversibility (for multi-equilibrium systems). Measures of ecological stress will also have to be agreed. The following examples illustrate the dificulty of establishing a set of coherent and credible criteria.

With reference to the issue of by-catch, for example, Miles" stressed the danger of setting criteria at excessively high levels, with the risk of crippling national industries beyond what is required to ensure long-term resources conservation, recalling that criteria established for high seas will tend to be proposed also for EEZs. This author cites a paper on driftnets presented to the United Nations in 1991, and in which an 'efficient harvest' is defined as the one which :

(a) will ensure as far as practicable that human activities do not result in the decrease of any population of marine species below a level close to what ensures the greatest net annual increment or

(b) will not catchnumbers ofeithertarget or non-target species that will result in significant changes in the relationship among any of the key components of the marine ecosystem of which they are part.

The first criterion implies that populations are not decreased beyond their MSY abundance level where their natural turnover is the highest. This is in line with the original UNCLOS requirements and it has been shown since then, that it is not biologically and economically advisable in most cases to extract the Maximum Sustainable Yield. For multispecies fisheries, however, it would require that all species be exploited below their MSY abundance and therefore that the overall level of exploitation be fixed at the lowest level required by the species with the lowest resilience. In a typical Mediterranean multispecies trawl fishery where long-living bottom species (e.g. seabreams and red mullets) are targeted together with short-living pelagics (e.g. sardines), this would imply fishing sardines well below the possible level ofharvest in order to meet the criterion for seabreams and mullets. The problem has been recognized in the report of the FAO Expert Consultation on Large Scale Pelagic Driftnet Fishing (FAO[19] para 74).

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The second criterion implies that fishing does not disturb the food chain significantly. There are two problems there. First, the word 'significantly' is subjective and the criterion gives no guidance on the basis of which-a food chain disturbance is to be considered 'significant' or not. Second, applying fully the first criterion leads, in practice, to differential fishing, to a change in relative abundance of species and may very well affect the food chain. As a consequence, the second criterion is difficult to use in practice for many fisheries and may not even be coherent with the first one.

It has been proposed respectively to the United Nations General Assembly (cited by Miles") and in the Report on Ecologically Sustainable Development of Fisheries (Australia") that :

> The mortality inflicted on any target or non-target species...is unacceptable if it exceeds the level that would when combined with other sources of mortality, result in a total level that is not sustainable by the population in the long term.
>
> As data permits, fish management authorities set target species catch levels in accordance with the requirement that fishing does not exceed ecologically sustainable levels for both target and non-target species..

Taking into account mortalities from all sources when assessing fisheries impacts is a prerequisite (including natural mortality, indirect fishing mortality as by-catch, direct fishing mortality as target, etc.). Estimating drop-out mortality is a very demanding task but assuming it is feasible. A problem remains with the term 'sustainable' in both proposals.

The production model theory says that resources are sustainable (in the sense of being able to regenerate themselves) at various levels of abundance depending on the level of harvest. In other words a stock can reproduce itself for a long period of time, and therefore be considered sustainable at high (virgin state), medium (MSY level) and even low level of abundance. As stocks are fished down, their variability and the risk of collapse increases. But in theory, and in practice, stocks can be said to be sustainable even at fairly low levels. It has been agreed in UNCLOS that stocks should not be exploited beyond their MSY level of abundance and this could be considered a bottom line criterion for stock 'sustainability', remembering, however, that stocks' MSY vary with environment and that, even when abundance is above the MSY level, the risk of collapse is not nil (Laurec[21]).

From an ecosystem point of view, if balance between ecosystem components must be maintained, minimizing by-catch or using extremely selective gears might not be necessarily the best solution (with the proviso that discards be limited to a strict minimum). Garrodd22 suggested that in multispecies management, a reasonable strategy would be to exploit all species proportionally to their abundance in order to maintain the overall structure. More work is certainly required on this matter before objective guidance can be given.

New criteria, not foreseen in UNCLOS, are required if species sustainability is to be ensured at low risk of collapse. They would have to refer to, for example, minimum reproductive biomass, safe biological limits, optimum recruitment levels, maximum statistical probability of ecological or economic collapse, especially in areas of high environmental variability (upwellings) or for particularly low resilience species.

New criteria are also needed for precautionary ecosystem management, related to global stress indicators, resilience factors, habitat conditions, etc. Some of the required principles can be found in the management charter of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and

in the IUCN Strategy for Sustainability :":[4]

minimize conversion of critical ecosystems to 'lower' conditions,

balance habitat conversion with restoration (not net loss),"

maintain ecological relationships,

- maintain populations at the greatest net annual increment

restore depleted populations

- minimize risk of irreversible change in the marine ecosystem, etc.

Genetic conservation criteria, when introduced, will make things even more complicated as management will have to face conservation requirements at both ecosystem/biodiversity, species and genetic level.

3.2.4. Improving decision-making process

In international management the best principles are useless if the decision-making process leading to their practical implementation is flawed and inefficient. The quality of the decision-making process is also important when criteria and standards have to be agreed on. The following section therefore briefly analyses the issue, looking at potential solutions for improvement.

In general, fisheries management agreements implicitly accept that fishing activities which are not explicitly prohibited or subject to regulations may be undertaken freely. Their regulation (including prohibition) requires a particular action to be taken. The necessary decisions are usually taken by consensus between all parties. Voting procedures are rarely used, even when they are foreseen by the basic texts. In international fora the consensus procedure allows agreement only on the lowest common denominator between all parties, gives a *dejhcto* right of veto to the minority and has led to the too little, too late fisheries management. The problem has been stressed by various scholars as a weakness in international fora and the introduction of majority voting procedures would correct this situation. [10,17,24,2s]

When the agreement reached is legally binding, parties are given time to object, and if they do so, to opt out of the procedure because 'no State can be expected to accept limitations on its sovereignty without its consent' even though the opting-out party puts at risk the interests that the others have in virtue of their own sovereignty." The country which does not accept the resulting legal obligation may find it convenient to leave the agreement while continuing to fish in the Convention area. (Alternatively, vessels from a party to the Convention may move under a flag of convenience of a State not party to the Convention in order to avoid the obligation contained in the Convention.) Attempts to make the right to fish in the high seas subject to complying with UNCLOS provisions or to the increase the flag State's liability have, for the moment, met with little success. The idea is progressing slowly, however.

The concept of 'people's participation' in national resources management is being voiced and increasingly recognized in international fora. We can safely assume that the public will be more and more associated with and involved in the decision-making process on environment and development issues. In parallel it is being proposed that management agencies, research and industry should be explicitly and directly accountable to the public for the state of the resources on which they have been given user-rights.[20,26] In addition public opinion has been used by environmental protection lobbies for decision-forcing and as a test-board for 'acceptability' ofmeasures, norms or criteria. Actively alterted public opinion has been

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instrumental for instance to force an international moratorium on whaling, an international ban on large-scale pelagic driftnets and a ban on coastal gillnets in California.

3.2.5 *The concept of best available technology*

One requirement ofprecautionary management or development is to use the 'best available technology' (a parallel to the concept of 'best scientific evidence available'). This requirement has been made in a number of international instruments related to environmental policy.[7][5] This simply means that all that is technologically feasible must be done to prevent the harmful effect, and little more can be done to make this requirement more precautionary.' The application of the concept usually implies the establishment of 'black' and 'grey' or 'red', 'orange' and 'green' lists of tishing practices.*' Poison and dynamite (and probably large-scale pelagic driftnets) would be in such a black or red list. As an example, the Convention on the Conservation of European Wildlife and Natural Habitats, Beme, 1979, gives in its annex IV, the list of non-selective gears to be banned, which includes nets in general. (Although relevant in principle for migratory birds, the Berne Convention has been used in Italy in reference to the large-scale pelagic driftnet fishery).

The potential problem in classifying fishing technologies in such lists is illustrated in Thome-Miller and Catenaz8 who mention that examples ofmethods that are contributing to depleting marine living resources include fishing the deep ocean with huge driftnets, operating large vessels able to process huge catches at sea, using aerial spotters and acoustic fish finders to process huge catches at sea, using aerial spotters and acoustic fish finders to locate schools of target fish, and using more and more efftcient fishing equipment without restrictions on size or location of catch. This shows a total confusion and unjustified amalgamate between the lack of selectivity of some gears and the large catches which are possible on abundant small pelagic species, as well as between fishing efficiency and fishing mortality, forgetting that total effort is what is to be controlled.

The 'best management methodology' would be, following the same rationale, a concept of value. It is unlikely that any management method would be the best in absolute terms but techniques particularly robust and well-adapted to fragile species or communities in a particular socio-economic and cultural context could be given a status as standard.

A criticism of the 'best available fishing technology' concept is that (a) 'best' is defined neither in qualitative nor quantitative terms and (b) the accumulation of 'best technologies' could be the worst thing happening to fish if the total effort is not controlled. The wording assumes a universal value judgement on what is 'best' without providing guidance on the basis for such judgement. The best gear from an extreme ecological point of view may be one that catches nothing. The General Assembly Resolution 441228 on UNCED refers to 'environmentally sound' technology in a document which, however, stresses abundantly the necessity to take into account also socio-economic value as required by the FAO definition on sustainable development.

3.3. *Legal implications*

Although General Assembly resolutions are not legally binding, they can have enormous political significance. The consequences of the General Assembly resolution on large-scale pelagic driftnets gave an example ofthe potential impact. Although its legal status is that of a recommendation, a UNGA resolution may have an effect wider than that in revealing indirectly what State practice is, or pointing

to what States might be willing to accept. The UN Convention on the Law of the Sea is in a similar category pending its entry into force (although it is considered that parts of the Convention (including the fisheries provisions) already constitute customary law even before the entry into force of the Convention), though an obligation to act in accordance with its provisions can be linked to the need for those States which have signed it not to act in a manner contrary to its objects and purposes (Vienna Convention of the Law of Treaties, Art. 15)

These points do not, however, elevate the Precautionary Principle to a legal requirement in its own right and Nollkaemper[7] indicates that, for the time being, the Precautionary Principle is no more than a non-binding norm, operating within the frame work ofparticular agrel:ments. Hey,[17] however, argues that the Principle 'may be on its way to becoming part of customary international law'.

The Precautionary Principle might, however be invoked in fisheries conservation issues as a factor, indeed very important factor, in negotiations between States to establish conservation measures in circumstances where there is an obligation to negotiate in good faith to reach agreement, e.g. with respect to straddling stocks under UNCLOS or with respect to high seas fishing under article I 19. Given the wide support to the Principle in the world community a State or a party which refers objectively to it directly or indirectly most probably hopes that it cannot be accused ofbad faith. The above discussions on the Principle show however that it may easily lead to abuse.

4. Implementation of precautionary approaches

4.1. *Existing precautionary approaches*

Precautionary approaches for fisheries management have long been advocated even though they have rarely been applied in practice. Preventive (proactive) management has been recommended in order to avoid crisis and higher costs in the future.

This included :

(1) step-wise development with impact monitorin g as opposed to massive development with no accompanying research;

(2) early effort limitation instead of laissez-faire investment strategies which lead to overfishing;

(3) design of institutional or financial 'brakes' to avoid 'explosive' development;

(4) prior authorization for ordering new vessels or borrowing money for them;

(5) precautionary quotas for species for which proper assessments are not available;

(6) using 'pessimistic models' (e.g. the Schaefer production model instead of the Fox model or yield-per-recruit models) for stocks where low resilience is suspected;

(7) recommendation for multispecies management;

(8) recommendations for 'experimental management' to test systems response.'

(9) recommendations of development targets below the Maximum Sustainable Yield (MSY) e.g. F_{01}, $F_{2/3}$, F_{MSY};

(10) adoption of the concept of 'safe biological limits'

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(11) modelling systems response across the whole uncertainty range;[29]

(12) agreement on cautious management thresholds (e.g. minimum spawning biomass) and course of action before crisis occurs.[30]

The poor state of fisheries resources in many areas indicate that despite their potential availability, such measures have not been adopted widely or successfully implemented. Ways must therefore be found to strengthen existing precautionary approaches.

In case of doubt as to the effect on the marine environment and resources, preventive or remedial action would have to be taken, decision erring on the safe side. For example, the General Assembly Resolution 44/225 on large-scale pelagic driftnet fishing recommended immediate action in the absence of scientific consensus. The generalization of the approach would imply that the prohibition of a disputed fishing technique is in order even in the absence of scientific information demonstrating its harmfulness until its harmlessness has been demonstrated (freely translated from the original in French)[31]. Although the usefulness of this approach can be easily seen in case of very high risk its ordinary application for everyday fisheries management could very quickly discredit the Principle itself.

Paying lip service to the principle will not satisfy the growing international pressure for more environmentally friendly technologies and development. As Hey25 rightly stresses, what is new in the Precautionary Principle is not so much the implied measures themselves but the way in which such measures are to be implemented (i.e. stringently) and when they are implemented ('as soon as a detrimental effect...becomes plausible'). A precautionary fisheries management policy may combine a variety of approaches and regulatory tools as follows :

- *Adopting the sustainable development principle* as defined by the FAO Conference. Specific and shorter-term objectives would have to be broadly compatible with it. Hey[17] argues that not linking explicitly environment and development would be contrary to the precautionary approach.
- *Adopting the principle ofprecautionary management,* This would entail adopting a preventive management approach and the measures listed below. The degree of 'precaution' (e.g. the amount of constraint and the degree of stringency) would be negotiated on a case-by-case basis, for each agreement or convention.
- *Using the 'best scientific evidence available* '. In most cases fisheries impacts are progressive and reversible leading to small risk. There should therefore be time available to collect data and build up scientific consensus at least on the level of uncertainty. All fisheries should be covered by an information system, the complexity and cost of which should be commensurate with the level of risk e.g. higher for long-living species (mammals, sharks, etc.) and in highly unstable resources systems, e.g. small pelagic stocks in upwelling areas.
- *Adopting a broader range of management beachmarks* and reference points more directly related to reproduction capacity (safe biological limits, minimum spawning biomass, etc.). In particular using such reproductive capacity as the system status indicator and explicit management target.
- *Developing a set* of *criteria* to be used when assessing present or potential impacts of developments. These criteria would take into account, *inter alia,* the potential degree of impact on the reproduction capacity of target and non-target species, the level of risk to the stock and associated species caused by the combination of fishing and environment variability, the degree of reversibility of the observed or forecasted impacts. In particular, criteria will be needed for

ecosystem management and acceptable degrees of ecosystem disturbance for the various types of ecosystems presently exploited.

- Taking a *risk- averse* stand : assessing the degree of risk created by ongoing fishing activities; establishing maximum rates of exploitation based on acceptable levels of impacts: requiring an environmental impact assessment before authorizing any increase of fishing intensity beyond such rates; requiring prior environmental assessment before opening a new fishery (as required by some pressure groups) implies that all resources are put under a management scheme of various degrees of stringency and sophistication, without exception. Such risk can, in theory, be assessed by simulation of management systems as already done for the management of Whales[29] but the degree of complexity will increase drastically for multispecies and ecosystem management and with the inclusion of socio-economic considerations.

- *Agreeing on acceptable levels of impacts (andrisk).* They will never be nil and their 'acceptability' will be influenced by cultural, historical and socio-economic conditions. Different pressure groups, with different interests, will disagree on the degree of risk which is 'acceptable'. Negotiations between interest groups, and within an appropriate institutional and legislative framework will be necessary. Without them, the degree of compliance will be low, raising the related costs of enforcement beyond acceptable levels. The bargaining that characterized past management practices will therefore still be necessary. The difference and strength of the new approach is that the process would be more formalized and trade-offs more explicit and transparent to public opinion.

- *Basing management decisions on combinedstresses* on resources and environment. This implies that effort reductions or special measures affecting fisheries will be taken when the stock will face unusually unfavourable environmental conditions. One implication that would prevent fishermen from being penalized by environmental degradation caused by other human activities is to see fisheries in the context of coastal integrated management.

- *Improving management response* time by adopting 'action triggering levels' for status variables (e.g. reproductive capacity, risk level) at which action will immediately be taken by management in pre-defined directions agreed beforehand. This would particularly be required for highly variable resources such as small pelagic species in upwelling systems and for depleted resources in a process of rebuilding and confronted with environmental variability.

- *Improving participation* of *'non-fishery users* ' in fisheries management bodies as a way to open a more constructive dialogue and take all interests into account when developing and managing fisheries. This requires more 'transparency' in fisheries management and better reporting procedures on the status of stocks to the public.

- *Improving decision-making procedures* by introducing voting procedures or using them when they already exist.

- *Introducing prior consultution procedures* for fishing activities listed in the 'grey' or 'orange' list. This would require that States proposing to introduce such activity present a report, comparable to an EIQ report for comments. Hey[24] warns, however, of the paperwork that might be involved if such procedures are used too often and suggests limiting the procedure to activities for which phasing out has been decided and to request an annual report during the phasing out period.

- *Strengthening monitoring control and surveillance* and raising penalties to deterrent levels.

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The type of action and the degree ofurgency required must be a function of the probability of occurrence of a certain type of impact of a certain magnitude. Decisions are comparatively easy when risks are extremely high. Proposing to prohibit, even without any scientific background, the use of explosives to fish in the high seas would probably not meet with much international opposition as harmful fisheries techniques (dynamite, poison) are normally banned in all national fisheries legislation, However, deciding whether a 5% by-catch of sharks in a longline tuna fishery is acceptable or not will require more careful consideration.

More stringent measures could and would probably be advocated by extremists as necessary for implementing a precautionary approach but that would probably be considered unrealistic from the technical, socio-economic and political points of view. Nollkaemper states that a strict interpretation of the Principle would render it meaningless in practice. In fisheries, extreme measures would include for instance :

- banning of all activities which negatively affect the environment (implying the closing down of all fisheries),
- requiring proof ofharmlessness before starting any fishery, a requirement obviously impossible to meet,
- requesting that the most advanced techniques be systematically applied by all member States

5. Conclusion and Discussion

Many environmentalists are beginning to understand and stress the need for managing the combination of natural and socio-economic systems, but it is not clear that they have reached the point of cost-benefit analysis or widely adopted a problem-solving approach in a social milieu." On the other hand, industry must also start to understand that the spiral of short-term economic and social problems created by a lack of control, the rates of harvest and the pursuit of short-term economic goals cannot continue to justify the erosion of the resources and the environment at the expense of present and future generations.

The Precautionary Principle looks like both a golden opportunity for better management and a threat to fisheries industries; at once a safeguard ofthe opportunities of future generations and a potential source of inequity for those of today. It is therefore important that misunderstanding and extremism are avoided. The problem should not be expressed in terms of a drastic choice between a standpoint of extreme ecological conservationism and one of total liberalism (terminology taken and freely translated from Savin[31]). Between these two unrealistic extremes lies an area of possibilities and opportunities for mankind, requiring balance, dialogue and mutual understanding, as well as significant changes indecision-making and legal frameworks.

UNCLOS already imposed the concepts of MSY and optimum utilization and referred to the need to take into account the reproductive needs ofspecies associated with or dependent upon harvested species. It did not impose on coastal States the heavy burden of proof before action could be taken even if it did not give much guidance on how to build consensus (apart from broadly referring to co-operation) and how to act if consensus could not be reached. This and the fact that precautionary techniques have always been available in the fisheries management tool-box lead us to conclude, with Nollkaemper[7] and Hey,[25] that the direction of the methods required under the Precautionary Principle is not a new one.

Instead of introducing a fundamental change, the Precautionary Principle follows and stresses the trend towards more environmental concern already expressed for instance in the FAO Technical Conference on Fisheries in Vancouver (Canada) in 1973[12] and in the FAO World Conference on Fisheries Development and Management, Rome 1984. It puts the focus more clearly on uncertainty and the related hidden costs of present decisions for future generations. It is promoted as a means to ensure inter-generational equity but, if incorrectly applied, is an attempt tore-allocate resources to non-consumptive users often without much reference or concern towards intra-generational equity or scientific objectivity.

The Principle underlines a growing consensus on the approaches to be taken. Its implicit extension to fisheries emphasizes the growing awareness that fisheries management cannot be seen in isolation and must fit an integrated context which satisfies the requirement for long-term resources sustainability and environmental conservation. The trend is particularly striking in coastal areas where the concept of Integrated Coastal Areas Management and Development (ICAM) is developing extremely rapidly. The psychological importance of coining a new term should not be underestimated and as Nollkaempfer points out, if this term is perceived by policy-makers as carrying with it the feeling of urgency and of the need to take drastic preventive measures, it may be effective where traditional jargon failed.

No matter how irritating environmental constraints may be, a responsible approach is required for at least two good reasons. First, it is required for the long-term survival of the economic activity. Second, taking the USA as an example, commercial fishermen represent 1% of the voters while recreational fishermen represent 20% of the voters." The 'public' pressure, triggered by environmental (or pseudo environmental) considerations could therefore lead to actual shifts in resources allocation to user-groups considered, rightly or wrongly, as environmentally safer. It is important to stress here, with Miles" and Sumi[35] that the principles and criteria adopted to solve the high seas problems will, most probably, end up also in national law inside EEZs.

Following the recommendation of its member countries, FAO will develop guidelines for Responsible Fishing. The International Conference on Responsible Fishing (Cancun. Mexico, May 1992), organized by Mexico in close consultation with FAO, recognized the need for such a comprehensive and balanced concept of sustainable utilization of fisheries resources in harmony with the environment. The concept intends to promote fishery practices compatible with the requirements of ecosystems, ocean resources and consumers (food quality) and the guidelines needed for its implementation will have to give due consideration to the need for precautionary approaches.

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COUNTRY STATUS PAPERS

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6. I BANGLADESH

FISHERIES OVERVIEW & FISHERIES MANAGEMENT

Introduction

The total fish production of Bangladesh is 1.264 million mt., of which the freshwater sub-sector provides 72% and the marine sub sector provides 28%. Fisheries accounts for about 80% of the animal protein consumed in the country and is a source of both employment and foreign exchange earnings. But despite a continuous increase in fish production, it has not been able to cope with the fast- growing population.

In 1975-76, the country's fish production from all sources was 640,000 mt. In 1994-95, this figure rose to I. 17 million mt, whereas the per capita fish consumption went down from 33.498 to 20.5g. This is so because fish production increased only in arithmetical progression, whereas the human population increased geometrically.

Bangladesh declared an Exclusive Economic Zone of 200 nautical miles in her sea waters in 1974 (Fig. I). As a result, an area of more than l,20,000 sq. km. is now under the economic jurisdiction of the country for exploration, exploitation, conservation and management of living and non-living resources. The development potential of this sector has not been properly exploited. Rather, because of unplanned and irrational increase in fishing effort, many of the marine fish and shrimp stocks have already declined. As a result, coastal fishing has became non-remunerative, fisherfolk are getting poorer and thus putting more and more pressure on the resource – a fruitless quest for survival. But the impression that the potential for marine resource exploitation has got exhausted is incorrect.

Bangladesh is a typical multispecies fishery. A number of species – demersals in particular – are exploited by every single type of fishing operation.

Both freshwater and brackishwater aquaculture are practised in Bangladesh. The Bay of Bengal and adjacent river mouths are characterised by strong waves and wide tidal and salinity fluctuations. Extensive areas of the coastal belt are, however, under shrimp-based brackishwater aquaculture. Fisheries, including aquaculture, constitute a vital source of food, employment, trade and economic well-being.

In recent years, Bangladesh fisheries have become a market-driven sector. Coastal fisheries entrepreneurs have tried hard to take advantage of these opportunities by investing in hatcheries, processing factories and intensive shrimp culture in response to growing international demand for fishery products. As a result, repeated pressure is applied in an unplanned manner on valuable shrimp resources.

Production of fresh water & marine aquaculture

Total fish production during the past decade has been increasing. It has gone up from 8. 15 lakh mt in 1986-87 to 12. 64 lakh mt in 1995-96. The fish production from different sources during 1990-91 to 1995-96 is indicated in the table below:

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Year	Inland Fish Production (MT)	Cult ure Production (MT)	Marine Production (MT)	Total (MT)
1990-91	4. 43	2. 11	2. 42	8. 96
1991- 92	4. 97	2. 27	2. 42	9. 52
1992-93	5. 33	2. 28	2. 50	10.21
1993-94	5. 52	2. 75	2. 60	10.97
1994- 95	5. 70	9. 30	2. 70	11. 79
1995-96	5. 95	3. 90	2. 79	12.61

Fish consumption, demand & export

Fisheries accounts for about 4.7% of the GDP and provides about 80% of the animal protein consumed. Despite the growing fish production, per capita consumption has fallen from 33.45 in 1975-76 to 20.5 gm in 1995-96. The recommended per capita fish consumption is 30 gm/day.

The export earnings of fishery products have risen sharply during the past two years, from 903.9 million taka in 1993-94 to 1,340.9 million taka in 1995-96. It accounted for 9.12% of the export earnings in 1995-96. The export earnings from 1990-9 I to 1995-96 are given in the table below.

Year	Amount in (MT)	Amount in (Crore Taka)
1990- 91	26,109	576.62
1991-92	22,080	524.35
1992-93	26,607	700.29
1993- 94	30,639	903.9
1994-95	40,419	1,285.7
1995-96	38,929	1,340. 9

Stock assessment results, facilities and present activities

A number of surveys have been conducted since 1958 in the marine waters of Bangladesh. Most of these surveys have been of an exploratory nature and oriented to fishin g and feasibility studies. Some surveys have been conducted to assess the standing stocks of marine resources, particularly the demersal stocks. But hardly any survey work has been done to assess pelagic resources in a reasonable manner.

The results of demersal fishery resources assessment vary considerably from those of West (1973). Through a desk study, he estimated the standing stock of demersal fish at 2,64,000 mt. to 3,74,000 mt. and the shrimp standing stock at 9,000 mt. His estimate was questioned by many authors. But recent results – from the surveys conducted by FridtjofNansen and Anusandhani before and after 1984 -show similar results. They estimate the standing stock of demersal fish to be within a range of 150,000 mt. to 160,000 mt. During the Dr. FridtjofNansen survey (Saetre, 1981), an acoustic study estimated the pelagic stock to be from 90,000 mt. to 160,000 mt. This figure was considered an under-estimate.

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Fig I. Marine and Coastal Waters of Bangladesh

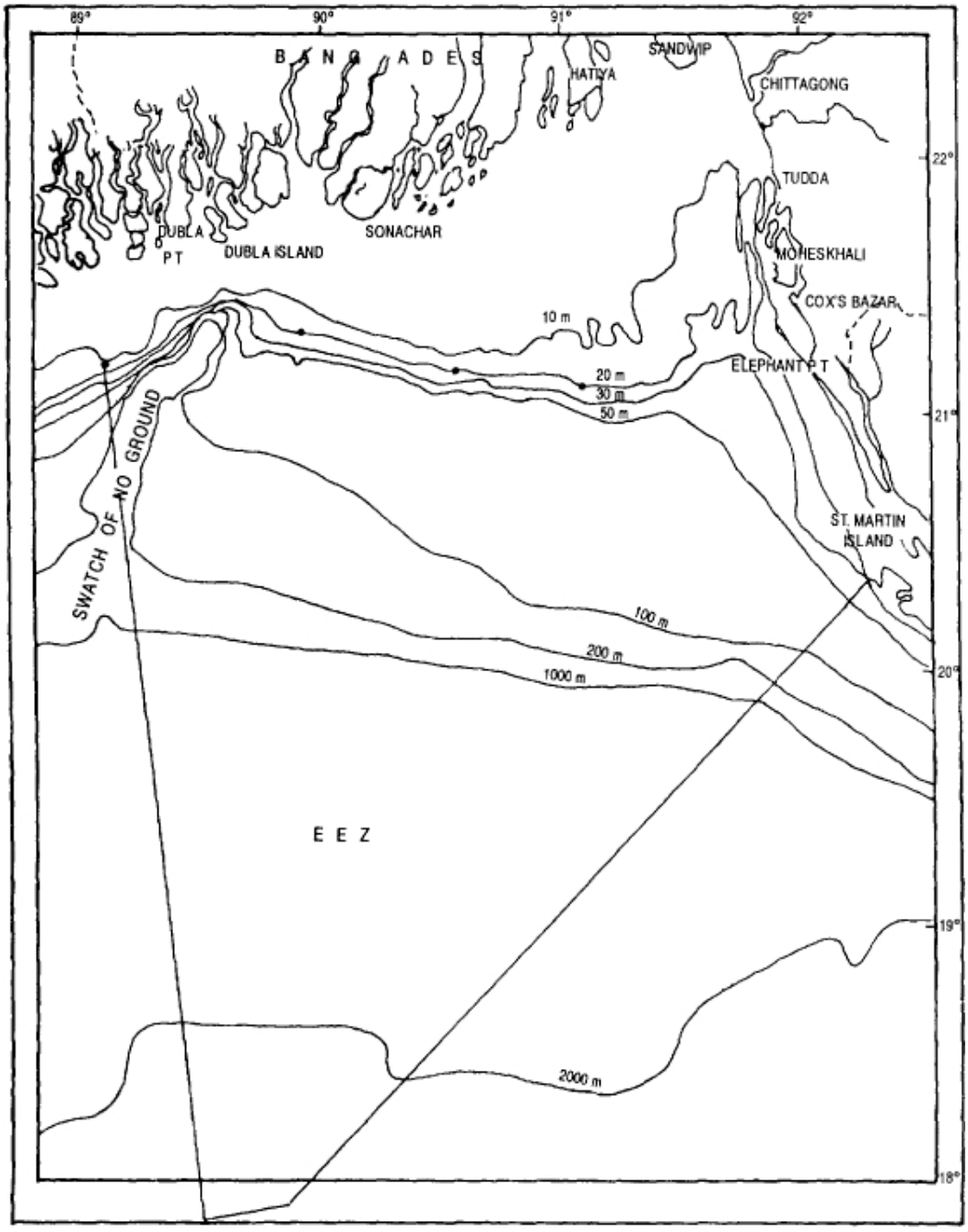

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Fig 2. Life Cycle Pattern of Panaeid Shrimp

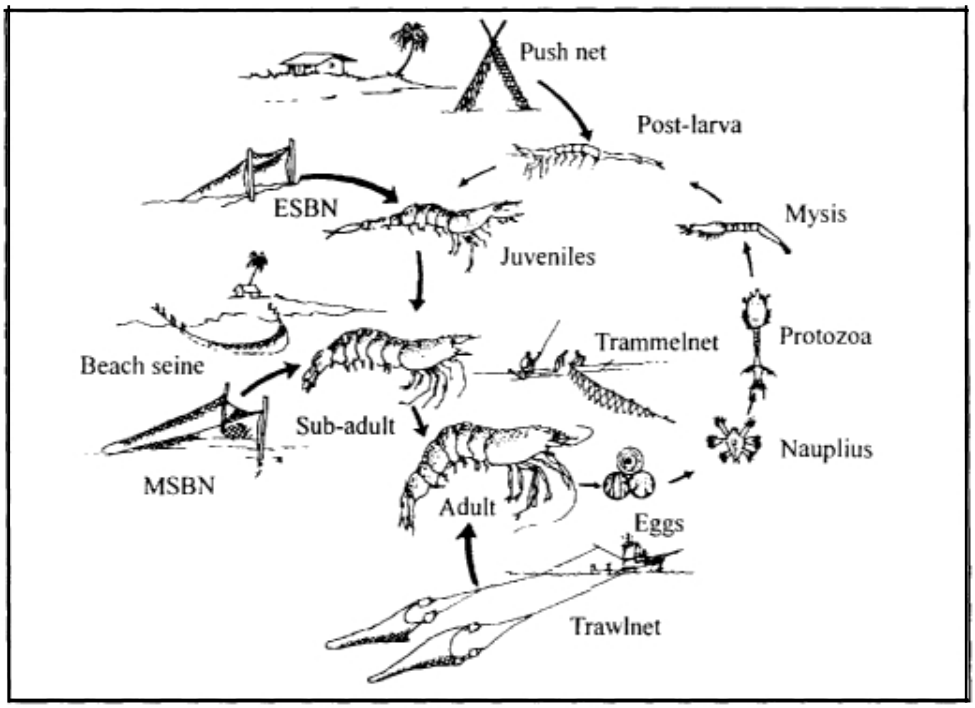
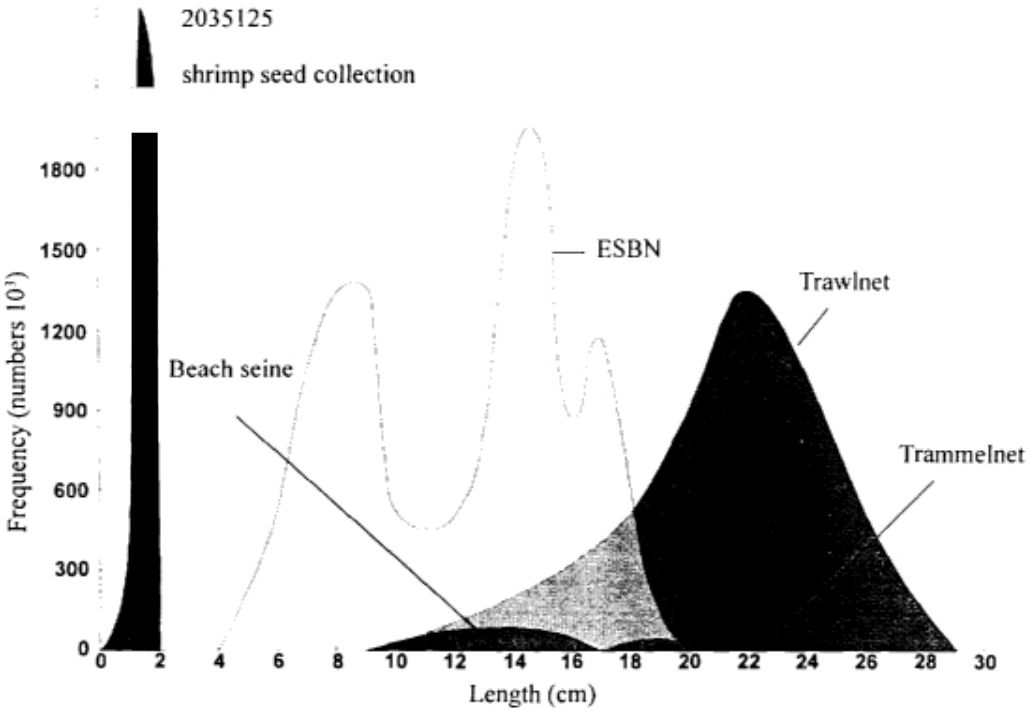


Fig 3. Annual Catch (number) of tiger shrimp *(P. monodon)* by length and gear



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Parameters of fish population dynamics for various commercial species of shrimp and finfish were estimated. The results of stock assessment studies so far achieved have been treated with these parameters to find out the fisheries potential for different resources. At this stage, it has been estimated that 40,000 mt to 55,000 mt of demersal finfish can be harvested annually from the offshore fishing grounds lying between the 10 m and 100 m depth zone. The maximum sustainable yield of shrimp has been estimated at 7,000 to 8,000 mt annually: this also includes the resources of the shallow water zone.

in the coastal area, infrastructure and service facilities are inadequate. In the absence of proper landing centres, artisanal fishermen land their catches at scattered places without processing, marketing and transportation facilities. It is only the industrial trawler fleet (public and private) that lands at defined places. Some of the mechanized hilsa boats land at the few landing centers of BFDC. The other private landing places do not have adequate ice, freshwater, berthing and bunkering facilities. The BFDC operates four landing centers in Cox's Bazar, Khulna, Barisal and Patuakhali districts. It has modern fish-landing, preservation, ice, water, berthing and bunkering facilities at Chittagong, that are used for its own fleet as well as for extended services to private operators. Such landing centers need to be developed in every coastal district and at other important landing centres.

The DOF marine wing has two establishments one for survey and monitoring another for scientific staff. But this is inadequate, hardly enough to carry out the task ofoperating two research vessels as well as land-based work for routine collection and processing of industrial, semi-industrial and artisanal, statistical and biological data. At present, the stock assessment survey and monitoring work cannot be continued as per schedule because of the condition of the vessels and the allocation ofinsufficient funds for maintenance, annual dry docking and procurement of equipment. The scientific staff are few and inadequately trained. Their exposure to programmes for marine and brackishwater research is limited.

Present Fishing System

Marine fishery resources are exploited by

(i) The Industrial/Trawl Fishery, and

(ii) The Artisanal Small- Scale Fishery

The Industrial/Trawl Fishery, is a relatively new development in Bangladesh; it began in 1972. At present, 4.5 shrimp trawlers and 17 white fish trawlers are in operation. Among the shrimp trawlers, five trawlers have a wooden body, the others have a steel body. Among the white fish trawlers, three have wooden bodies, the others have steel bodies. The overall length of shrimp trawlers varies from 20. 5 m to 44.5 m, while the white fish trawlers range from 70. 5m to 28m. Engine power varies from 350 to 1200 HP, but mostly falls within the 550-850 HP range.

The white fish trawlers use mostly high opening bottom trawls from the stern side. Cod-end mesh size is 60 mm. The shrimp trawlers use outriggers and operate two nets at a time from two sides with booms and use modern shrimp trawl nets with cod-end mesh size ranging 45-50 mm. The headrope length in the trawler fleet varies from 18 m to 32 m. Almost all the vessels are equipped with modern navigation, communication and fish-finding equipment. Trawl fishing is restricted to operate within a 40 meter depth contour.

The Artisanal/ Small-Scale *Fishery;* Till mid- 1960, only traditional craft operated in estuaries and coastal waters. Two organizations -the Bangladesh Fisheries Development Corporation (BFDC) and

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the Bangladesh Jatio Matshyajibi Samabay Samity (BJMSS) – started the process ofmechanisation by importing and introducing marine engines.

These fisheries include different types of fishing craft and gear. Some of the gears are operated by mechanized /motorized boats, some others by country boats (row boat, sail boat), some without any boat. These include five different types of gill nets (i. e drift gill net, fixed gill net, large mesh drift net, bottom set gill net and mullet gill net), three types of set bagnet (i. e estuarine set bagnet, marine setbag net and large mesh set bagnet), trammel net, bottom longline, beach seine, and many others scattered throughout the coast and estuaries which operate up to a depth of 40 meters (Fig 2).

According to the frame survey of traditional and mechanized boats carried out by the FRSS (Fisheries Resources Survey System) of the DOF (Department of Fisheries) during 1984-85, a total of 17,33 I boats were in operation in the marine artisanal fishery, of which 3,3 17 were reported to be mechanized and 14,014 non-mechanised. According to the Marine Wing of the DOF, some 6,000 mechanised boats are currently in operation in the Bay, of which about 4,000 are registered with the MMD (Mercantile Marine Department). According to another estimate (Nuruzzaman, 1991) the number of traditional and motorized boats in the estuaries and coastal waters of Bangladesh is 20,000 and 12,700 respectively.

The following nets are used in marine and coastal waters. They need special mention because of their major contribution in production or their major role from the management standpoint:

a. Drift Gill Net (DGN)

Drift gill nets are operated at depths varying from 20 to 40m exclusively for pelagic fish. The principal catch is *Hilsa ilisha.* Skipjack tuna, mackerels and sharks figure as by-catches. The nets are made of nylon twine or tire cord and are operated by motorized boats. The mesh size is around 100 mm. Hilsa drift gill nets operate during March to October, the other gill nets from November to February.

b. Estuarine set bagnet (ESBN)

This is a trawl-type bagnet fixed at the bottom in canals and estuaries all around the coastline. It is the most widely operated net in Bangladesh. The depth of water during the operation varies from 3 to 10 meters. The net operates throughout the year. It is very effective for capture of juvenile/undersized species of fish and shrimp of marine origin. The gear is in fact destructive to the stock from the biological sustenance point of view. The cod-end mesh size varies from 5 to 18 mm. These nets are mainly operated by row boats.

c. Marine set bagnet (MSBN)

This net is almost similar to the ESBN and follows the same type of operation. But the mesh size is a little bigger. It operates in winter from mid-September through February in the deeper waters from the island base e. g from Dubla island, Sonadia island and Mohipur – at a depth of 10 to 30 m. The net is operated by mechanised boats.

d. Trammel net (TRN)

This is a three fold bottom-drifting gill net targeted at penaeid shrimps but also useful for capture of valuable finfish species. The net is comparatively new in Bangladesh and is concentrated along the

Teknaf – Cox's coast, The mesh size at the inner wall is 40-50 mm, and is made of nylon twine. This gear is operated by country rowing boats within a depth of 5 to 15 meters and operates almost right through the year. The sizes of species caught are biologically sustainable. Expansion of operation, both horizontal and vertical, could be encouraged.

e. Bottom longline (BLL)

Bottom longlines operate during the period mid-August to mid-February at depths of 20 to 30 meters, i.e. beyond 20 km from the shoreline, mainly from Cox's Bazar. These gears are operated from 6- 14 HP mechanized boats. They target jewfish and croakers, and also catch salmon, cat fish, threadfin bream etc.

f. Beach Seine (BS)

Beach seine are semi-encircling nets operated during November to February from the beach and from March to November in the estuary by country boats. They are concentrated in the Teknaf- Cox's Bazar coast but available throughout the country. Since the mesh size is small, i.e 12 mm in the middle, and the area of operation very shallow, the beach seine catch the young and juveniles of jew fish, anchovies. clupeids and small shrimps.

g. *Shrimp-seed collecting gears*

Fine-mesh push nets, fixed bagnets and dragnets are used throughout the coastline in creeks, canals and estuaries for harvesting the larvae of P. *monodon,* the tiger shrimp. These nets are operated seasonally almost throughout the year (such as January to October in Cox's Bazar, February to April in Patuakhali, January to April in Khulna, November to August in Satkhira). The catches contain larvae and juveniles of other shrimps, fin fishes and zooplanktons.

The tiger shrimp larvae constitute less than 1% of the total catch. The remaining 99% which constitute other species, are destroyed by the seed collectors who are interested only in shrimp seed. This practice results in serious damage to the resource and to the ecology. But it cannot be stopped because of the demand for shrimp fry from the shrimp culture industry. Measures for monitoring and control are, however, being taken – including development of hatcheries as a substitute for wild capture of shrimp seed. Fishing by different crafts and gears has an impact on the fish population.

Artisanal Fisheries Sector

Artisanal fisheries includes a number ofdifferent type of fishing gears and crafts as listed above. According to recent survey reports, drift gillnetters account for about 55% of the artisanal production (mainly composed of Hilsa), while estuarine set bag nets account for 30%. (Most of the catch consists ofjuveniles and post-juveniles of animals of marine origin).

a. Gill net fishery

These fisheries include drift gill net, fixed gill net, large mesh drift net, bottom set gill net and mullet gill net, These do not by themselves indicate overfishing. But fishing of Hilsa spawner and Jatka in the riverine ecosystem does raise management concerns. Overfishing is noticed, however, in the exploitation

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of brooders of Indian Salmon and long jew fish (Lakhua and Lambu) by large mesh driftnet (LMD) in the shallow waters off Cox's Bazar.

h. *Set bagnet fishery*

Catch assessment and biological information on the pattern of exploitation by this fishery was studied in detail. It is evident that this fishery is the most destructive regular fishery. It was found that species of brackishwater origin i.e *Aceles* indicus (the sergestid shrimp), Raconda *russeliana* and Setipinna taty are not over-harvested, they are under- fished to some extent. Almost all species of marine and freshwater origin which visit the brackishwater area for nursery and breeding are seriously overfished (growth overfishing). Fig 3 shows that P *monodon* (tiger shrimp), caught by this gear before the adult stage, are not permitted to join in the spawning process.

C. *Shrimp PL fishery*

The coastal aquaculture industry for penaeid shrimp has developed and remained dependent on the wild seed. So harvesting of the larvae and post larvae of almost all fish and shrimps along with that of tiger shrimp are increasing day by day. According to a recent survey report (Paul et al 1993), more than two billion larvae of Penaeus monodon are caught by seed collectors annually throughout the coastline.

These two billion larvae constitute less than two per cent of the total catch of seed collected. The rest (more than 98%) is just killed. These include the larvae of other shrimp fish and zooplankton. On the other hand, out of the total number of P. monodon removed from the sea and estuary by different fisheries, the shrimp seed fishery alone takes 99.568 %, while the trawl fishery takes 0. 2 15% only. But if the percentage of harvest is calculated in terms of weight, the impact is just the reverse – i.e the trawl fishery takes 6 I .27% and the shrimp seed fishery only 3.08%.

A considerable part of the two billion larvae of tiger shrimp (and other fish and shrimp larvae) would have the chance to go back to the sea and grow to adult size and substantially increase the catch and catch rate of shrimp by offshore fishing gears – if it is not caught in the estuaries and the sea coastline. The main solution that can permit this scenario is raising commercial hatcheries for supply of shrimp seed. Controlling the transportation, handling and stocking of seed may also reduce the demand of seed for aquaculture.

Industrial Fisheries

a. *Truwlers*

The effort in the trawl fishery during the past one and a half decades has stayed around 5,000-6,000 standard fishing days to produce 3,500-6,000 mt of shrimp. The MSY of penaeid shrimp is 7,000 mt. The optimum effort for producing the amount is 7,000- 8,000 standard days. Till date the shrimp production is much below the MSY level. White fishes landed by the trawler fleet are in the range of 8,000- 12,000 mt (only 20% of the actual catch), while 80%, equivalent to 35-45,000 mt (White & Khan 1985) are discarded dead in the sea. Even if the discarded amount is considered as production, MSY is not achieved. The MSY is 85,000 mt (Lamboeuf, 1987). Although effort in the trawl fishery is below the optimum and the gear is non-selective, the population of tiger shrimp has become over-exploited.

Present Management System

The present management system largely focuses on the industrial trawl fishery. The other brackishwater and marine fisheries do not see very much of management practices. In 1983. the Government of Bangladesh enacted the Marine Fisheries Rules, 1983, in accordance with the provisions of the Marine Fisheries Ordinance, 1983. The marine fisheries rules amended in 1993 provide for licensing and monitoring of artisanal mechanised fishing boats. The monitoring of fishing vessels is carried out only by the Marine Fisheries Surveillance Checkpost at Patenga, Chittagong.

The main features of the Ordinance are as follows:

1. Every fishing vessel should take a license from the Department of Fisheries

2. Every fishing vessel should supply its catch and effort data regularly to the Fisheries Department.

3. Rules prohibit the following methods:
   a. fishing with any gear having mesh size smaller than the mesh size mentioned in the rules.
   b. Fishing with any kind of explosive, poison or noxious substance.
   c. Fishing marine species of any type with electrolighting.

4. Mesh size: All licensed fishing vessels should use nets of mesh size with the following dimensions:
   a. for shrimp trawl net (boom) with low opening, the minimum mesh size shall be 45 mm at the cod-end.
   b. for fish trawl net, mesh size at the cod-end shall be 60 mm
   c. for large mesh drift net (LMD), the minimum mesh size shall be 200 mm
   d. for small mesh drift net (LMD) the minimum mesh size shall be 100 mm
   e. for set bagnet (behundi net) the minimum mesh size at the cod-end shall be 30 mm.

5. Area for fishing

   The area upto 40 meter depth is reversed for artisanal fishing gear.
   The industrial fishery is allowed to operate beyond 40 meter depth.

Limitations, enforcement, compliance and inadequacies of the present management system

Management of marine fisheries is a very big task. It calls for activities both within and outside fisheries. The following constraints are encountered during management:

1. *Limited capabilities:*

DOF in respect of marine fishery performs two main functions (a) monitoring of the fishing gears, and vessel and stock assessment for sustainable development of fishery resources (b) implementation and enforcement of rules under the Marine Fisheries Ordinance 1983.

To discharge these two responsibilities, the DOF have two units. But these are managed by, a limited number of scientific staff and legislative officers. So the capabilities of the organizations under MOFL, particularly in respect of marine and brackishwater fisheries, need to be strengthened greatly.

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2. *Need for revising the existing Marine Fisheries Ordinance 1983*

The Marine Fisheries Ordinance 1983 and subsequent rules need to be amended to meet current practices and requirements. Existing rules mention a 30 mm codend mesh size for ESBN – which actually use only 8-12 mm mesh. But recent experimentation and investigation reveal that 30mm cod end in ESBN would result virtually in **no** catch, since they target juveniles. It would also be non-remunerative for fisherfolk. So mesh size increase would not help management. This is why complete withdrawal of this gear from the estuarine habitat is necessary. Accordingly, it needs to be included in marine fisheries rules as follows:

ESBN fishery: As an immediate measure to reduce effort, ESBN operations (during the periods July-September and February - April) in the offshore region of Cox's Bazar district, should be totally stopped.

Large mesh drift net: Operation of LMD in shallow waters should be banned

Marine set bagnet: Should use 45 mm cod-end mesh size.

Trummel net fishery: As the trammel net fishery has been proved to be a biologically sustainable fishery. it should be extended up to 40 m depth of water after appropriate biological and technological studies.

Truwl fshery.

(a) A shrimp trawler that is dying out should be replaced not by a shrimp trawler, but by a fish trawler.

(b) Existing rules stipulate that white fish should constitute 30% of the total catch. The figure should be 50%, not 30%.

(c) 20-day fishing trips should be allowed, instead of the 30-day trips mandatory at present.

(d) To facilitate resource monitoring and management, an enhanced fee should be included in the annual licence fee for fishing vessels.

Registration of mechanised boats: In the MFO'83 and subsequent rules, provision has been made for licensing of artisanal fishing boats with DOF. But it is the Mercantile Marine Department that deals with the registration of these boats. It **is** evident, however, that all the boats are not registered. Fishermen do not like observing formalities with two different departments for registration and for fishing licence. The DOF has the capability to check the craft's health and safety equipment. These two functions need to be placed under the DOF for an easy monitoring and enforcement system.

Besides, a fishing boat – whether mechanised or non-mechanised – has to face many other departments before it can legally go fishing. This makes registration a complex procedure which is not in fact conducive for the smooth operation of fishing boats. For instance, a boat after construction needs to be registered with the Mercantile Marine Department, and obtain a valid inspection certificate (for hull and safety equipment) from the same authority. After that, the DOF provides a fishing licence for a year, then pays river dues, income tax, forest royalities, local tax for water bodies etc. All these activities should be unified and dealt with by a single authority – this is the demand of fishermen.

Co- ordination among different organizations

The various waters in the coastal districts come under different organizations – the Ministry of Land, the Ministry of Forests, the Ministry of Water Development and Irrigation, the Ministry of Fisheries and

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Livestock. A high-power committee co-ordinates with different organizations for sustainable development and integrated management of coastal fisheries zones.

Present departmental strength, facilities and needs

The Department of Fisheries is the key organization responsible for development and management of fisheries. This department has two wings, Inland and Marine, each headed by a Director. The Marine Wing of DOF is located at Chittagong. The Marine Fisheries Ordinance 1983 and the subsequent Marine Fisheries Rules (Amended) 1993 were enacted to serve as a legal base for the conservation and management of marine fisheries. A system of licensing all fishing vessels, together with a provision for providing Identity Cards to fishermen, has come info force from September 1996.

Previously, only deep sea trawlers were provided with a licence. But in spite of a coastline of 480 km and fishing activity in every nook and corner of the coast, the present system of a single office in Chittagong with a meagre staff severely hampers the management and conservation initiatives of the DOF's marine wing. An increase in the strength of infrastructure facilities and personnel has become imperative for proper management of marine fisheries. In this context, a proposal for dividing the entire coastal area into seven zones – Cox's Bazar, Chittagong, Noakhali, Khulna, Barisal, Bhola and Patuakhal i – with provision for establishing a marine fisheries office in each zone with appropriate staffing and infrastructure facilities, should be considered.

Fishing Communities

Fishing is traditionally a low-status occupation, and the majority of fishing families belong to socially, neglected Jaladas (who are Hindus). With increasing commercialization of marine fisheries and the rise in landlessness due to population pressure on limited agricultural lands, a large number of Muslims began taking up fisheries full time.

The traditional fishing communities live in coastal villages, generally at the very edge of the land mass, where land is least productive and subject to river and sea erosion. Exposure to floods, fires and storms is high. Cyclones are regular annual phenomena in coastal areas. They are often accompanied by tidal bores measuring 10 to 20 feet above the high tide level. The cyclones damage the fishing crafts and gears of fishermen and destroy their livelihood. Examples: the cyclones of November 1970 and April 1991, which led to severe loss of life and material. Government rehabilitation programmes do not compensate sufficiently for these losses.

The living conditions offishermen, particularly in urban areas, are deplorable. In such areas they live in slum settlements noted for congestion, sub-standard housing, inadequate municipal services e. g refuse disposal and sanitation. The only facility available for bathing and washing is a small polluted communal pond. Fishermen in rural areas do not face such severe congestion, but battle difficult conditions regarding sanitation, housing and water supply.

Within fishing communities, there are two distinct groups: those who own boats and fishing gears, and those who work only as fishing crew. Most fishermen are landless. Many of them are emplolyed only, during the fishing season. A few revert to estuarine fishing when the marine fishing season is over. A majority of fishermen thus rely on money-lenders during the off-fishing season to meet their subsistence needs. Result: most fishermen are chronically indebted to fish traders and money-lenders. The fishermen

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are inclined to borrow from money lenders despite the presence of formal credit systems in some areas. Many of the larger mechanised boats and gears are owned by individuals not actively engaged in fishing. They have fishermen as crew on a share or cash basis (or on a wage basis – in a few cases).

Most fishing communities live below the poverty line. Within a community, incomes arc uneven and disparities quite high. Since fishing is a seasonal activity, incomes are not evenly spaced through the year. This uneven pattern of earnings, together with spending on non-essentials, inhibits savings and breeds indebtedness. Fishermen do not get the right price for their catches. Middlemen acquire fish from them at hefty discounts because of the loans they have given fishermen. The social structure and the low economic level of fishing communities has made it difficult for fishermen to organize themselves into economic units or into co-operative societies.

The increased effort in the estuarine set bagnet fishery and the shrimp larvae fishery has created severe problems from the conservation and management standpoint. These fisheries have proven to be destructive and are major obstacles to the recruitment of major fish and shrimp species to deep-water areas. A study programme to motivate fishermen and let them participate in the management of marine fisheries is being implemented with the help of BOBP. This programme seeks methods to make fishers more conscious of the fishery resource and the need for management, and to help them find alternative jobs that offer better incomes, leading to better living standards and a brighter future for their children.

Better programmes for community development and social welfare are required to provider basic adult education, primary education for children, health care, and better housing resettlement in a less congested environment and upgrading of hygienic standards. The establishment of close liaison and understanding between the fisheries department and other government departments concerned with health education. rural development, land etc, will be needed to obtain these services for fishing communities.

Fishermen need training for marine sector development

Subsequent to development of a technology for management practices in inland fisheries. the DOF (Directorate of Fisheries) has undertaken elaborate training programmes for its staff. But the DOF does not have an organized training programme to transfer the technology to fishermen and ensure that they protect and manage the marine fishery resource.

Thorough participation: A short-term training programme with active participation by fisherfolk can help enhance fisherfolk knowledge about resource limitations. The programme would consist of the following elements:

1. Different types of fishing gear and their operation.
2. Destructive fishing gear
3. improved gear to reduce juvenile catches without reducing the incomes of fisherfolk.
4. Improving the value of ESBN catches
5. How to improve the value of the catch through processing and marketing.
6. Impact of pushnet fishery

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7. Transport of shrimp fry

8. Maintenance of crafts and gears.

Suitable, economically viable alternative fishery methods to replace destructive fishing gears can be established with the active participation of fisherfolk.

Through motivation: Before introducing any restrictions on tishing operations, the economic effect on very poor fisherfolk should be assessed. Special social training programmes should be undertaken to motivate the fisherfolk to replace destructive fishing gears with alternative income- generating fishing methods.

Training inputs

For improved marine fisheries management, emphasis should be placed on training target groups in sustainable methodologies. The coastal shrimp culture industry depends solely on the push net fishery for supply of shrimp seed from the wild. More than 2,035 million Bagda 'post larvae are collected annually – this is only one per cent of the total catch of the fishery. The rest of the catch – which is equivalent to about 200 billion PL of the shrimps/fishes and zooplankton – is thrown on the sands to die. This is considered as a serious growth overfishing.

Up to 60% of the PL collected from nature perish during sorting, transportation and stocking. If this mortality could be reduced substantially, 50% of the PL could be left behind in the sea and enhance production, A strong extension and motivation campaign is necessary to address that problem. Alternative sources for seed supply should be developed so that seed collection effort is reduced. The government should help train fry collectors in simple operations like keeping the larval catch in good condition in a large earthen or aluminium pot or bowl, and releasing what is not wanted into the sea. Extensive training of fry catchers and traders is necessary for this purpose.

Recommendations

I. The dependence on natural shrimp seeds by shrimp farms has to be gradually reduced. Supply from shrimp hatcheries has to be increased.

2. Destructive fisheries such as ESBN, push net fishery and beach seine fishery have to be gradually eliminated with the help of appropriate rehabilitation programmes.

3. The feasibility of extending the trammel net fishery into deeper waters, also the feasibility of longlining and other viable fishing methods, should be studied in detail with the participation of ESBN fisherfolk.

4. Under-exploited and unexploited resources such as tuna and tuna-like fishes, mussels, squids, octopus, lobster etc, have to be assessed through scientific surveys. Initiatives have to be undertaken for their exploitation with strict monitoring and control programmes. A project should be undertaken in this connection.

5. The industrial demersal trawler fleet (particularly shrimp trawlers) should be phased out gradually and replaced by the artisanal fishing fleet in order to overcome discards at high sea. This will also help to reduce capital cost and generate socio-economic benefits. This in turn will enhance optimum exploitation of resources and maximization of benefits from the limited resources.

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6. A more comprehensive awareness-building programme is needed among coastal fisherfolk to ensure their participation in government management and conservation initiatives.

7. Regulatory systems including new revenue controls. closed seasons, net mesh limits and stock conservation rules should be established as a matter ofurgency by coordination ofresponsibilities and management within and outside the Sunderban reserve forest between Departments of Fisheries and other related departments.

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6.2 INDIA

"NO EVIDENCE OF OVERFISHING IN INDIA'S EEZ"

India with its large coastline and Exclusive Economic Zone is a major player in marine fisheries in the Indian Ocean. The country has a coastline of 8,129 km, of which 4,568 km is in the Bay of Bengal. The marine fisheries potential of the country was estimated in 1977 at 4.49 million tonnes. However, a revalidation exercise in 1991 came up with an estimate of 3.90 million tonnes, of which 2.21 million tonnes is within 50 metres depth and 1 .69 million tonnes in the waters beyond 50 metres depth.

The annual marine fish catch has touched 2.71 million tonnes in 1995 - 1996. Together with inland fish production of2.24 million tonnes, making a total production of4.95 million tonnes, India is perhaps the seventh largest producer of fish in the world.

At this level of production, the availability of fish per caput per annum (of the fish eating population estimated at 56% of the population of the country) is about 9 kg. This is substantially below the World Health Organization norm of consumption of 11 kg per caput per annum. One must note that about 0.5 million tonnes of fish are handled/processed for export and substantial quantities of trash fish go into the preparation of fishmeal/feed.

Against this background, the Government have been playing an active role in promoting the development of fisheries, fishing communities and fish production. The objective is to push up fish production to 6.37 million tonnes by 2001 – 2002 AD. This will take availability to 11.24 kg p.c.p.a. The Government of India welcomes the initiatives which led to the finalization of the Code of Conduct for Responsible Fisheries following the World Fisheries Conference at Cancun, the U.N. Conference on Environment and Development of Rio, and the U.N. Conference on Straddling and Highly Migratory Fish Stocks. India had participated actively in the drafting of the Code of Conduct for Responsible Fisheries. India welcome also the initiative of the FAO - BOBP and the host country Indonesia in organizing this workshop on the Precautionary Approach to Fisheries Management.

Throughout its history, India has been conscious of the need for conservation and sustainable use of the world's resources. The ethos of the large number of religions and cultures co-existing in the country is one of harmony with nature. A streak of vegetarianism running through many groups also keeps down demand for meat and fish to manageable levels. In this scenario the precautionary approach to fisheries management should almost be regarded as a part of the ethos of the people!

While overfishing is a problem in many of the world's oceans and seas, there is no evidence of any overfishing in the Indian EEZ – in zones 5 I and 57 of the FAO Marine Statistical Areas.

In fact, production is only about 70% of the assessed potential of 3.9 million tonnes. There are reasons to believe that as resources hitherto considered non- commercial are tapped in future, the potential itself will be found to be much higher. The total fleet at present (1994 - 1995) is 238,000 fishing crafts, of which only 46,900 are mechanised vessels. Of these mechanised vessels, only about 25% engaged mainly in trawling or gillnetting – have the capacity to make voyages of 6 - 8 days and fish in depths up to a maximum of 70 - 80 metres. Substantial areas of the continental shelf lying at depths beyond 70 - 80 metres, particularly on the N.West coast and the N.East coast, remain unexploited. These are about 191,000 traditional craft (catamarans, dugouts, plank built boats) of which about 32,000 have

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been motorized with outboard motors or small inboard engines. Such craft ply in the in-shore waters, going out on voyages of less than 24 hours.

While Marine Fishing Regulations Acts have been legislated by most of the coastal states of India, and these require registration of vessels with State Fisheries Departments, the reality of large numbers of fishing communities relying only on fishing for a livelihood cannot be ignored. Hence, entry restrictions on traditional craft do not appear feasible. At the same time, the GOI is conscious of the need to regulate the growth of mechanised fishing vessels and channel their growth in directions which would increase production from areas presently untapped.

To further this objective, it is proposed to go in for a new generation of fishing vessels between I.5 · 20 metres O.A.L, which would be able to tap waters of about 150 · 200 metres depth and go on voyages up to about l5 days. This would also help shift the fishing effort from the inshore/nearshore areas to offshore areas within the EEZ.

6.3 INDONESIA

FISHERIES AND FISHERIES MANAGEMENT OVERVIEW

1. Indonesia

The fisheries sector plays an important role in the national economy of Indonesia and its long-term development. Its share of the Gross Domestic Product is relatively small (about 3%).

Fisheries provides employment to over 4.3 million fishermen/fish farmers especially in coastal and rural areas. Handling, processing and marketing activities employ some more people. In all, the fisheries sector employs about 5% of Indonesia's total productive labour force.

The sector also supplies about 60% of the total animal protein consumed by the population with annual per capita consumption of about 19.4 kg. This is still below the national nutrition requirement level of 26. 5 kg/capita/year of fish.

The sector's growth over the last decade has been steady. Total fish production went up from 2.4 million tons (1985) to 4 million tons (1 994) with an average annual growth rate of 5.9%.

Table 1. Indonesia: Fisheries Production 1985 and 1994

Sub- sector	198.5 *(In '000 tonnes)*	1994
Marine Capture Fisheries	1,82 1	3,080
Inland Open Waters	269	336
Aquaculture	305	597
Total	2,395	4,013

The BOBP project area is in Tapian Nauli Bay, Sibolga, North Sumatera. It is estimated that almost 20% of the male population is engaged directly in fishing. Many more of the population, both men and women, take part in the processing, transportation and marketing of fish, and the building and servicing of boats and gear.

Three subject areas pose potential problems: mariculturc, anchovy lift net fishing, and small-scale fisheries.

The project's goal is to evolve model fishing villages to undertake community - based fisheries management. The project seeks to facilitate and enable improved management ofmariculture, anchovy lift net fishery and small-scale fisheries in the Tapian Nauli bay area of North Sumatera, through awareness-building, strengthening the institutional capacity of the agencies concerned and provision of technical assistance.

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II. Recent Perspectives and Trends in Fisheries Management (after 1990) in Tapian Nauli Bay, West Coast, North Sumatera Province, Indonesia

The West Coast of North Sumatera is divided into four district areas: municipality of Sibolga, the districts of Central Tapanuli, West Tapanuli and Nias. However, the BOBP operates during its III Phase only in Central Tapanuli and the Municipality of Sibolga.

The number of fishermen who capture fish in Tapian Nauli increases year by year. So does the number and size of the gear. But the fishing ground remains the same.

Fish capture technology has developed very rapidly. In comparison with large-scale fisheries, the production from small-scale fisheries which uses simple gear is low.

Devices such as high-intensity light (20,000 watt), echo sounder and GPS determine the position of the boat and the fishing ground and provide navigation aids.

There are more than 440 fishing crafts in Sibolga. It is estimated that 25% of them fish for small pelagics. Besides, there are 5 19 units of lift net platform and 170 units of moveable lift net. There are also many small- scale fisheries which use canoes, and boats without engines and gillnet monofilament as a fishing gear. The main product is usually small pelagic fish.

Grouper are being reared for live export to Singapore. Grouper farms started to develop in 1989 in Hong Kong and Malaysia after the Regional Fisheries Services (Dinas Perikanan) introduced such technology to the farmer.

Seed are still supplied from the wild. They are caught locally by fishermen. At present there is no grouper hatchery in Tapian Nauli Bay.

Till 1993, cage-culture production ofgrouper was very good. But production then fell dramatically due to outbreak of disease. Result: mass mortality of cage culture grouper. The number of cages therefore decreased from 398 in 1993 to 250 in 1996. Some surveys have been carried out but the disease still remains a mystery. So does its prevention.

III Problems

3. I Fish Capture

Large-scale fisheries using trap, purse seine, and moveable lift net as fishing gear run into conflicts with small- scale fisheries, which generally use hand line, gillnet, and lampara for small pelagics and operate up to three miles from the coast.

Small-scale and large- scale fisheries usually fish round the year without limits to area and season. As a result, fishermen catch small sizes of fish. This may be a problem for the re-generation of certain species in the long term.

The number of fishing crafts increase not only in quantity but also in type of gear, whereas the fishing ground is still the same. The level of exploitation will soon impair carrying capacity.

Fishermen usually fish in areas they are familiar with. Their knowledge of the habits and habitat of fish is limited. Transfer of fishing technology will therefore be very slow. The quality of fish during catch and after landing is very poor.

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3.2 Fish Culture

Grouper farming has grown very rapidly in Tapian Nauli bay. Both technology and management are simple and traditional.

The site of the majority of grouper culture cages around the bay has been selected on the basis of security and easy access, rather than the quality of the water in which the cages are set.

In most farms of Tapian Nauli Bay, feed frequency and quantity of feed are not very scientific or systematic because feed supply depends on trash fish stocks.

Grouper seed supply is very limited, both in and quantity and quality. Problems in seed supply may be caused by:

- Decrease in the quality of the nursery ground
- Lack of technology in seed capture
- Lack of technology in transportation
- No grouper hatchery developed yet
- No information about grouper seed potency in Tapian Nauli Bay

Grouper farms achieve a higher level ofenterprise than small-scale farms because of the higher investment.

There is no government regulation concerning location of grouper farms in North Sumatera. Result: possible conflicts between grouper farms and other users of the water surface.

IV Some suggestions to solve the problems

- Extension, training and education are needed to solve the problems of site selection and culture method. Seed supply problems can be tackled as follows:
- Identification of seed in Tapian Nauli Bay
  - Research on fishing gears that help grouper seed capture
  - Research on seed transportation methods
  - Research on treatment before the seeds are transferred to the grow-out facility
  - Research on grouper hatchery
- Capital investment can help develop small- scale farms.
- Government regulation in needed in order to manage water usage.
- Management is needed to produce a map ofthe fishing ground and improve control of resources exploitation.
- Regulations concerning fishing area and number of fishing craft must be strengthened to reduce conflicts between small-scale and large scale fisheries.

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- Research is needed on optimal light intensity for moveable lift net and purse seine as well as the right distance between the two.

A new technology in fish capture and culture must be introduced that does not damage the fisheries resource.

V Government's Actions in terms of Precautionary Approach

5.1 Capture

- Presidential Decree No 3911980 introduced a nationwide trawler ban in response to protests from fishing communities that large trawlers were destroying their traditional grounds.
- Minister of Agriculture Decree no 123/Kpts/Um/l975 provides for closed seasons, closure of fishing areas, and mesh size regulations.

5.2 Culture

- Presidential Decree No 23/l 982 on Mariculture Development in Indonesia.
- Presidential Decree No 473/Kpts/Um/&/l982: Guidelines on Mariculture Development in Indonesia
- Policies such as ban on broodstock capture, ban on capture of *Napoleon wrasse* (an endangered demersal fish found among coral reefs), ban on fish using chemicals and potassium.

5.3 Supervision of fshermen

Apart from regulations, the government will also improve monitoring and supervision of fishermen and fish farmers. It will strengthen extension and training through workshops for extension officers and meetings among them. Groups of fishermen and fish farmers will be set up to promote an agribusiness approach among them.

6.4 MALAYSIA

MANY MANAGEMENT MEASURES INTRODUCED

1. Description of the fishery setting

Malaysia has a long coastline of about 3,400 km made up of the main land masses of Peninsular Malaysia, Sarawak and Sabah, the EEZ waters in the Andaman sea, the Straits of Malacca, the South China Sea, the Sulu Sea and the Celebes Sea. With the declaration of the EEZ in 1980, the area available for exploitation and management increased from 47,000 to 160,000 square nautical miles. The bulk of the resources exploited come from within the continental shelf.

The main climatic influences that affect the sea conditions are those associated with the North East Monsoon and the South West Monsoon winds. In general terms, Malaysia has a warm water multi-species fishery in relatively calm water; natural phenomena like typhoons just miss Malaysia. The coastal zone includes a number ofecosystem types, of which the more prominent are the mangroves and the extensive mudflats in the intertidal zones where large rivers have their estuaries. These features cast their influence on the bottom areas of the coastal waters and the demersal coastal fisheries.

The mainstay of Malaysia's capture fishery lies the coastal zone, which is also the main aquaculture production area. This picture is both comforting and disconcerting. Comforting because our inshore fishery production from the coastal zone has been giving stable yields for many years, although it has reached the maximum exploitation limit. The manager's task is to ensure sustainable utilisation. It would be satisfying if one can claim that because of management measures already practised (in full earnest since the early '80s), the coastal fisheries has managed to maintain the landings of its coastal resources. The other comfort is to know that in the paper on the National Agriculture Policy (NAP), 1992 - 20 10, the growth rate figures for 199 1 - 1995 are calculated as 3.5% for agriculture and 1 1 .5% for manufacturing, while that for the fishery sector is 6.2%. It thus averages higher than the overall agriculture growth rate.

The fishery sector is expected to overtake other traditional contributors to the agriculture sector such as rubber and sawlogs. This shows that the fisheries sector has so far managed to hold itselfwell. Although it is not possible to gauge the success ofmanagement measures, there is enough indication ofstability of some kind in fishery resources.

Why is this picture disconcerting as well? Because, in a sense, our coastal fishery is vulnerable -being subject to any changes that take place 'upstream'. Malaysia is well aware of the impact of development on the environment. Some form of 'safe zones' must be set aside for aquaculture development. Since the coastal resource is fully exploited, it is imperative that the limited resources of the coastal waters are maintained and do not suffer decline. Aquaculture takes the front stage because it is seen to be a source of fish products for the growing population. Consumption (by an estimated population of 26.3 million) is expected to touch 1,579,800 metric tones by the year 20 10 (on the basis of an estimated per capita consumption of 60 kg per year). In 1994, the total marine landings exceeded 1,1 8 1,763 metric tonnes valued at over RM2.99 billion. Aquaculture and the development of offshore waters should together help meet the estimated demand. Malaysia's experiences in fisheries management relate mainly to coastal fisheries. Starting from coastal fisheries, a management quota has been set of offshore fisheries, based on a comprehensive survey done during 1986 - 87 in the EEZ waters of Malaysia. Although not contributing in a big way to total fishery production., inland fisheries has great potential for development,

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because Malaysia is well-endowed with inland water bodies that are both natural and man-made. In terms of legal jurisdiction, inland fisheries are looked after by state governments. Only marine waters are under the Federal Government.

The development of the marine fisheries subsector has long been restricted to the territorial waters. But after the proclamation of an EEZ, the Department of Fisheries has not only got the opportunity to practise resource management (thereby ensuring sustainable exploitation and equitable allocation of her natural marine resources), but also to increase production, and protect the marine environment from pollution and degradation.

2. Industry

2. I. Capture fisheries

The capture fisheries is divided into pelagic and demersal resources; these in turn consist of reef and island fishery, (This classification is based on fish behaviour and methods of catching.) In terms of development, the fishery may be divided into inshore and offshore fisheries. We do not as yet have afar-shore fishery, because of a relatively short history of mechanised fishing (trawlers were introduced in the late '60s) and a relatively small population of about I9 million (1993 estimate), but we hope to have one in the not-distant future. The closest thing to a far-shore fishery are some Taiwanese longliners who used our shore-based facilities for their Indian ocean tuna fishing, and started a minor culture activity on bait (milkfish) rearing. Perhaps some of their ventures can rub off on our local entrepreneurs before too long.

All fishing activity is licensed, and based on the type of fishing gear used. The fishing gears in use include bottom trawl, purse seine, seines of various types, drift/gill net, lift nets, traps, hooks and lines, bagnets, barrier nets and push/scoop nets. The first two gears are designated as commercial gear while the others are referred to as traditional gear. These gears are not designed to catch shellfish. Bottom trawls yielded 54% of the total marine landings at 561,942 tonnes, indicating that they are an important gear and a controlled gear for management purposes.

2.2. Inshore/coastal fishery

The inshore fishery has been arbitrarily defined to include water up to 30 nautical miles from the coast. In practice, this zone lies within the continental shelf. The fishery continues to be the most important subsector; it provides about 86% of the total marine landings at 90 I ,80 ⁞ mt valued at RM 2. I billion for 1993 Fishery regulations allow for the use of traditional gear while commercial vessels of less than 70 GRT using all types of gear operate in this zone. In practice, being accessible to some 80% of the labour force means that a large number of boats, many less than 10 GRT with small engines, operate in this fishery. Fishing pressure is therefore high (trash to food fish ratio in the 1986-87 trawl survey for the west coast peninsula was 62:38, while for the east coast it was 33:67). The more or less stable landings over the years point to a fully exploited fishery.

2.3. Offshore/deepsea fishery

The deep sea fishery sub-sector operates beyond the 30 mm zone and includes vessels of 70 GRT and above, operating trawl, purse seine, hooks and line, and drift/gillnets. The fishery yielded catches of

145,549 mt in 1993, constituting about 14% of the total marine landings. Trawlers landed 69.7% while purse seiners landed 30.2% of the catch in this fishery.

By value, the deep sea contributed RM 269 million. The East Coast of Peninsular Malaysia had the greatest share of the landings at 52.2% while Sarawak got only 20%. In contrast, the potential yield from the East Coast and Sarawak was expected to be 43% and 33% respectively. The disparity may indicate that Sarawak is under-utitising its resources, and has further potential for exploitation.

We have good reason to believe that foreign vessels have been tapping our EEZ waters with gear ranging from tongliners to paired bottom trawls. Our survey of potential yield for 1987 shows what is left after their rampant exploitation.

2.4. Aquaculture

The development ofaquacutture in Malaysia is relatively recent when one compares its experience with that of neighbours. Though it began as early as the turn of the century, sizeable operation began only in the 1950s with the development of cockle semi-culture and the culture of Chinese major carps in mining pools. Significant changes occurred only during the last two decades, especially with the introduction of marine cage culture in the early '70s and more recently, the significant involvement of the corporate sector in commercial marine shrimp culture. Aquaculture in Malaysia is experiencing rapid growth. Total production in 1993 amounted to 105,237 metric tons, valued at RM 292.4 million. These figures show increases of 32% and 4 1% respectively over the corresponding figures of the previous year.

Nonetheless, semi-culture of cockle, *Anadara gramsa,* was still predominant. contributing about 74% of the total aquaculture output. Culture of oyster, *Crassostrea iredalei,* has managed to gain a foothold in the hotel half-shell market, which was formerly supplied by wholly imported species despite limited seed supply. Oyster spat are being hatchery-produced on an experimental scale. The quantum of aquaculture production is still small; it contributes only 7% of the national fish production. Utilisation of labour was also insignificant, involving only about 16,853 fish farmers, over 90% of whom take part in fresh water aquaculture production.

The major culture systems, based on freshwater and brackishwater, comprise the following :

i) Cockle culture in mudflats
ii) Freshwater fish and shrimp culture in ponds
iii) Freshwater fish culture in floating net-cages
iv) Brackishwater culture of shrimp and marine fish in ponds
vi) Marine fish culture in floating net cages
vi) Mussel culture in rafts and racks
vii) Oyster culture in rafts and racks
viii) Crab culture in cages and ponds
ix) Aquarium fish breeding and culture in tanks and ponds

The total pond surface area utilised for aquaculture in 1993 was 6,235 ha of which about 68% consisted of freshwater ponds. In addition, a total of 716,953 m^2 of cage surface area was utilised in the same year,

of which marine fish cages took up 93%. In terms of value, freshwater pond production was the biggest contributor (RM 112.53 million) to the total output, accounting for 38.48%.

In Sarawak, the gill net fishery also targets the Tenualosa (locally known as "ikan terubok"). The fish is being exploited primarily for its roe, and the spawning adult is the target, which has resulted in the fishery being threatened by over-exploitation (Cheen, 1994). The landing of this species has also been declining for the past few years.

2.5. *Other Traditional Fisheries*

The other traditional fishing gear employed by coastal fishermen includes hook and line, bagnets, liftnets, seine nets, traps, barrier nets and scoop nets. Together they contributed 132,05 I tonnes (I 2.4%) to the total marine fish landings in 1994. These are very passive fishing gears, which are operated by the smaller fishing crafts in the coastal waters and harvest a large number of demersal as well as pelagic fish species, prawns and cephalopods. In Sarawak, a number oftraditional fishing activities is being conducted in the mangrove areas of Kuching, Sarikei and Lawas (Pang 1989).

The description of the industry given above shows that the management of the fisheries in Malaysia covers a wide variety of fishery practices that has to be dealt with, bearing in mind the sensitivity of the different perceptions of the 13 States that make up Malaysia.

3. Mission, Vision and Objectives of the Department of Fisheries

The DOF's mission is to bring about changes in the country's fishery sector. It is guided by other Government policies, in particular the National Development Policy together with Vision 2020, and the National Agriculture Policy 1992 - 20 10 (new NAP). Malaysia is a relatively young country. In its early y cars, emphasis on socio-economic development was necessary. With the country increasingly recognised as one of the emerging nations, the new NAP is founded on the vision of a market-led, commercialised, efficient, competitive and dynamic agricultural sector (fisheries included) in the context of sustainable development.

The mission translates into five main Department of Fisheries objectives :

- to increase national fish production
- to rationally manage fishing resources
- to develop the deep sea fishing industry
- to speed up the growth of the aquaculture industry
- to maximise the income of the fishing industry

4. Management of the Fisheries

4.1. *Legal Framework*

The 'Fisheries Ordinance 1909' was the initial ordinance that regulated the fishing industry in the early 1900s. The Ordinance was subsequently amended in 19 12, 1924, and 1926, presumably to cater to new needs, and was finally repealed in 195 I. The Fisheries Rules of 195 I were then enacted on August 195 1. During this time there were also seven fisheries ordinances/enactments introduced by the various

states. The fishing industry up to that time consisted mostlyoftraditional fisheries, and regulation ofthe industry at that time was at a minimum. It is interesting to note that early fishery laws related to the maritime ordinances made to regulate river and sea transport by all vessels. As an example, the Sea Fishing and Kilongs Ordinance 1963 of the State of Sarawak, and the Fishing Stakes Ordinance of Sabah were both made under the parent law, the Merchant Shipping Ordinance. The implementing agency was the Marine Department because fisheries were not yet significant enough as an industry to warrant the creation of a government department. As such they were more concerned with fishing stakes as obstructions to shipping lanes than with regulation offisheries from the resource point of view.

4.1.2. However, in the 1960s and 1970s, the introduction of trawling in the coastal waters created several conflicts between traditional fishermen and trawlers, especially when they fished in the same grounds. This led to the enactment of the Fisheries Act 1963 (incidental ly the year of independence), which became the legal instrument to manage fisheries in Malaysian waters. The Act sprang more from the practical need to handle conflicts than to provide a fisheries management plan, because conflicts easily got politicised. It served to integrate and strengthen the legal framework relating to marine and inland fisheries; to protect the natural living resources; protect the interests of fishermen; equitably allocate fisheries resources and administrative activities to reduce conflicts among fishing communities.

This Act was repealed when the current Fisheries Act 1985 was enacted. The new enactment can be seen to represent the accumulated experience of over 20 years of fishing practices. During this time, new practices have come in; and more efficient fishing gears have worsened the problem of resource depletion, consequently aggravating conflicts. The Act came into force after the declaration ofthe EEZ; additional clauses not in the previous Act were necessary to deal with foreign fishermen. The management problem was no longer one ofcontrolling local fishermen; there was the serious problem ofencroachment by foreign vessels whom Malaysian fishermen now meet in more open waters.

4.2 Management Measures

The Department of Fisheries has worked out a number ofmanagement measures and implemented them within the framework provided by new fisheries laws. New features have been incorporated in the drafting, which allow for great flexibility. One is to recognise that developments in fisheries practices and situations vary at different places and times. Thus the parent Act passed in Parliament contained features that cater to the whole country. Regulations made under the Act could be drafted differently for different situations. Under each set of regulations, the licenses can reflect further differences at local levels within each State and for every fishery. This tier-by-tier drafting allows for changes to be made without having to go back to Parliament. They can therefore be speedily put into effect once they are endorsed by the Minister of Agriculture (Fisheries). There are now many examples ofvarious regulations that Malaysia has enacted in response to internal country demands, also to international conventions. In this way, management policies and measures can be effectively carried out in response to need. The current measures carried out include

4.2.1. Direct Limitation of FishingEffort

A moratorium has been placed on the issuance of new or additional fishing licenses for vessels to fish in coastal waters. This is to ensure that the current high fishing pressure on the limited coastal fisheries resources will not be increased to prevent or ameliorate over-exploitation.

4.2.2. *Closed Fishing A reas*

Commercial fishing gears like trawlers and fishing purse seiners are prohibited from fishing in waters less than five nautical miles from the shore, which are nursery grounds for juveniles of prawns and fish. This move will serve to reduce fishing pressure. On the other hand, exclusion clauses can be introduced into licensing conditions to allow the same boats to go closer inshore when it is too rough for the boats to go further from the shore, and adult prawns come closer to the shore.

4.2.3. Management Zones

Four fishing zones were established through a limited licensing scheme, whereby zones were designated for specific fishing gears, class of vessels and ownership. The four management zones aimed at equitable allocation of resources and at reducing conflicts between traditional and commercial fishermen.

The four zones were :

- Zone A, less than five nautical miles from the shore, reserved solely for small-scale fishermen using traditional fishing gears and operated by owners.
- Zone B, beyond five nautical miles, reserved for owner-operated commercial fishing gears such as trawlers and purse seiners of less than 40 GRT.
- Zone C, beyond 12 nautical miles, reserved for commercial fishing gears which are more than 40 GRT.
- Zone C,, beyond 30 nautical miles, reserved for deep sea fishing vessels of 70 GRT and above.

4.2.4. Conservation of Resources

Conservation of marine resources has always been the primary concern of the Department. Marine Parks and Marine Reserves, as well as prohibited areas for fisheries. have been established under the Fisheries Act 1985 as a management measure. This is to protect, conserve and manage in perpetuity special representative portions of the marine environment in order that they remain undamaged for future generations. Public awareness is being promoted of the need to protect the corals and other marine flora and fauna in the waters surrounding the islands off the coast. At present, four Marine Parks in the waters of 35 islands off the west and east coasts of Peninsular Malaysia have been gazetted. The waters of three islands off Labuan have also been gazetted. In Sabah itself, three marine parks have been established, consisting of about 10 islands. The waters around five islands in Terengganu and Sarawak – Palau Nyireh, Pulau Tennggol, Palau Talang-Talang Besar, Pulau Talang-Talang Kecil and Pulau Satang- have also been gazetted as fisheries-protected areas. The collection ofshells, molluscs or corals is prohibited. Fishing is also prohibited unless it is licensed. An order has been gazetted to pronounce the waters up to two nautical miles outwards surrounding the island and island groups as out of bounds to all fishing activities.

4.2.5. Rehabilitation of Resources

Artificial reefs have been established in Malaysian fisheries waters to enhance marine resources, also to alleviate the problem of depleting fish resources in coastal waters. It is also a possible

fishing management tool to maximise catches, conserve resources, rehabilitate the habitat and mitigate the effects of overfishing. A total of 54 artificial tyre reefs, 10 boat reefs and 10 concrete reefs have been constructed. Some experimental reefs using PVC pipes have also been set up to study the effect of the artificial reef.

4.2.6. Monitoring, Control, and Surveillance (MCS) in Fisheries Management Programmes

The collection of information over a wide are covered by stations throughout the country imposes a big demand on resources to communicate, compile, analyse and generated reports. Laws and regulations are effective only if they are enforceable. The MCS refers to the provision of a composite of group teleconference systems, a marine HF communication system, a marine VHF voice-secure communication system and a National Integrated Database Management System (NJDMS) to service just the above functions. It links up all the enforcement bases and stations with the patrol vessels and the headquarters. Foreign fishing in the Malaysian Exclusive Economic Zone has always been a problem, especially in the waters of the East Coast of Peninsular Malaysia and off the coast of Sabah and Sarawak, and their activity widens the coverage, So we are now looking at cost - cutting methods of doing the MCS.

Two approaches are being looked at seriously, one through software, another through hardware. The software approach is the idea ofcommunity-based management (CBM). In the past, a tough stand was taken. It yielded results but needed a lot ofpolitical will. However, it can be seen to be very costly in terms of human and financial resources. The new management feels that while enforcement will always have its role to play in implementing laws, other ways are now open CBM is in its infancy and is yet to crystallize in realistic action. But a more educated society is already making itself heard. There is need to give these people the responsibility to make joint decisions with the government. So NGOs have been invited to the table in the National Advisory Council for Marine Parks, as provided for by the Fishery Act 1985. A Special Area Management Plan (SAMP) project is being undertaken by Malaysia with BOBP support. It is applied to the Pulau Payar Marine Park in Kedah state as an example of CBM. It is intended that SAMP will be applied also to Marine Parks in the rest of the country. A beginning has been made with CBM.

The hardware is the potential application of a Vessel Monitoring System, principally making use of high bandwidth satellite transmission and GPS, allowing for E-mail and updated location of fishing vessels instead of only from patrol vessels. Transmitters/receivers are fitted on to fishing vessels and give their position automatically every 15 minutes. The potential for management information is tremendous, as the information on catch and location is not only for the DOF but also for entrepreneurs of deep-sea vessels who know just where their fishing vessels are at any time. There is the likelihood that the owners of vessels will pay for these transmitters. Then they can also report on foreign encroachments and become part of the enforcement capability. So the whole fleet of offshore patrol vessels and the operational costs incurred can be reduced when the existing MCS is revamped by the VMS.

4.2.7. Research monitoring surveys and landing data are regularly carried out and collected to provide usable information for management to take decisions.

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5. Implications for the Fishing Industry

5.1. A rational fisheries management strategy will help to reduce conflicts between traditional and commercial fishermen. They will also ensure sustainable exploitation of fisheries resources and at the same time increase the productivity of fishermen.

5.2. In the case of inshore fisheries, the strategy will be geared towards a reduction of fishing effort in the inshore waters. This is to reduce over-capitalization in the fishing industry, removing excess fishing effort. Alternative employment is more easily available in the present labour market. In the current development plan, funds are allocated for 'buy back schemes' to purchase fishing boats and gear from the fishermen.

5.3. Fishermen graduating from the Fisheries Training Institute in Terengganu will be encouraged to venture into deep-sea fisheries. Much emphasis is given to the development of deep-sea fisheries to increase production from offshore areas, especially in the waters off Sarawak and Sabah, as well as in the Indian Ocean.

5.4. There will be a focus on Marine Parks and Marine Reserves as one of the conservation measures to ensure sustainability of fish stocks, as well as on their potential for contributing to the leisure and tourism industries. Gazetting of islands as Marine Parks and Reserves is a good example of the precautionary approach, because gazettment does not require a through justification study. In any case, there will be not much left for conservation by the time such studies are completed. In fact, gazetting enables a proper study.

5.5. Apart from the implementation of all these management strategies and tools, future management policies to be implemented will also include :

3.5.1. Strengthening and intensification of research into the biology and ecology and assessment of fisheries resources.

It is recognized that limited access through licensing cannot by itself effectively control the fishing effort. With mechanization, greater use of sophisticated fishing aids and more efficient fishing gears, the fishing effort has actually increased with time. The increase in the landings of trash fish, especially the juveniles of commercial fishes, is a matter of great concern to the Department, and research in the use of selective gears should be developed. Necessary intensive research on biology, population ecology and resource assessment has been implemented. It will be intensified under the Seventh Malaysia Plan to provide comprehensive data and information for formulating management plans for different types of fisheries and fishing gears. This will also include research on selective and environmentally friendly gears, which will contribute towards a reduction in by-catch. Such efforts will be further supplemented by a research monitoring programme, whereby the state of fisheries resources will be monitored to support the management plan. Such research-monitoring programmes will be conducted by research vessels as well as by observers on board deep-sea fishing vessels.

5.5.2. Provision of more efficient extension services to educate the target group on management needs and benefits derivedfrom such management

5.5.3. In the international arena, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas was finalized and approved at the 27th Session of the FAO Conference in Rome on 24 November 1993. The agreement will be

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enforced up to the 25th instrument of acceptance. As of May 1995, six countries agreed to be party to this agreement. The Agreement calls on all states that fish in the high seas to be responsible for their own vessels, and practise international conservation and management measures, and ensure that their fishing vessels do not engage in any activity that undermines the effectiveness of such measures. Records have to be kept. Information will be freely exchanged through international cooperation. Settlement of disputes is also provided for in the Agreement.

In addition to the above Agreement, the Agreement for implementing the provisions of the United Nations Convention on the Law of the Sea (UNCLOS) of IO December 1982, relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, was opened for signature in December 1995. The Agreement also deals with mechanisms for international cooperation, duties of flag states, complaints and enforcement by flag states, dispute settlement and the requirements of developing states. With these two Agreements, there are development opportunities for our fishermen to develop further to fish in the high seas as well as in the Indian Ocean. However, there are implications in relation to the existing law as well as in the marine fisheries development of Malaysia.

Jt is envisaged that if Malaysia wants to set up her own distant water fishing fleet, this will require additional/supplementary national legislation to manage these distant water fishing fleets in accordance with the two international agreements. To safeguard Malaysia's participatory rights to tuna resources in the Indian Ocean, Malaysia should be a founder member of relevant fisheries organizations such as the Indian Ocean Tuna Commission (IOTC) that will be established for the conservation and management of these resources.

6. Conclusions

The fisheries resources, especially in the coastal areas, are depleting fast due to over-esploitation as well as pollution. These degrade the aquatic environment and destroy the aquatic habitat. At this point of time, sound management strategies and measures need to be applied to prevent further decline in fish landings. Efforts to further enhance fisheries resources will be necessary to increase fish stocks. Measures such as better management of the coastal habitat by formulating sound management models, coastal zone management plan, rehabilitation of resources through artificial reefs and also through restocking programmes will help in ensuring that fishery resources are managed effectively and exploited rationally at the maximum sustainable level. With the implementation of the international agreements relating to high seas fisheries and management of the straddling fish stocks and highly migratory fish stocks. our fishermen will be encouraged to exploit the fisheries resources in the high seas - especially in the Indian Ocean IMT-GT and the BIMP-EAGA growth development area.

Such management measures will ensure sustainable and rational exploitation of fishing resources as well as increase the productivity of the fishermen in line with the mission and vision of the Department Fisheries.

Going back to NAP till 2010, it was observed that the share of agriculture in the GDP continued its long-term decline from 22.9% in 1980 to 18.7% in 1990. Even though it was able to sustain a value-added growth of 4.6% per annum over 1986-1990, the manufacturing sector's growth was 13.7% increasing its GDP share to 27% in 1990. This transformation and development of the Malaysian economy marked a milestone as it shifted from an agriculture base to diversify into manufacturing. The implication for fisheries development of an active economy could include the following :

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- It is to be expected that fisheries have to compete for labour with other sectors
- Increasing affluence would support the expectation that consumption per capita is likely to increase as greater consciousness on health and nutrition aspects of food consumption favour fish as a source of fat free protein.
- Land will increasingly be scarce and expensive for aquaculture.

However, despite the trend that seemingly works against the fishing industry, the government will not allow a fishery that has maintained itself after so many years of commercial fishing to 'shrink' below a threshold point. Agriculture (including fisheries), assumes strategic importance at this threshold. A Food Policy embodied in the National Agricultural Policy (NAP) (1992-2010) emphasises local availability of such food items as meat (fish included) in household consumption from the food security aspect. Fish constitutes about 60% of the animal protein intake. The NAP suggests that import substitution, domestic demand and the export market present opportunities for increasing output and income. The existing level of technology in the Fisheries Research Institute, although not high, is able to provide the technical support for resource management and the production of fish protein if factors like current species preferences and price are not considerations for viability. In other words, we can meet the strategic requirements of production of protein for food in existing bodies of water.

The production of high market-value items such as exotic species of fish, shrimp, and ornamental fish, suggests that we have components that are money earners and 'cash crops' that bring in foreign exchange from their export. The tourism industry as well as the recreational fishery and the processing and packaging industry are downstream activities that generate incomes many times their value in weight as raw fish meat. Post-harvest technology would ensure better utilisation of existing limited resources and add value to fisheries production.

Malaysia seldom talks these days about providing for poor fishermen through fisheries projects. Since the late SO's, subsidy programmes were no longer proposed as development projects. So-called poor fishermen, if unable to make their living from fisheries, are absorbed into other industries because of the country's general development. Roads and factories with easy access to markets are now found everywhere in rural areas. They often allow the fisherfolk to take part directly in the leisure industry and sell their fish products at their doorstep. There is no longer any social pressure to make higher incomes for fishermen a development objective. The emphasis of the fisheries administrator today is to increase production to meet projection of demand calculated at 1,579,800 tonnes by 2010,

Appendix : Practical problems of fisheries enforcement in Malaysia

The following are the problems in fisheries enforcement.

- *Areas of coverage*

  Ifone observes the sightings of foreign vessels and the areas they cover, one can begin to appreciate the task of enforcement. The EEZ waters cover an area of 160,000 square nautical miles.

- *Apprehension of offenders*

  Poachers and illegal trawlers often use fast boats designed for swift escape - they can get into waters too shallow for enforcement boats. Their ability to sight patrol vessels from afar enables them to dump incriminating evidence.

- *Armed fishing vessels*

  Possession of arms is an offence that invites severe punishment in Malaysia. So it is foreign vessels rather than local vessels that are likely to carry arms. Apart from the DOF, the Air Force and the Navy also take part in enforcement. The armed forces are more suitable that other institutions for offshore enforcement.

- *Vessels in Custody*

  Court procedures in Malaysia and the handing out of sentences take time. A case can drag on for years. Fishing gear and vessels are bulky items, and while a case is on, the vessel in custody deteriorates beyond repair. This is a problem when prosecution fails.

- *Prosecution*

  Prosecution is a tough job. After enforcement by the Navy and the police, the DOF has to carry out investigation and prosecution. Failure at any link in the chain results in failure to prosecute. The need to attend court to provide evidence is costly.

Table 1: Arrests of local vessels

Year	*No of Vessels Arrested*				*Total*
	DOF	*Police*	*Navy*	*Customs*	
1993	722	578	16	3	1319
1994	598	650	1	2	1251
1995	495	406	2	1	904
1996	410	406	0	0	816
Total	2225	2040	19	6	4290

Table 2 : Sightings of Infringements/Fishing by Foreign Fishing Vessels in Malaysian Fisheries Waters

Country	1991	1992	1993	1994	1995	*Total*
Thailand	1746	2290	1242	1102	625	7005
Indonesia	473	276	140	297	284	1470
Vietnam	21	20	76	41	II	169
China	27	24	40	56	160	307
Taiwan	83	25	42	28	24	202
Singapore	6	1	0	2	11	20
Hong Kong	3	4	18	63	6	94
Others	59	56	37	92	59	303
Total	2418	2696	1.595	1681	1180	9570

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Year	No. of vessels arrested			Total
	DOF	Police	Navy	
1993	4	64	39	107
1994	62	46	40	148
1995	37	18	71	126
1996	43	22	32	97

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6.5 MALDIVES

FISHERIES MANAGEMENT OVERVIEW

by Economic Planning and Co-ordination Section,
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Introduction

Maldives is an archipelago of nearly 1,200 coral islands grouped into 19 widely dispersed administrative atolls. Marine resources constitute the country's main natural endowment; economic activities concentrate heavily on fishing and tourism. Currently, fisheries account for 11% of GDP, 20.6% of employment, and 75% of the country's export of commodities. (Ministry of Planning, Human Resources and Environment, 1996)

Maldives depended solely on fisheries and fishery-related activities until the development of the tourism industry in the '70s. Major changes then started taking place, as opportunities for alternative income-generating activities increased. The fishery industry too has seen substantial development during recent years -tuna and other fisheries have got bigger and new fisheries have emerged. The reef fish fisheries, which remained at a subsistence level for a long time, has now come into its own, and is a major source of jobs, particularly when tuna fishing is poor.

These developments have many socio-economic implications for fishing communities. Detrimental effects include over-exploitation of fisheries and user conflicts. To overcome these implications and sustain the country's only renewable resource, as well as to develop its key economic base, fisheries management has a vital role to play. Various stakeholders in fisheries must collaborate, and the problems of the current fisheries management system must be reviewed from the resource user standpoint as well as the policymaker's standpoint. A more effective and efficient fisheries management system, in which different stakeholders can carry out tasks and responsibilities, needs to be formulated.

In view of the central role fisheries management has to play, it is important to understand the present fisheries management system and the issues it confronts. Putting this into perspective, this paper will attempt to provide an overview of the fisheries management system, highlighting the problems of enforcement compliance and the violations associated with various types of fisheries.

Overview of the fisheries management system

As Maniku (1995) has stated, the management of marine resources is quite a complex task. The legal framework of the current fisheries management system is found in the Constitution, the official mandate of the ministries concerned and other bodies, as well as in various laws, regulations, decrees and guidelines. The National Development Plan outlines national policies and strategies, including priority to fisheries management and the setting of long-term fisheries development plans. It covers a wide range of specific issues. These plans are developed by various government and government-related agencies, the most important being the President's Office, the Fisheries Advisory Board (FAB) and the Ministry of Fisheries and Agriculture (MOFA).

a) The President's Office

The President's Office plays an important role by generating and implementing fisheries policies. It provides policy direction through decisions based on laws relating to the sector, the

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recommendations of the FAB, and general policy statements including Presidential decrees and the regulations of relevant Ministries.

b) *Fisheries Advisory Board (FAB)*

The FAB provides a mechanism for high-level consultation among the various ministries and agencies concerned with fisheries development to ensure a more coordinated approach to decision-making. It is chaired by the Minister of Fisheries and Agriculture and is mandated to provide guidance to the President on matters requiring major policy decisions.

c) *Ministry of Fisheries and Agriculture*

The Fisheries law of Maldives (Law no. 5/87,24 August 1987) empowers MOFA to "formulate and administer regulations on matters relating to fisheries." It has the "obligation . to explore the possibilities for the development of fisheries, to carry out the research needed for such development and to develop fisheries. " (Gozun, 1992) So the main responsibility for proper and efficient management of the fisheries resources vests on MOFA. It has to provide a basic framework in terms of clear policies and regulations for efficient resource management by collecting and analysing statistical and other information on fisheries necessary for the management and development of the sector.

d) Surveillance, monitoring and enforcement

The National Security Service (NSS), coast guard section, provides a credible deterrent to violations of regulations concerning management surveillance, monitoring and enforcement. It ensures that agreed measures for both nationals and foreigners are observed. Other roles: it collects information on fishing effort, catches, and other data needed to negotiate fishing agreements, decide on national policies, and take strategic and tactical decisions about enforcement.

The modes of enforcement are air patrols, sea patrols, special observers on fishing vessels, and harbour inspection. The enforcement modes used depend on the resources available, the nature of the regulations and the characteristics of the fishery. Due to the openness of the seas where traditional fishing for tunas takes place, NSS is well equipped for search and rescue activities as well.

e) *Other responsible bodies*

In addition to the above, various other institutions are involved, either indirectly or directly, in fisheries. They play an important role in their respective areas ofresponsibility. These institutions are;

1. Maldives Industrial Fisheries Company (MIFCO)
2. Ministry of Trade and Industries (MTI)
3. Ministry of Planning and Human Resources and Environment (MPHRE)
4. Ministry of Atolls Administration (MAA)
5. Ministry of Transport and Shipping (MTS)

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6. Ministry of Finance (MOF)
7. Ministry of Education (MOE)
8. Vocational Training Center (VTC)
9. Maldives Monetary Authority (MMA)
10. Ministry of Foreign Affairs (MFA)

Management Issues

The difficult nature of integrated management has given rise to many issues and problems among different interest groups and economic sectors sharing common resources. These problems are inter- related. They relate to institutional weaknesses, the country's geography and lack ofawareness among resource users. The main problems identified are:

a) *Over-exploitation*

As stated in a review of the marine resources (Marine Research Section, Ministry of Fisheries and Agriculture 1997), the most dramatic developments in recent years in the fisheries sector have been in the reef fisheries. Several of the newly developed reef fisheries are being driven by demand from overseas markets. These include the beche-de-mer, live grouper, shark oil, shark fin, giant clam and *Napoleon wrasse* fisheries. As the gap between demand and supply of these fisheries widened, prices continued to rise, putting pressure on the resources and resulting in over-exploitation, Consequently, many of these fisheries – including *Napoleon* wrasse, marine turtles. giant clams, whale shark and whales had to be banned.

Similarly, the condition of skipjack tuna resources is also worth reviewing. According to the review of the Maldivian living marine resources (Marine Research Section, Ministry of Fisheries and Agriculture, 1997), catches in recent years have stagnated, with catch rates as well as the sizes of skipjack declining. The reasons for these changes are still not known though there are many possibilities. For a country that depends almost entirely on marine resources, the economic implications of these problems would be disastrous if proper management actions are not taken in time.

b) *User conflicts*

The tourist industry in the Maldives contributes 18.4% to the GDP (MPHRE, 1996). It is important to realize that certain reef resources are more valuable as tourist attractions than as export commodities. It is estimated that shark watching, by direct diving alone, generates US $2.3 million per year. (Marine Research Section, Ministry of Fisheries and Agriculture, 1997). As reef resources gained in economic importance in recent years, user conflicts also emerged. Reef resource utilization involves fisheries, coral mining and tourism. The tourist industry often uses reef resources like diving and snorkeling in a non-extractive manner, while the fisheries and other industries uses it mainly in a extractive manner. These contrasting patterns of resource utilization have given rise to user conflicts.

c) Lack of compliance

There are many difficulties in gettin g management programmes to work effectively. Non-compliance is one of them. A number offactors make for non-compliance. Dual ownership is one

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of these factors. Maldives became a republic in 1968. With this change, the system of resource ownership also changed. The modern law which came into force during this time changed the communal system of ownership to the dual legal system. In the former system, each atoll had a major role to play in managing immediate resources, mainly due to transport and telecommunication problems. The atoll chief controls the resources as a common property of that atoll with advice from the elders of the community. In the dual legal system, total control in resource management by the community was in dispute, leading to other management problems such as clashes between traditional and modern laws, and differing interpretations of laws and regulations. (Maniku, 1996).

Lack of information is another major problem encountered by users. Maldives lacks an easy central mechanism by which the user may refer to current regulations. In many cases, users who live in various comers of the country are unaware of the current situation. Not knowing the regulations, they may not follow them. Similarly, misunderstanding and misinterpretation of these laws and regulations also makes for lack of success in implementation.

Another major factor behind non-compliance is insufficient prior consultation among various stakeholders in developing regulations. As the opportunities for different types of fishing increased, new laws and regulations were being implemented without much research and consultation among the various stakeholders, leading to conflicts between government objectives and the profit motives of fishermen.

d) *Inadequate statistics and information*

The fisheries sector has the potential to strengthen its contribution to the GDP and to employment. To achieve this, a number of management measures and policy decisions are required. And to formulate these measures, more realistic data is of paramount importance. To provide a policy framework for development and management, the fisheries sector lacks a scientific database and sufficient technical support as well as the capability and financial support to do economic analysis on resource data and to undertake broad sector-wide analysis.

From a socio- economic point of view, one may observe many changes taking place in the fishing industry due to alternative income-generating opportunities. Private sector participation in new sectors being developed has affected fishermen and members of the island communities. The percentage of active fishermen in the country has been stable since 1980 and the number of fishing vessels has decreased. The reasons and the underlying causes must be studied. The national fishery strategy has to be investigated to ensure efficient management and development of the sector.

e) Others

Many other basic difficulties are also encountered in getting management programmes to work effectively. They include

(i) Lack of funds and lack of manpower to enforce management measures.

(ii) Inappropriate and inadequate policies and objectives arising from the conflicting interests of stakeholders.

(iii) Insufficient coordination between the departments concerned with fisheries development and management.

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Conclusions

The fisheries management system in the Maldives faces a number of constraints. These call for a collaborative effort by stakeholders. Development and management objectives must be related to resource potential and sustainability, with an active contribution and commitment from fishing communities as well as policy-makers. People's participation in decision-making is a key factor behind successful management.

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6.6 SRI LANKA

FISHERIES MANAGEMENT OVERVIEW

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Introduction

Sri Lanka is a coastal state located in the Indian Ocean to the south of India, between latitudes 6 - 10 degrees north and longitudes 80 82 degrees east. The fishing industry of the island has a long history. According to the Mahawansa (the historical record of the island), a coastal fishery existed even prior to 190 B.C. The fishery plays an important role in the island's economy because of the following reasons.

1. Contribution to jobs, nutrition, GDP and foreign exchange

According to the Frame survey of the current fisheries census, there are some 82,600 marine fishing households (excluding those from the north), and a total of I 10,000 fishermen with a dependent population of 700,000 (Atapattu 1996). In addition, some 25,000 people are employed in fishery-related industries.

Fish account for more than 70% of the animal protein requirement of the island. Sri Lankans prefer fish to meat due to religious and cultural reasons.

The fisheries sector contributes 3% to the Gross Domestic Product (GDP) and employs a quarter of island's labour force.

Fish and fishery products contribute more than 2% of the total value of the exports. In 1996, Rs. 4,125 million was earned by exporting fish and fishery products. The total fish landings in 1995 were 237,000 mt, of which 157,500 mt. was from the coastal sub-sector, 60,000 mt. from offshore and the deep sea and 20,000 mt. from inland fisheries and aquaculture (Atapattu, 1996).

2. Resource Base

The island has a land area of 66,000 sq km, and a coastline 1,700 km long. Since the declaration of the Exclusive Economic Zone (EEZ) in 1978, Sri Lanka has sovereign rights over 233,000 sq km of the area. The marine fishery is seen all around the island, but mainly confined to the continental shelf area which is rather narrow. It rarely exceeds 40 km, and averages around 22 km in width. The total area of the shelf is about 26,000 **sq** km, which **is** about 11% of the total area of the EEZ of Sri Lanka (Anon,1995). The fresh water fishery potential is nearly 12,500 ha,. covering large, medium and small tanks, around 100,000 ha of village seasonal tanks and villus (Jayasekara, 1995). The brackish water potential covers 120,000 ha. of lagoons, riverine estuaries, mangrove swamps and salt marshes.

Marine fish production plays an important role in the island's economy and food security. The bulk of the national fish production, particularly the capture fishery, comes from the marine sector, and the major part of the latter From the coastal area. According to the resource survey done by Dr. Fridjof Nansen, 250,000 mt. of fish could be harvested from the coastal sector – about 170,000 mt. from

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pelagic resources and 80,000 mt. from coastal demersal resources. The offshore and deep sea resources have been estimated by the same survey to be 70,000 - 90,000 mt.

3. Present Status

The relatively organized artisanal fishery in the latter part of the 19th century evolved from what was once a purely "hunting and gathering" fishery. With the inboard motorization of the famous 28 feet boats in 1958, and the introduction of nylon nets in 1961, the fishery graduated from subsistence level to commercial level.

From 1959 to 1994, four development plans were implemented. They focused mainly on increase of fish production to meet local fish demand. As a result, fish production has increased from 42,633 mt. in 1959 to 172,746 mt. in 1994 (Mahalingam, 1995). This is a nearly 300% increase within four decades. This significant increase in production was mainly due to increased fishing effort through developments in gear and craft technology.

As a result of increased fishing effort aimed merely at maximising output without being part of a resource management plan, many problems and issues related to resource management emerged in the near-shore area. Management of coastal fishery resources is necessary. The government faces the challenge of increasing the per capita availability of fish to meet increasing demand. The new Fisheries and Aquatic Resources Act No.2 of 1996 was enacted with a view to managing the fishery resources effectively and efficiently. This fulfils a long-felt need in fisheries.

4. Management Issues and Problems

4.1 *Open Access*

Certain features make the fishing industry somewhat different from others. Fishery resources are finite and therefore scarce, but they are renewable if properly managed. Economic returns could be attained over the long run. Since the sea represents an open-access resource, there is no resource rent attached to the exploitation of fishery resources, other than the costs incurred to reach the fishing ground for exploitation.

There are certain distortions in the market system, so far as fisheries are concerned. The book "Common property economics: a general theory and land use applications" by Glenn G. Stevenson (1991), clearly shows the disadvantage of open-access resource. It is a depletable resource characterised by rivalry in exploitation. It is subject to use by any person who has the capability and the desire to harvest the fishery.

Barring a few traditional fishing systems which regulate access to the resource through community-based informal institutions (Atapattu, 1992; Kulatunga and Edirisinghe, 1995; Atapattu, 1996), the sea is mainly an open access resource in Sri Lanka. In the 1940s, when total fish production was in the region of 40,000 tons, a major part of it came from traditional fishing gear such as beach seine nets, stake nets etc. These have existed for a long period. Coastal rural communities practised fishing methods which were in harmony with the environment in which they lived. In addition, these systems had important economic features like the distribution of income among fisherfolk communities (equity). There were rotational systems where many had a stake. The income from these operations was distributed among them. These traditional fishing systems continue. They were not devoid of conflict. But many conflicts were resolved by the village leaders through social and economic sanctions imposed on violators.

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4.2 Uncontrolled Demandfor Fishing Effort

These traditional methods could not, of course, meet the needs of an increasing Sri Lankan population. The per capita supply was low, and economically efficient gears and methods based on experiences from developed countries had to be introduced. Motorization of fishing craft commenced in the late '50s (1 958) and introduction of nylon nets was done in 1962 (Pieterz, 1995, Atapattu, 1997). These methods brought about a dramatic increase in fish production.

4.3 Lack of reliable information on fish resources

The conservation intent oftraditional fishing systems is subject to question (Ruddle, 1994). It is important not to assume a *priori* that traditional fishing systems are inherently conservationist. Management measures should have been introduced from the very inception of these schemes. Unfortunately, such a management regime was not considered. This is the main cause of present-day problems in fisheries. Thanks to the incentives given in the form of subsidies on capital goods and institutional credit under an open-access, common property regime, the fishing effort increased substantially in the coastal fishery. The popular 9 metre (28 feet) boat was introduced in 1958 without a proper management plan. A major constraint was the lack of reliable information on available resources. Sustainable exploitation levels could not therefore be determined.

Knowledge about exploitation of fisheries and the rate of fishing effort are as important as stock assessment. The existing data collection systems are somewhat outdated and need to be upgraded for effective resource management. Further, a legal framework was not adequately available to deal with present-day problems and issues, especially of coastal fisheries. All development plans of the past 1959 - 68, 1972 - 76, 1979 - 83 and 1990 - 94 -had concentrated mainly on increasing fish production through increased fishing effort (Mahalingam 1995). During this period, little attention was paid to resource management (Atapattu, 1973). Result: by the mid-1980s, many conflicts among groups of fishermen from coastal waters surfaced. This led to the framing of beach seine regulations in 1984 and purse seine regulations in 1986.

4.4 *Destructive Fishing Gears and Methods*

In view of the open-access free-entry nature of fisheries in Sri Lanka and most other countries, economically wasteful and biologically destructive fishing gears and methods are employed to tap the resource. Such uncontrolled effort depletes resources. The high- value species such as lobster, prawn and crab are particularly vulnerable. Overfishing of resources beyond the carrying capacity or the Maximum Sustainable Yield (MSY) is a natural consequence. It is well known that the national lobster fishery suffers from overfishing (Jayakody,1991). Coastal fisheries including shrimp and lobster (Joseph, 1993) also suffer from Declining Catch per Unit Effort (CPUE). Suraweera and Jayawickrama (1989) have suggested that the prawn fishery in Portugal Bay of Kalpitiya be managed, since the resource has been over-exploited.

4.5 *Poor Enforcement*

In the past, the authorities concentrated mainly on increasing output by increasing fishing effort. Action was later taken to manage the fishery by framing regulations under several ordinances, such as the Village Communities Ordinance of 1889, the Small-Town Sanitary Ordinance 1892, the Local Board

Ordinance 1898, the Game Protection Ordinance 1909, the Local Government Ordinance 1920, the Pearl Fishery Ordinance 1925 and the Fisheries Ordinance No. 24 of 1940. From 1895 to 1940, nearly 56 regulations were gazetted. Seven regulations applicable to the whole island were added to the statute from 1940 to 1986. In addition, the following amendments for effective fishery management (Fernando, 1997) were made to the Fisheries Ordinance.

(i) Protection of young fish and fish eggs (1950).

(ii) Fisheries disputes to be referred to a public inquiry. Enhanced punishments for destructive fishing (1952).

(iii) Establishment of a fisheries reward fund to pay informants and witnesses about the illegal use of explosives (1952).

(iv) The possession or use of fish killed by dynamite or poison was made an offence (1956).

(v) The scope of matters referred for public inquiry was widened (1956)

(vi) Wider powers were given to the Minister of Fisheries to formulate regulations regarding fishing disputes (1966).

(vii) The possession, sale and transport of fish taken by explosives within or outside the country's waters was banned (1973).

(viii) The power given the Director of Fisheries for settlement of fishing disputes was widened (1973).

However, enforcement of these regulations was very poor for various reasons, and the objectives of enforcement could not be met satisfactorily. This has led to a continuous increase in fishing pressure on the coastal resources, and to many social, economic and environmental problems in the coastal fishery (Jayakody, 1991; Atapattu and Dayaratne, 1992; White, 1994; Atapattu, 1994; Kulatunga and Edirisinghe. 1995; Dayaratne, 1996).

4.6 *Habitat Degradation*

During the past few decades, different types of fishing gear have been introduced to the coastal fishery in order to exploit resources and meet increasing consumer demand, not only from the local market but also from foreign markets. These environmentally unfriendly fishing gears badly degrade the coastal habitats which play such a vital role in the coastal fishery by maintaining wild stocks and conserving nurseries for recruitment and juvenile fishes (Kulatunge and Edirisinghe, 1995; Rajasuriya, 1997).

4.7 Poaching

Poaching by foreign fishing vessels is a menace faced by Sri Lankan fishermen. Large quantities of resources are being exploited by these fleets; the country loses foreign exchange, employment opportunities and an abundance of animal protein. To minimise this problem, manage the fishery and regulate the activities offoreign boats in Sri Lankan waters, specially the region covered by the declaration of the Exclusive Economic Zone (EEZ) in 1976, a new Act (Regulation of Foreign Fishing Boats Act No. 59 of 1979) was enacted by Parliament in 1979. In the process, amendments were made to the already revised Fisheries Ordinance of 1940. But the problem still exists. An effort is being made to upgrade the existing air sea rescue system into an effective system for monitoring control and surveillance of the EEZ of the island.

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5 Lessons Learned and Strategies Pursued

5. 1 *Fisheries Policy*

In the past, fisheries policy in Sri Lanka was based on four main objectives viz

(i) Increase fish production

(ii) Expand employment opportunities.

(iii) Improve the social well-being of the fishing community.

(iv) Earn foreign exchange.

To achieve these objectives, emphasis was laid on increasing output by stepping up fishing effort through the introduction of motorised fishing boats and nets made out of synthetic fibres. The emphasis was on development, without any thought being given to management (Mahalingam, 1995; Atapattu. 1996). Result: resources in the coastal waters got depleted. conflicts among resource users were aggravated, and incomes fell. Today the fisheries policy has changed. Due consideration has been given to fisheries management in the 1995-2000 fisheries development plan.

5.2 *New Legislation*

Most of the regulations framed in the past (1989-1995) were either location- specific or case- specific. The large number of fisheries regulations that existed then were found to be vague. They were not uniform, since they were framed under the provisions of different ordinances (Fernando,1996). To overcome these problems and to bring uniformity to the regulations, a new set of laws were drafted in 1940 and gazetted as Fisheries Ordinance No. 24 of 1940. From 1940 to 1973, amendments were made to the Ordinance nine times to deal with the management problems.

During the 1980s and 1990s, conflicts among various resource user groups went up. The Department of Fisheries and Aquatic Resources was convinced of the need to enact a new set of laws to deal with increasing management problems. The new Fisheries and Aquatic Resources Act No.2 of 1996, enacted in 1996, made provisions for effective and efficient fisheries management.

5.3 *Public Awareness Campaign*

A massive public awareness programme has been planned to enhance knowledge on the importance of fishery resource management. A series of seminars and workshops has been programmed. Under the sponsorship of the Bay of Bengal Programme (BOBP), one national -level and two regional and sector-specific workshops were completed for policy makers, resource managers, administrators, researchers and others. In addition, a series of district and village-level seminars were conducted under the aegis of the FAO/UNDP-supported marine resources management project. A large number of seminars are to organized under the programme.

5.4 *Fishery* Resource Survey*

Although a few ad *hoc* location- specific or species-specific surveys were done by NARA from time to time, a meaningful resource survey was not carried out until the ADB- funded resource survey which is now in progress.

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5.5 *A Set of New Regulations*

As discussed above, the main objective of past development plans until 1996 was to exploit the resource, not manage it. Implementation of this objective under an open-access common property regime has caused the coastal fishery a lot of problems. Environmentally unfriendly gears and destructive fishing methods have increased in number as well as gear types. The increased fishing effort with these destructive gears badly degraded the critical coastal ecosystem. The new Act was enacted with a view to overcome these problems. A number of regulations were framed under the new Act.

5.6 *Monitoring, Control and Surveillance System*

As discussed above, poaching by the foreign fishing fleet is a problem. Donor assistance has been sought to upgrade the existing air-sea rescue system to a monitoring, control and surveillance system (MCS). Such a system is highly capital-intensive and needs donor support.

5. 7 *Environmental Impact Assessment (EIA)*

The new National Environmental Act (NEA) was enacted in 1993 to minimise environmental degradation in implementing development projects. It stipulates that all aquaculture projects of more than 4 ha should go through EIA procedures. If the proposed project is within an environmentally sensitive area, the project – irrespective of size – should undergo EIA screening.

5.8 *Fisheries Management Project (UNDP)*

The United National Development Programme has donated US $ 1.8 million for a project to manage the island's coastal fishery. The following tasks have been completed so far.

(i) A book "Fishing Gear and Crafts in Sri Lanka" has been published. This will provide the information on fishing craft and gear in Sri Lanka required by decision-makers for sound and effective management.

(ii) A trilingual tish directory has been published.

(iii) A Management Plan has been prepared for the Negombo lagoon.

(iv) A compendium of fisheries legislation in Sri Lanka was prepared in 1996.

(v) Shrimp and lobster regulations were revised to suit current requirements.

5.9 *Fisheries Development Project (ADB)*

The ADB-funded Fisheries Development project concentrated mainly on fishery harbours and anchorages. To manage coastal fisheries, it is essential to reduce the fishing pressure on coastal resources. The deep sea and off shore fishery has to be developed in order to accommodate fishermen who quit the coastal sub sector. Berthing facilities have to be provided either by constructing new harbours or by expanding existing structures.

5.10 International Conventions, Treaties and Agreements

With technological advances and developments in communications that have made the world a global village, no country ought to isolate itself from the rest of the world. There are many conventions,

treaties and agreements, international and regional, which influence the national fishery. The foremost of these are

(i) The Law of the Sea convention which came into force on 16 November, 1996.

(ii) The UN General Assembly Resolution 44 /228 of December 22, 1989, which brought about the UN Conference on Environment and Development (UNCED) in Rio in 1992 and adopted Agenda 21.

(iii) The 1992 Declaration of Cancun.

(iv) The UN Conference on Straddling and Highly Migratory Fish Stocks which adopted an agreement in 1995.

(v) The Code of Conduct for Responsible Fisheries and other related legislation.

(vi) The Ramsar Convention on Conservation and Management of Wetlands (1973).

(vii) The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) signed in Washington in 1973.

The main effect of such conventions is to further the conservation and management of resources in the EEZ of Sri Lanka and the high seas. The most recent international convention is the Agreement on the Establishment of the Indian Ocean Tuna Commission (IOTC), which will impact substantially on the Sri Lankan fishery.

6. Conclusions

A well-thought out fisheries policy, new legislation and sound strategies will enable a suitable environment for meaningful fishery resources management. Success will mainly depend on implementation and enforcement either by statute or by the community or both. Changing a system that has been in force for nearly half a century is not easy. A massive awareness campaign has to be mounted aimed at policy-makers, administrators, resource managers and other stakeholders, and a sound enforcement and monitoring mechanism has to be developed. Can a developing country accomplish this without assistance from developed countries?

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6.7 THAILAND

COASTAL FISHERIES MANAGEMENT IN THAILAND

By Jate Pimoljinda and Sakul Supongpan

Introduction

Thailand is situated in the Southeast Asia Peninsula, extending from 5º N to 21Nº latitude and 95º E to 106º E longitude, with a seabed area of 420,280 sq.km (Gulf of Thailand 304,000 sq.km and Andaman Sea 116,280 sq.km.). The coastline is 2,615 km long (Gulf of Thailand 1,875 km and Andaman Sea 740 km). The Gulf is relatively shallow, with an average depth of approximately 58 m, and 84 m in the deepest area, while the Andaman Sea has a depth of up to 1,000 m. Fishing activities have therefore to be conducted in an area of less than 90 m depth.

During the last three decades, the demand for marine products has increased rapidly as a result of economic and population growth in Thailand. Land has been encroaching into the sea, particularly for setting up new community settlements in the coastal belt, followed by infrastructure construction to support economic development in the communities. There has also been decentralization of industry, which has been moving away from congested areas like Bangkok. Result: degradation of coastal areas, destruction of huge mangrove areas, pollution of sea water along the coast by discharged urban and industrial waste, and expanding tourism. Fisheries resources suffered due to overfishing and illegal and destructive fishing. New recruitment ofaquatic resources could not take place, because the main nursery grounds were destroyed and water was polluted. The incomes of traditional coastal populations who make a living through small-scale fisheries, aquaculture and agriculture fell. These populations have recently been overwhelmed by migrant workers who compete with them for scarce jobs and exploited coastal resources in an indiscriminate manner to supplement their low wages. Urban investors have sought land and developed it indiscriminately for shrimp aquaculture which provides a relatively a high return in a short time. Mangrove areas too have been encroached upon for shrimp culture. Basic commodity prices have increased. Growing social conflicts have created problems.

Marine fisheries play an important role in Thailand. People in coastal areas catch fish for their own food. Recorded fish production has increased every year – total marine landings in 1992 and 1993, for example, were 2.74 and 2.75 million metric tons, valued at $ 1.436 and $ 1.445 million respectively. But trash fish constituted the bulk of increased catch (Statistical records, 1993).

Thai marine waters harbour more than 1,000 species of fish, representing 135 families of marine fish. These can be divided into three major groups — pelagic fish, demersal fish and invertebrates.

The most abundant commercially important pelagic fish are Indo-Pacific mackerel *(Rastrelliger brachysoma)* Indian mackerel *(R. kanagurta),* scad *(Decapterus maruadsi, D macrosoma),* Spanish mackerel *(Scomberomorus commersoni),* tunas *(Thunnus tonggol, Euthynnus affinis, Auxis thazard),* sardines *(Sardinella gibbosa),* anchovy *(Stolephorus heterolobus),* carangids *(Selar cruminophthalmus, Selaroides leptoleptis, Atul mate)* etc.

Common high-value demersal fish include snappers *(Lutjanus lineolatus)* groupers *(Ephinepherus sp),* threadfin bream *(Nemipterus japonicus, N. hexodon, N. mesoprion, N. tolu N. peronii),* monocle bream *(Scolopsis taeniopterus),* lizardfish *(Saurida hexodon, S, trndosquamis S. elongata),* barracuda *(Sphyraena obtusata, S. jello),* bigeyes *(Pricanthus tayenus)* etc.

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The invertebrates of high economic value include more than 10 species of shrimps *(Pentreus monodon, P semisulcatus, P merguiensis., P latisulcatus, P longistylus, P japonicus, Metapenaeus ensis, M, affinis, M. intermedius etc.),* cephalopod *(Loligo duvaucelli, L. chinensis, Sepiotuethis lessoniana, Sepia pharaonis, S. aculata, S. recurvirostra, etc.),* swimming crab *(Portunus pelagicus, Charybdis ferriatus),* mud crab (Scylla *serrata),* spiny lobster *(Thynus orientalis),* green mussels *(perna viridis, Musculus scnhausia),* bloody cockle *(Anadara granosa),* oyster *(Crassostrea* cucullata), shortnecked clam *(Paphia undulata)* etc.

There are 24 coastal provinces in Thailand. According to the Fisheries Statistical Record, the fishing grounds are divided into five zones: Zone 1, Eastern Gulf; Zone 2, inner Gulf; Zone 3, Upper Southern Gulf; Zone 4, Lower Southern Gulf and Zone 5, the Andaman Sea (Fig. I). The Statistical Data Base and Data Information, 1995, revealed that there were 53,3 13 full-time fishing household units and 18,934 fishing worker household units – an increase over the last ten years of 3.1% and 6.8 % respectively (Table I).

Table 1 Number of marine fishing households and fishing boats of Thailand, 1995 (classified by fishing zone).

Fishing type	Fishing Zone					
	Total	1	2	3	4	5
Full time households	53,3 13	6,280	5,923	7,312	16,935	16,863
Worker households	28,934	2,570	3,360	4,424	11,272	7,308
Fishing boats	54,715	6,43 1	6,633	7,568	16,846	17,237
Outboard engine boats	36,634	3,261	2,362	4,969	12,869	13,446
Inboard engine boats	14,965	2,930	4,076	2,718	2,75 1	2,254
Boats without engines	3,116	267	225	154	1,226	1,244

Zone 1 : Trad. Chanta Buri and Rayong Province

Zone 2 Chon Buri, Chaseangsao, Samuth Prakam, Bangkok, Samuth Sakorn, Samuth Songkram and Phet Buri Province

Zone 3 Prachaub Kiri Khan, Chumpom and Surat Thani Province

Zone 4 Nakom Sri Thammarat, Pattalung, Songkhla, Pattani and Narathivat Province

Zone 5 Rangon, Phang-Nga, Phuket, Krabi, Trang and Satun Province

Sources Statistical Data Base and Data Information, 1995

The majority of these households engage in marine capture fisheries, which can be divided into large-scale fisheries and small-scale fisheries. Large-scale fisheries employ powerful fishing gears such as trawlers and purse seiners, while small-scale subsistence fishers use traditional fishing gears such as trammel net, crab gill net, fish net etc. The full-time small-scale fishing households constituted about 87 % of the total fishing households, and produced about 13 % of the country's total fish production (Piumsombun, 1994). A total population of 320,000 is engaged in fisheries or the fisheries-related

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sector. They may be classified as 70,000 large-scale fishermen, 180,000 small scale fisherfolk and 70,000 in fisheries-related sectors.

There were 54,75 1 fishing boats. These included 36,634 boats with outboard (longtail) engines, 14,956 with inboard engines. and 3,116 non-motorized boats (Statistical Data Base and Data Information, 1995 Table 1). In 1983, the number of fishing boats had gone up over 10 years by 1288 – an increase of about 2.4 %.

Prior to the development of marine fisheries, pelagic species were mainly caught near the shore, using non-mechanized boats and traditional fishing gears such as bamboo stake trap and set bag net. The Chinese purse seine was introduced in 1925 and modified into the Thai purse seine for catching pelagic fish, using a mesh size of 2.5 cm. The green purse seine or mackerel encircling net, made of payao coconut leaves and using a mesh size of 4.7 cm, was also introduced. It was anchored for a number of days, and used luring lights produced by simple kerosene, butane lamps, and further developed using electric generators.

In 1964, the tishermen succeeded in developing beam trawls to catch shrimp. This fishing gear became popular along the coastal area of the Gulf. Following an agreement for economic and technical co-operation signed in 1960 between the Thai Government and the Government of the Federal Republic of Germany, otterboard trawlers were introduced to the Gulf of Thailand. The subsequent increase in the number of trawlers in operation, and the fish catches, was remarkable (Table 2).

The marine fishing industry of Thailand was buoyed by the success in otterboard trawling, which rapidly developed and expanded during the late 1960s and the early 1970s. The trawl fisheries are the most productive sector of marine fisheries, accounting for over 58 % of the total marine catch in 1993 (Statistical Records. 1993). The number of registered trawlers of Thailand rose sharply from 99 units to 2,026 units in 1963. Thereafter, the number rose continuously to 9,465 units in 1992. The highest figure was 13, 1 13 units in 1989. The rest of the marine catch (43%) is shared by the pelagic fisheries which is dominated by purse seines, gill nets and small-scale fisheries. Fish meal plants that used trash fish to produce fish meal rose dramatically from 79 units in I978 to 9 I-98 units during the years 1979 to 199 1. The sharpest rise was in 1990 and I992 by 104 and 106 units respectively (Statistics of Fisheries Factory, 1992).

Attempts have been made by scientists from Thailand and abroad to assess the potential of demersal, pelagic and invertebrate fisheries resources in the Gulf of Thailand and Andaman Sea. The potential yields of various fish stock, derived from the relationship between catch and effort, were assessed. It is clear that the demersal fish stocks in Thai waters have been overexploited. Catch composition is changing in favour of small and less valuable species. It is estimated that trash fish caught by trawlers ranged from 45 % to 65 %. Eighteen per cent to 32 % of these trash fish are juveniles of food fish species (average from 1989-1993. Stock Assessment Section, Bkk. Marine Fish Development Centre).

The rapid development of the commercial trawling and purse seining fleet has meant extreme economic hardship for small-scale fisherfolk, who can no longer compete for limited resources. Furthermore. trawlers, purse seiners, push netters and clam dredgers damage marine resources through their use of small-mesh cod-end and sieve sizes, which retain juvenile fish, shrimp, swimming crab and clam. Result: reduced recruitment of high-value species and marketable-size fish into the fisheries.

The coastal population have earned a livelihood not only through capture fisheries but also through the culture of shrimp, fish, oyster, mussel, crab etc. The increase in shrimp culture areas is remarkable,

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because during the last decade, the culture areas have increased by 93.9 % and shrimp culture households have gone up four-and-a-half times. The total shrimp culture area is 420,724 Rai, whereas the areas for fish culture, mussel and oyster, culture, and crab culture are 1, 15,605 and 6,329 Rai respectively (Statistical Data Base and Data Information, 1995).

Table 2 Number of trawlers registered in 1960 - 1992

Year	OBT	PT	BT	Total
1960				99
1961				201
1962				976
1963				2,026
1964				2,360
1965				2,393
1966				2,695
1967	1,380	176	316	1,872
1968	2,258	244	424	2,926
1969	1.939	243	420	2,602
1970	2,210	442	430	3,082
1971	2,472	522	614	3,608
1972	3,185	702	599	4,486
1973	4,480	824	533	5,837
1974	4,074	854	343	5,271
1975	3,816	852	294	4,962
1976	4,088	832	284	5,204
1977	4,962	906	420	6,288
1978	5,110	854	489	6,453
1979	7,038	1,172	537	8,747
1980	8,131	1,230	1,060	10,421
1981	6,02 1	1,008	496	7,527
1982	9,358	1,406	711	11,475
1983	7,796	1,266	328	9,390
1984	7,769	1,166	196	9,131
1985	6,968	1,218	139	8,325
1986	6,226	1,084	97	7,407
1987	6,1 29	1,164	50	7,343
1988	5,766	1,132	52	6,950
1989	10,438	2,193	482	13,113
1990	10,256	2,1 93	456	12,905
1991	8,1 17	2,037	144	10,298
1992	7,538	1,876	51	9,465

OBT : Otterboard trawl, PT : Pair trawl, BT : Beam trawl

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The remarkable developments mentioned above have intensified the mechanization of fishing craft and the development of land for aquaculture. In the absence of appropriate management measures, they have led to a decline in resource abundance and degradation of the coastal environment. A drastic reduction in catch rates is clearly perceived, so also is the overfishing of demersal resources.

As regards pelagic resources, many economically important species have been fully exploited, while some species may have suffered over- exploitation. Common phenomena at present are a continuing decline in catch rates, the virtual disappearance of certain predominant species, a change in species composition of catches, and a predominance of trash fish of low-value economic species.

The Thai Department of Fisheries recognized that marine capture fisheries had still to extend to the high seas; the potential for proper utilization of deep- sea resources has still to be studied. The DOF also lays greater stress on increasing mariculture production per unit area. Ways to minimize fish waste, and introduce better technologies to utilize fish discards and trash fish either for for human consumption or for other uses-have been developed. Fishing grounds have been rehabilitated, and conflicts between small-scale and large- scale fishermen have been sought to be minimized. Thailand is willing to share its fishery expertise with neighboring countries both within and outside ASEAN, through joint venture and capital investment (ASEAN, 1994).

Problems to be addressed

The rapid expansion of Thai marine fisheries in the past has exerted great pressure on the available resources. Intensive exploitation of resources, without systematic management and rehabilitation, has led to use conflicts. It is clear that demersal resources and some of the pelagic resources are declining in both size and abundance. Catch composition is changing in favour of smaller and less valuable species. It is estimated that trash fish constitutes over 50 % of the total landings, and more than 30% of the trash fish are juveniles of food fish species. Likewise, coral reef resources have sustained damage through both natural factors and economic development. Both fisheries and tourism have suffered in consequence.

To conserve the marine fisheries resources, the DOF has set up various management measures through the Fisheries Act of 1901. This was revised in 1947 and 1982. These regulations aim to determine the use of certain types of fishing methodology in certain areas; establish spawning and nursing seasons and areas for marine resources; prohibit certain types of fishing gear during these seasons and areas; regulate mesh sizes for purse seining, gill netting and squid lift netting; limit fresh entrants to trawl fisheries by ceasing issue of new trawl licenses. However, these regulations have not been fully enforced. Violations do occur. Illegal fishing operations do go on.

Recently, the DOF set up a project for artificial reef installation to provide habitats for marine resources and their juveniles, allowing more resources to reach marketable and reproductive size. The reefs will physically obstruct nearshore trawling and push netting. Conservation areas are also being established.

The depletion of fisheries resources and the degradation of coastal habitats because of destructive fishing, have affected all living resources. In addition, land- based economic development in some coastal areas has polluted the coastal waters. The major pollutants that undermine coastal habitats are sedimentation, increased nutrient input from domestic discharge, and industrial and mining runoff.

The law should be enforced to prohibit illegal fishing. As various types of fishing gears increase, user conflicts among gears that compete for the same resource will increase. Small - scale fishing gears are

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usually damaged by trawlers and mechanized push nets. In resolving user conflicts, the authorities should bear in mind the fact that small- scale fishermen constitute the majority of Thailand's fisher population and that they are a poor and disadvantaged lot.

Policies and Strategies of DOF

The following strategies to ensure better marine fisheries/resources management have been prioritized:

I. Speed up amendments to fisheries laws, rules, regulations and restrictions.

2. Strengthen the enforcement of fisheries management measures.

3. Prevent further degradation of resources by limiting the number of fishing boats and by regulating mesh size.

4. Instal artificial reefs in appropriate coastal areas to act as sanctuaries, spawning and seed bed areas. These will also reduce conflicts among fishermen and serve as a management tool.

5. Encourage the formation of associations among small- scale fishermen.

6. Formulate area-based or community-based fisheries resources management at the provincial or district level, as well as setting up a coastal resource information center.

7. Disseminate knowledge to fishermen, fisheries-related operators and the public about the conservation, utilization and management of marine fisheries resources to ensure maximum sustainable benefits.

8. Speed up the demarcation ofcoastal reefzones including the mapping and rehabilitation of coral reef resources, and formulate criteria for undertaking activities in them, as well as issue rules and restrictions on the possession of corals.

9. Monitor and improve the quality of water resources. Prevent and solve pollution problems that may impact on fisheries resources, aquatic reserve areas, areas of historical importance and touristic areas.

10. Monitor surveys of marine fisheries resources, periodically assessing the status of economically important species, and improving the standard of fisheries statistics information.

11. Encourage better co-operation among researchers, resources managers and fishermen to jointly solve problems.

Strategies and Plans for Coastal Fisheries Resources Management

1. *Bettering the living standards of small-scale fishermen* by improving the infrastructure of fishing communities, increasing their educational and employment opportunities, improving health. Aquaculture, mariculture, and extension services for capture and post-harvest fisheries have been introduced to the communities to raise incomes and strengthen job skills. Efforts have been made to set up up fisheries co-operatives to improve financial management.

2. *Awareness-building in marine resources conservation:* Public campaigns for conservation and sustainable resource use are essential on account of resource depletion, the growing numbers of fishermen, and the increasing efficiency in fishing methods. Education programmes concerning resource conservation have been implemented in many communities.

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3. Community-based resources management: Management to improve the participation of fishing communities in resources management has been established in several communities of Thailand to reduce over-exploitation of coastal resources and degradation of habitats.

4. Artificial reefs installation: Several artificial reefs have been installed along the coast of Thailand. This is a management device to help reduce confrontation and conflict between trawlers and small-scale fishermen. It will also enhance coastal productivity, which will benetit small-scale fishermen and help rehabilitate coastal habitats.

5. *Establishment ofmurine reserves:* Marine reserves have been set up to serve as protected areas and as spawning and nursing grounds for aquatic resources which might otherwise be endangered or overfished. Fishing is not permitted in these areas. Many coral reefs areas have been declared as marine reserves.

6. Enforcement of fisheries laws and regulations: Strict and systematic enforcement of the law is essential if resource management is to succeed.

Table 3: Plan for infrastructure facilities and activities allocation under the 8th National Economic and Social Development Scheme for small-scale fisheries development in 22 coastal provinces

	Artificial Reef	Unit	*Fiscal Year* 1997	1998	1999	2000
1.	Arificial Reef Installation	Site	15	15	15	15
2.	Retaining Wall	Site	25	25	25	25
3.	Fishing Equipment Repair and Storage	Unit	5	5	5	5
4.	Rain Water Stocking Tank	Unit	5	5	5	5
5.	Demonstration and Supply of Fishing Gear	Village	30	30	30	30
6.	Fishing Pier Construction	Site	25	25	25	25
7.	Fish Processing and Nutrition	Unit	12	12	12	12
8.	Green Mussel and Bloody Cockle Culture	Village	10	10	10	10
9.	Fish Culture	Village	10	10	10	10
10.	Seed Release (number)	million	30	30	30	30
11.	Infrastructure deepening	Site	10	10	10	10
12.	Pilot Project on CBFM	Village	3		3	

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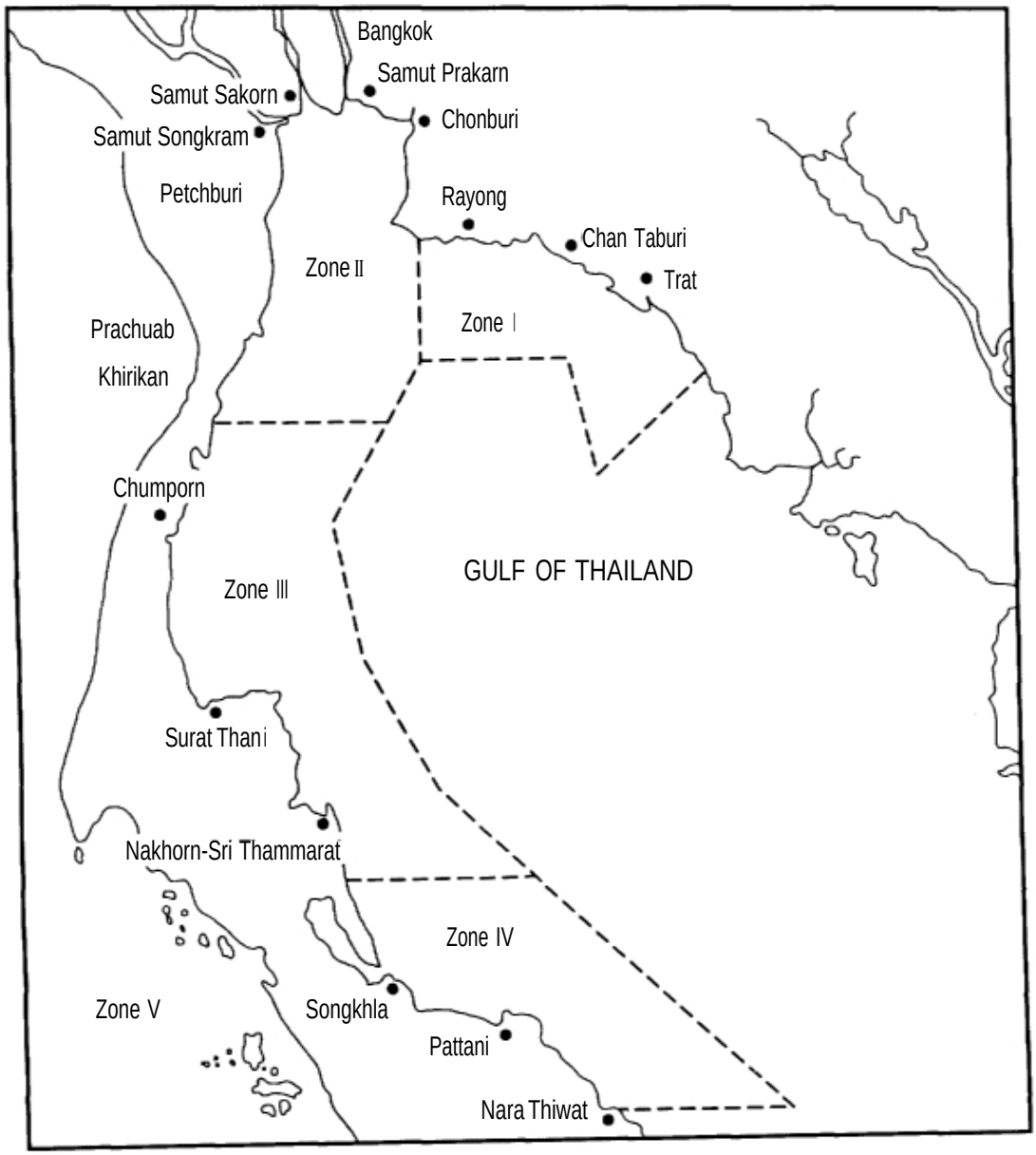
Fig 1: Map illustrating Zonation of Thai Waters



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TECHNICAL PAPERS

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7. ROLE OF SCIENTIFIC ADVICE ON OPERATIONALIZATION AND IMPLEMENTATION OF THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

by John Fitzpatrick, FAO Consultant

Article 7 of the Code of Conduct for Responsible Fisheries sets out the principles of the precautionary approach. These recall Principle I5 of the Rio Declaration': which states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

The implications of the implementation of the Code in general and the precautionary approach to capture fisheries in particular, are far-reaching. Considering the uncertainties in fisheries systems as well as the need to take action, often with incomplete knowledge, the Code needs, *infer* alia, the following actions and attitudes:

- Consider the needs of future generations. Avoid changes that are not potentially reversible;
- Identify undesirable outcomes in advance. Take measures that will avoid these outcomes or correct them.
- Initiate any necessary corrective measures without delay. They should achieve their purpose promptly, on a time scale not exceeding two or three decades
- Where the likely impact of resource use is uncertain, give priority to conserving the productive capacity of the resource.
- Make sure that harvestable and processing capacity in fisheries is commensurate with estimated sustainable levels of resource. Any increase in capacity should be contained when resource productivity is highly uncertain;
- All fishing activities must have prior management authorization and be subject to periodic reviews:
- An established legal and institutional framework should be created for fishery management. Within this framework, management plans that implement the above points should be instituted for each fishery; and
- Appropriate placement of the burden of proof by adhering to the above requirements

Since the above requirements are an integral part of each section of the Code, it is essential that necessary linkages are forged between fisheries managers, researchers, those responsible for coastal area management, the fish harvesting sector, traders and other users of the seas. Above all, fisheries managers must have in place an intelligence system through which they can be well informed, not only about activities undertaken. but also about trends.

I **UN Conference** *on Environment and Development, June 1992*

Authorization to Fish

A prerequisite for responsible fisheries is allocation of an "authorization to fish," and a vetting system for such authorization, coupled with a record-keeping system for ail authorizations issued. The system should be updated at regular intervals. The record should contain details of the fishing activity authorised, the names and addresses of those authorised and, where appropriate, information related to any fishing vessel involved.

The authorization to fish should be conditional. These conditions should include. and specify *inter-alia.*

- That the recipient will abide by the provisions of the Code of Conduct as and when they relate to fishing operations;
- Area to be fished, species to be fished and or quota for vessel or fisher;
- The type of fishing gear or fishing implements so authorized;
- Time/seasonal limitations;
- The need for certain classes of fishing vessels to be issued with a Certificate of Registry'
- The limitation of navigational warranties; and
- Any special requirements with respect to monitoring, control and surveillance (MCS).

Monitoring, control, surveillance and enforcement

MCS schemes and law enforcement powers should be established that include, inter *alia.*

The granting of powers to the officers appointed to carry out monitoring, control and surveillance activities'

Legal provision for action to be taken that is ofsuffrcient gravity so as to be effective in achieving compliance with conservation and management measures;

Appropriate marking systems to identify vehicles, vessels and aircraft authorized for monitoring, control and surveillance activities; and

- A communication network that would ensure that all those engaged in fishing are aware of regulations in force and the penalties for misconduct.

"No force" strategies should also be employed and these may include, *inter-alia.*

- The use ofobservers(without enforcetnent powers) on board vessels for the purpose ofcotlecting data and reporting on the conduct of the Master and the crew;

] *In most States. the process of allocation of a flag to a fishing vessel and the issue of a certificate of registry is conducted by those responsible far marine matters rather than the competent authority for fisheries management*

} *Some countries find it appropriate to enter into a commercial form of contract for MCS purposes*

- The establishment of sub-regional and regional records of fishing vessels and authorizations to fish;
- Flag State responsibility
- Remote sensing and communication techniques'
- Catch and gear monitoring at the dockside as well as catch processing plant inspections and
- Inspection and reporting by Port States

Management data information requirements

The collection of data must not be seen as an end unto itself. It is in fact essential for informed decision-making. Furthermore, data should be collected and analysed in a timely manner and disseminated to where it can best be used, whether at the national level or to regional or sub- regional bodies as may be required by treaty or convention. **To** the extent possible, data should also be made available in an appropriate format for more general dissemination to the fishing industry and the general public.

Scientific data and information must be provided to fisheries managers at three distinct levels:

- Policy formulation
- Formulation of management plans, and
- The determination of management actions to implement policy and plans

Although data requirements differ for each of the three levels mentioned, the quantity and quality of the data collected will have **a** direct bearing on the quality of management at each level. Further, verification or validation of the data collected is essential to the decision- making process. Some examples of methods to validata data include:

- Checking log books against landing data (e.g sales notes)
- Sampling catches for species monitoring
- Comparing landing statistics with certificates of origin, trade and commodity production statistics (value-added processes) etc.
- Inspecting data collection methods by statistical staff
- Interviews with fishers
- Observer schemes
- Reporting of catches on entering and leaving the fishing zone;

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4 With regard to remote sensing andsatellite communication systems. States should agree on technical specifications andperformance standards that wouldprovide the basis for agreement on the admission in court of evidence so generated at the time of the alleged contravention. For example, identification of the position of a vessel and date and time, as well as the operation mode. There shouldalso be an agreement on how catch data may be communicated over satellite data communication networks.

- Developing and implementing the use of vessel monitoring systems such as satellite communication systems and on board sensing to track the position of a vessel and to obtain information on catch and fishing operations;
- Surveillance by ship, particularly boarding of fishing vessels and by airborne observation

Standardization of Data Collection

The task ofmanagement in general would be made much easier if standard procedures were adapted. In this respect, the "Agreement for the Implementation o the Provision of the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish stocks and Highly Migratory Fish Stocks" set out reporting requirements for people fishing such stocks on the high seas. In addition, the Agreement requires the coastal States concerned to co-operate on the question of scientific reporting of stocks that occur within their **EEZs.**

The "Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas" also sets out data reporting requirements to be met by parties to the Agreement. It also allocates responsibility to the FAO to maintain records and to disseminate information in a timely manner.

Confidentiality of Data

A key factor in obtaining and verifying catch data is the level of confidentiality. Those responsible for data collection, analysis and dissemination of information are required by convention to co-operate with other States, regional bodies and international organizations through the exchange of aggregate data. There should, therefore, be a clear understanding between scientists, fisheries managers and fishers that the data supplied by them about individual fishing activities would not be:

- Used against them
- Held in a manner that imperils confidentiality; and
- Transmitted in a manner that would give other fishers a competitive edge.

Social and Economic Information

Fishers and their families constitute the human element and are an integral part of fisheries systems. Such systems cannot be fully understood unless the social and cultural features as well as the economic characteristics of the people and their communities within the system are fully understood. Collection and analysis of data on relevant social, economic and institutional factors is therefore essential for responsible fisheries management and for the application of the precautionary approach. The decision makers should have information on

- the interested groups, their features and their interests in the fishery;
- the economic factors related to the fishery, particularly the economic and social dependence of the different interest groups on the fishery;
- the role of the fishery in providing employment and income for the different interest groups or communities:

- the current status of access to the resource or ownership of the resource;
- the institutions currently involved in decision-making with the fishery; and.
- an outline of the history of the fishery and the historical roles of the different interest groups within that fishery.

Technology

Fisheries managers and scientists have at their disposal a further aid to enable States to meet their obligations with regard to UNCLOS 1982, as well as better management through the adoption of elements of satellite technology (always given that they have an integrated management plan in place and the capability and capacity to process data in good time) on the basis of:

- improved research/monitoring of stocks
- remote sensing of fishing operations
- a vessel position monitoring scheme, and
- the reporting and processing of catch data

The fishing industry already makes use of the same technology to increase efficiency and reduce the element of risk associated with "hunting".

As regards fisheries research, Coastal Zone Colour Scanner (CZCS) data provides ocean colour information enabling phytoplankton pigment concentration estimates from space. The relationship between CZCS measures and phytoplankton distibution has been widely applied to physical and biological studies in many parts of the world since the early 1980s. Further, the ability to remotely sense phytoplankton pigment over large areas has provided biological information at spatial and temporal scales unavailable from shipboard measures alone.

When used in conjunction with shipboard sampling, satellite data may enhance the analysis process related to fisheries research and commercial operations. Most researchers also incorporate data derived from the Advanced Very High Resolution Radiometer (AVHRR) that provides sea surface temperatures unavailable from CZCS.

Technological aspects should also be considered with respect to appropriate fishing gear, fishing practices and operational methods. In this regard, standards should be set for research on fishing gear selectivity and fishing gear behaviour.

Scientists should also ensure through prior assessment that the introduction of new fishing practices or fishing gear would not result in significant waste of target species or non-target species. Likewise, they should ensure that no new fishing practices or fishing gear should be introduced by the industry on a commercial basis if it is detrimental to artisanal or small- scale fisherfolk and their communities. There should be a prior assessment to make sure that such detriment does not occur.

Partnership and Co-operation

Co-operation and partnership go beyond the immediate and necessary links between fisheries managers (including researchers) and resource users. This is very much the case with coastal zone management

on environmental issues and with the implementation of the many international conventions that have a direct or indirect effect on fisheries.

Management measures in general depend to a large extent on the support given by the interested parties. In applying the provisions of the Code of Conduct, full support is essential. If a partnership arrangement is in place, compliance is more likely.

Partnership arrangements could also go a long way towards recognition of the responsibilities of the partners and the level and nature of their accountability. This is particularly important at higher levels of government where there must be a political will (on the basis of thrust and respect) to act responsibly on the basis of the best scientific advice available.

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8. OVERVIEW OF FISHERIES MANAGEMENT IN INDONESIA: PAST, PRESENT AND FUTURE

by Sukotjo Adisukresno

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Introduction

Indonesia is an archipelago of 17,000 islands. It has a long coastline of 8 1,000 km.70 per cent of Indonesia's territory consists of the sea, 30% of land. The annual potential yield of Indonesia's fishing zone, including the EEZ of Indonesia, has been estimated at 6.7 million tons. This figure includes 0.5 million tons ofshellfish and seaweed. The fishery resource constitutes the basic potential for fisheries development. Utilization of this potential is discussed in Indonesia's Sixth Five- Year Development Plan, which aims to:

- Improve human resources quality and the earnings of fishermen and fish farmers through sustainable fisheries resources utilization:
- Increase production and distribution of fisheries commodities in order to improve the quality of nutrition among the population;
- Expand employment opportunities;
- Boost development of domestic industry by providing raw materials and increasing foreign exchange earnings;

The plan is being implemented with due regard to fisheries resources management measures. Their aims:

- Sustainable resources development, so that utilization does not exceed its carrying capacity
- Harmony between large-scale and small-scale fisheries

Problems encountered while implementing these measures:

- Rapid development of fisheries
- Scientific data is very limited, especially for capture fisheries
- Increasing violations of fisheries regulations;
- Need to comply with international laws and agreements, such as UNCLOS, Code of Conduct for Responsible Fisheries, etc.

In order to overcome these problems, several measures need to be taken

Il Present Status of Fisheries

I. *Potential Yield and Environment*

Indonesia's fishing zones comprise a total ofapproximately 5.8 million sq.km. This includes 3. I million sq.km of Nusantara and territorial zone, and 2.7 million sq.km of EEZ. The potential marine yield is approximately 4.5 million metric tons and 2. 1million metric tons respectively.

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Further, Indonesia as an archipelagic country comprises approximately 17,000 islands and a coastal area of 81,000 km. The potential area for brackishwater pond culture is 840,000 ha, and that for mariculture is 114,325 ha.

2. Production

During the ten-year period 1985 - 1994, total fisheries production increased from about 2.4 million tons in 1985 to 4.0 million tons in 1994 – an annual increase of 5.91%. Marine fish capture increased by 6.02%, fish capture in open waters by 2.53% and fish culture by 7.86%.

Among fish culture activities, brackishwater pond culture and paddy field culture recorded good increases in production. Brackishwater pond production was 156,367 tons in 1985 and 346,2 14 tons in 1994 – an annual increase of 9.42%. Cage culture production increased annually by 70.55%. from 746 tons in 1985 to 33,011 tons in 1994.

During the same period, the number of marine fishing boats increased from 3 16.446 units in 1985 to 396,185 units in 1994 – an average annual rate of increase of 2.56%. The marine fishing boats of 1994 were more developed than those of 1985. The number of non- powered boats increased from 220,823 units in 1985 to 245,486 units in 1994 – an annual increase of 1.22 % per annum. While the number of outboard motor boats increased from 6 1,887 units in 1985 to 87,749 units in 1994 (an annual increase of 4.02%), the number of inboard motor boats rose from 33.756 units in 1985 to 62,950 units in I994 (an annual increase of 7.26%)

Fisheries activities are concentrated in densely populated areas. Western Indonesia is more densely populated than Eastern. This has led to several problems, particularly in Western Indonesia. such as overlap of fishing grounds and degradation of fisheries resources. Several actions have been taken to prevent and solve such problems:

* Minister decree No 60711976 of Fishing Zones regulates fishing activity based on fishing zone and size of fishing vessel
* Waters of Western Indonesia have been allocated for artisanal fisheries
* Industrial fisheries can be developed in this region through the Nucleus Estate Small Holder System (NEES).

3.Export

During the period 1990 – 1994, export of fisheries products increased by 14.85% per annum, from 320,24 1 mt in 1990 to 545,37 I mt in 1994. The value of export increased by 13 .O 1 % per annum over the same period. from US$ 1.04 million to US$ 1.679 million. Shrimp and tunas/skipjack were the main contributors to the total export. In 1990, shrimp (unfrozen. frozen and canned) accounted for 29.36% of the total export by volume and 66.39% of total export by value. In 1994. shrimp accounted for 18.25% of total export by volume and 59.80% of total export by value,

Tunas/skipjack -- fresh/chilled, frozen and canned -accounted for 22.72% of the total volume or 12.0% of the total value in 1990; and 14.61% of the total volume or 10.85% of the total value in 1994.

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III Fisheries Resources Management

I. *Principles and Implementation of Fisheries Resources Management*

On the basis of Law No 9/1985, fisheries resources management aims principally at community welfare, and pays due heed to sustainability ofresources. The government ought to formulate regulations relating to type, species, size and number of fishing gears operating in a fishing ground. It should specifically) examine the following factors:

- Technical condition of fishing vessel
- Total allowable catch
- Fishing zone and fishing season
- Environmental protection and rehabilitation
- Restocking
- Fish culture and its protection

2. *Basic Considerations in Establishing Fisheries Management Policy*

a. *Archipelagic conception*

Indonesian fisheries resources management policy is principally based on the Archipelagic Conception which says the sea is a single- integrity zone that cannot be divided by administrative boundaries. That is quite different from the principle of provincial land authority. Accordingly, fishermen may operate in all Indonesian waters and fish in accordance with fish migration and season. The management conception is in line with acts issued so far: Law No 4 Prp/1990 on Indonesian waters, Law No 511985 on EEZ of Indonesia and Law No 9/1985 on Fisheries.

b. *Balanced approach to utilization*

Exploitation lacks balance: The utilization of fisheries resources lacks balance. The inshore fishing ground, close to thickly populated fisherfolk settlements, suffers intensive exploitation. But the offshore areas within the EEZ, and the waters of Eastern Indonesia, are under-utilized. Fisheries must be encouraged in these areas.

improving the quality ***of*** welfare: Large-scale fisheries should not be allowed to undermine small scale fisheries. Small-scale fisheries should be protected by measures such as

- Fishing zonation based on type and size of fishing gear/vessel
- Priority in Western Indonesian waters to be given to artisanal fisheries;
- In artisanal fisheries, specific species (such as *Napoleon Wrasse)* should be targeted.

c. *Sustainable fisheries development*

The fishery resource is renewable, but the carrying capacity of fisheries is limited. To ensure sustainability, fisheries resources should be exploited optimally. The potential yield should be taken into account during the process of current utilisation. Negative impact on the environment must be avoided.

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3. *Implementation of Fisheries Resources Management*

Since Law No 9/1985 in fisheries was passed, fisheries resources management has been covered by it. But in recent years, several other regulations relating to fisheries resources management have been passed:

a. Fishing zonation regulation

Ministry of Agriculture decree No 60711976 regulates fishing activities on the basis of size of fishing gear, fishing vessel and fishing zone. The aims are to protect small-scale fisheries and fisheries resources in coastal areas. The decree is implemented in several coastal areas which have a dense population, and where potential exists for conflict of interests between fishermen.

b. Legislation banning trawls

Presidential decree No 39/1980 bans the operation of trawls in all of Indonesia's waters. It has several objectives, such as:

- Ensuring sustainability of fisheries resources, mainly demersal and shrimp:
- Encouraging artisanal fisheries
- Preventing social conflicts between small-scale and medium-scale fisheries

c. Mesh size measurement

Ministerial decree No 607/l 976 specified a minimum mesh size of I inch for purse seines. The objectives are to prevent catches of small fishes or juveniles and ensure sustainability of fisheries.

Through Law No 511985 on the EEZ, and No 9/l 985 on Fisheries, the government brought into force several regulations concerning fisheries resources management, such as:

- Government regulation No 1511984 on Natural Resources Management in the EEZ of Indonesia;
- Government regulation No 15/1990 on Fisheries Effort:
- Government regulation No. 46/1993, which improves on Government regulation No. 1511990 dealing with Fisheries Effort.

For implementing such regulations, several Ministerial decrees have been issued:

- Minister's decree No.473a/1985 on TAC;
- Minister's decree No.8 15/1990 on Fisheries Licence;
- Minister's decree No. 81611990 on the use of foreign fishing vessels by charter to fish in the EEZ of Indonesia:
- Minister's decree No. 144/1993 on Checkpoint Port.

Formal regulation apart, some traditional laws are also followed. Some local fishermen enjoy exclusive fishing rights on the basis of traditional law, Accordingly, fishing activity in the area is permitted or local conventions prevail. The regulation does not undermine the effectiveness ofresources management measures under formal/national law.

4. General Problems of Fisheries Resources Management

a. *Exploitation of fisheries resources*

Exploitation of fisheries resources over Indonesia's fishing zone is uneven. The inshore fishing grounds. near densely populated fishermen's villages, suffer intensive exploitation. Most of the fishing fleet consists of small boats and vessels. Fisheries activities are encouraged in under-exploited fishing grounds, such as offshore areas. the EEZ of Indonesia and the eastern Indonesian waters.

To encourage the development of artisanal fisheries, the government has applied the Nucleus Estate Small Holder System. This has enabled rapid development of fisheries activities during the last decade, because ofprogress in fishing technology and the size of fishing vessels. They are therefore able to fish far away from their home base.

Fishing is concentrated in certain fishing grounds, according to season. The level of exploitation could exceed carrying capacity. This may undermine the sustainability of fisheries resources. In addition. it could trigger conflicts between migrant and local fishermen. The government is therefore establishing coordination between institutions that have authority for fisheries regulation/licence and other related institutions.

b. *Fishcries violations*

Several fisheries regulations govern the waters of Indonesia and its EEZ. The following activities are considered to be violations:

- Illegal fishing, by either foreign or domestic fishing vessels.
- Zone violations (EEZ to territorial waters or Zone III to Zone I, as spelled out in Ministerial decree 60711976).
- Use of trawls, fishing gear similar to trawls or modified fishing gear similar to trawls;
- Use of blasting or chemical materials for fishing coral reef species.
- Possession of an invalid licence;
- Coral reef exploitation.

Such violations occur because surveillance is weak. At present, marine surveillance is coordinated by Bakorkamla, headed by the Defence Minister/Panglima ABRI. Members of the body are the Minister for Transportation, the Finance Minister, the Minister for Justice, the Attorney General, the Navy Headquarters, the Policy Headquarters and the Minister for Agriculture (DGF).

Thus, surveillance is not the responsibility of the Directorate General of Fisheries alone. The poor coordination between the institutions concerned leads to ineffective implementation, and an increasing number of violations from year to year.

c. *Limitations in data*

Data available at present is limited -especially data concerning potential yield and catches. Insufficient data may lead to errors in estimates of the level of esploitation and lead to unsustainable development. At present, the level of exploitation is lower than the potential yield, and scope for development still

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exists. But some areas have been fully exploited. a few others remain under-exploited, so the exploitation is uneven. To tap development opportunities, one needs supporting data on potential yield, and specifics about catches of important economic species, stock density etc. Biological data is also needed on size of fish, migration patterns, fishing season, spawning season, maturity size etc. Non-biological or socio-economic data are also needed. Current data being very limited, perceptions of the level ofexploitation vary.

d. *Fish Aggregating Devices (FADs)*

FADs have a positive impact on increasing fishing gear productivity, but a negative impact on sustainability ofresources and on social conflicts among fishermen. To overcome such negative impact, government has issued regulations concerning FADs.

e. *Delimit&ion of EEZ*

Since Indonesia's EEZ border with other countries has not been clearly delineated, Indonesian fishermen sometimes enter the fishing zones of neighbouring countries. Likewise, fishermen from neighbouring countries enter Indonesia's EEZ waters.

Fishermen who cross the border are apprehended by the surveillance fleet of neighbouring countries. This is a sensitive situation, with potential for conflict. It highlights the fact that marine delimitation of border areas is still unclear, and overlaps occur in certain areas.

f. *Exploitation of fisheries in EEZ waters*

On the basis of UNCLOS 1982, coastal states should give foreign fishing vessels the opportunity to operate in the EEZ of Indonesia, if the coastal states have a surplus allowable catch. Accordingly, Indonesia has taken some measures, such as Ministerial decree No. 473 a/1985, No. 81511990, No. 81611990 and No. 144/1993. On the basis of Ministerial decree No. 473 a/1985, the TAC of the Indonesian EEZ has been determined to be 1.86 tons annually or 80.2 % of the potential yield.

In 1995, the EEZ production in Indonesia was about 565,864 tons (30 % of the TAC). It was produced by 2,2 17 Indonesian fishing vessels and 945 foreign fishing vessels. The number of Indonesian fishing vessels is expected to increase gradually, in order to utilize the surplus allowable catch.

Fisheries Resources Management in the Future

I. *Institution Enhancement*

A coordination forum is needed among the institutions concerned to overcome the problems of fisheries resources management. The DGF has therefore established a Coordination Forum for Fishing Management. The Provincial Fisheries Service is a member of the forum. The forum has several objectives:

* Synchronise the perceptions on resource management measures among members and other institutions
* Seek harmonious implementation and optimal utilization ofresource management measures and thereby ensure sustainability of fisheries resources.

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Based on fish migration and fishing patterns, Indonesia's fishing zone is divided into eight fisheries management regions:

* Malacca Strait
* South China Sea and Natuna Sea
* Java Sea, Sunda Strait and Kalimantan Strait
* Flores Sea and Makassar Strait
* Maluku Sea, Tomini Sea, Halmahera Sea and Seram Sea
* Indian Ocean
* Sulawesi Sea and Pacific Ocean.

One of the management actions was a meeting, attended by institutions such as the DGF, the Marine Fisheries Research Centre, the Navy, the Police, the Fishing Port, the Fishing Enterprises Association and the Fishermen's Association. The aim of the meeting was to obtain a consensus on problem-solving approaches to fisheries resources management, such as:

* Formulating effort allocations for each province;
* Regulations for migrant fishermen;
* FAD regulations;
* Fishing logbook applications for improving the quality of catch data and the level of exploitation;
* Strengthening coordination for surveillance to ensure both punitive action through the BAKORKAMLA (Badar Koordenasi Keananan Linkungan Awan), an agency for coordinating civil security, and preventive action in fishing ports.

However, the Forum is still in an embryonic stage. It is yet to run effectively. Some measures are still needed:

* Legality of the Forum to be established through a Minister's decree to widen acceptance
* Legality of the surveillance/inspector officer to be established
* Training to improve the quantity and calibre of surveillance and monitoring effort.

2. *International Issues*

UNCLOS 1982 became effective in November 1994. The Government of Indonesia therefore has international obligations concerning fisheries resources management.

Exploitation of marine fisheries resources should be governed by the FAO Code of Conduct for Responsible Fishing and by environmental concepts. This means the resources should be exploited optimally, with due attention to resource sustainability, and the habitat should not be degraded. The Code is accepted in principle. But developing countries such as Indonesia are at a disadvantage on certain international issues – such as gill net and purse seine curbs, and species protection concerning southern bluefin tuna and shark. Research is therefore needed to back Indonesia's argument in international

fora. Shared stocks and highly migratory species also need attention when we discuss international fisheries resources management. Research is needed to identify and inventorize species that can be defined as shared stocks, to support management measures concerning the stocks.

Marine delimitation of the borders between Indonesia and neighbouring countries is urgent. The DGF and other institutions have the following tasks on hand:

* Formulating Indonesia's position for discussion with neighbour ng countries.

* Frequent discussion on marine delimitation with neighbouring countries.

In terms of exploitation of the EEZ at the end of the Sixth Five-Year Development Plan (1988), the Domestic Harvesting Capacity (DHC) is projected at 770,000 tons or 40 % of the TAC. So, a surplus allowable catch of about 1 .09 million tons (60 %), should be allocated for Foreign Harvesting Capacity (FHC). The ratio of DHC and FHC is therefore 40:60, and the DHC contribution will gradually increase. It is expected that at the end of the second Long-Term Development Plan, Indonesia's fishing fleet will fully exploit all of the TAC on its own. Vessels, human resources and capital investment should be made available.

V. Conclusion

The objectives of fisheries resource management are to ensure optimal utilization and sustainability of resources. This is line with the principles ofresponsible fishing. But the rapid development offisheries during the past decade has led to certain resource management problems such as limitations in data, increasing fisheries violations, conflicts among fishermen, etc. Besides, international issues such as UNCLOS 1982, the Code of conduct for Responsible Fishing, use of Turtle-Excluder Devices or TED, protection/conservation of certain species, and marine delimitation of EEZ borders, have come to the fore.

Expertise on fishery resources management must be strengthened, also coordination between institutions concerned with such management. Legal issues and international issues must be addressed and resolved.

9. GOVERNMENT DECISION - MAKING UNDER UNCERTAINTY: A CASE FOR FISHERIES MANAGEMENT

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Abstract

To achieve the objectives of fisheries management, essentially to attain a sustainable yield from fish stocks, the government must evolve and enforce a set of curbs on fishing activity. Fisheries management entails choices and uncertainty. Any choice must take into account the condition of the fish stocks along with their dynamics over time. The available data cannot usually provide reliable estimates of the best management policy. The uncertainties are not just a matter of annoying imprecision in fish population estimates; in general they reflect a fundamental lack of experience about how fish stocks behave in response to different policy options.

In the face of uncertainties, fisheries management is necessarily an adaptive process; decisions and policies are developed over time. The most important step in any fisheries policy design is to list alternative hypothesis on one side, and alternative management plans on another, then examine the effects of different hypotheses on different plans.

Introduction

The physical yield from fish stocks cannot be increased beyond a certain level by adding more vessels and fishermen: nor can it be enhanced beyond a point through technological innovation. Fishing pressure must therefore be adjusted according to the limited potential yield of the resources. The purpose of adjustments is first, to enhance the efficiency of exploitation, and second, to conserve the resources. The two objectives are compatible and inter-related; exploitation is not efficient when stocks are over-harvested. On the contrary, over-capacity makes conservation impossible. Consequently, the solution to overfishing lies in a steady reduction of over-capacity. i.e. the effective regulation of access.

Under conditions ofuncontrolled and open access, too many boats and people tend to enter the fisheries and generate a fishing pressure that is greater than what is optimal on a sustainable basis. Result: An equal or smaller yield of smaller fish harvested annually at steadily growing cost. The solution to the problem producing at a low cost a high yield that the fish stock can sustain year after year - requires the design, adoption and implementation of institutions that will enable the harvesting sector to function efficiently from the economic perpective.

A number of measures might be implemented to correct the imbalance between fishing pressure and potential yield. First, the catch level might be controlled, by allocating individual catch quotas for example. Second, a restrictive licensing system could be implemented only the licensed vessels may participate legally in the fishery. Third, fishing rights would have to be paid for a system of fees or fishing right auctions could be introduced.

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To determine the most appropriate management system for a given fishery, the likely impact of alternative regulatory measures must be assessed. For that purpose, it is useful to construct a mathematical model of the fishery in question, combining both its biological and socio-economic aspects. i.e.. a bioeconomic model. Such a model can be used to simulate the likely consequences ofdifferent kinds of regulations. Clearly, such a model is only as reliable as the data that is used to set it up. But a second merit of the model is that it can identify the processes most directly relevant in fisheries management, the control variables through which the management authority can effectively regulate the amount of fishing. and. therefore, the major data gaps and priorities of research topics.

Fisheries management measures in the tropical waters ofmultispecies stocks face a number of constraints. One constraint is that available mathematical models of the dynamics of the fish population are not immediately applicable to tropical situations. Basic data that can be applied to any model are sparse, there are few scientists to perform the necessary studies, and often the administrative structure to implement and enforce the detailed restrictive measures does not exist.

Fisheries management requires information on resources, e.g., on the delimitation of stocks that can be better managed separately; on the size of fish that need to be protected for maximizing stock productivity: and the relationship between stocks and fishing yield. The work of stock assessment biologists will play an important role in providing such information for fisheries management. Information on the amount of fishing, along with information on the costs of fishing and the value of the harvest, are important to determine desirable objectives of exploitation and the intensity of exploitation. They constitute the basic information needed for management planning.

The concept of a precautionary approach to fisheries management requires that fisheries should and must be managed even in the absence of documented evidence of overfishing.

Unctrtainity in Fisheries

Uncertainty often dogs fisheries analysis. This factor must be taken into account, directly and explicitly. in deciding on fisheries management measures to avert any disaster. The ability and willingness of fisheries management agencies, e.g., government. to deal with uncertainty, play a significant role in promoting more efficient and effective fisheries management.

“Conventional constraints”(Marr, 1982) account for some ofthc uncertainties in fisheries management. These include lack of theories applicable to the multispecies stocks of tropical fisheries resources, lack of data, lack of well-trained personnel, lack of institutional infrastructure, and gear conflicts.

“Lack oftheories” relates to the fact that modern theories of fish population dynamics are largely based on single-species fisheries of high latitude in which the species usually live long, whereas the fisheries in tropical waters are generally multispecies fisheries based on a large number of short-living species. Catch, effort and age/size data are often sparse for tropical species. Result: there is no theory against which one could check available data; there is no data on the basis of which one could develop a valid theory; and data is insufficient for a bio-economic approach to fisheries management.

The dearth ofwell-trained personnel provokes frequent comment. The fact is that there are a number of trained fishery scientists, but poor pay scales keep them off government jobs. Such individuals may either quit the government fishery service or remain nominally active with it while devoting most of their time to more profitable activities.

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Often, the institutional infrastructure necessary to supply the essential scientific information. identify the broad problems of fishery management in an appropriate context. take the necessary policy decisions and put management plans effectively in place are simply not present. However, with increased interest in fisheries, increased awareness of resource limitations and the virtually universal establishment of 2OO-mile EEZs, there is some optimism in this regard.

The establishment of EEZs makes fisheries management feasible by establishing national resource ownership, thus making it possible to deal with the problem of unlimited access. But it has at the same time created enforcement problems of unanticipated magnitude. Countries worldwide simply do not have the physical infrastructure to effectively enforce management regimes.

Gear conflicts are a protean component of fisheries, that seem to appear in various forms. Usually, but not always, they involve two or more different kinds of gear taking not only the same species but also the same species at essentially the same life-history stage. In these conflicts, the "inshore" artisanal fishermen using traditional gears are pitted against the "offshore" commercial fishermen using modern fishing gears. The conflict is major, because artisanal fisheries involves so many people. Some measures require modem gears to stay and operate beyond a specified distance from the shore.

The effectiveness of this measure in the context of the resource is questionable, since the species caught commonly occurs on the "inshore" grounds as juveniles and on the "offshore" grounds as adults. 1 Incertainty in fisheries management is also brought about by "unconventional constraints'*-geographic, demographic, institutional, international and cultural (Marr 1982).

Geographic/demographic constraints are especially important in archipelagic states like Indonesia and Philippines. Exceptionally long coastlines, with a very large number of artisanal fishermen distributed along the coastlines, pose management problems of overwhelming magnitude.

Among institutional constraints, tuo in particular should be noted. First, the responsibility for various components of management may be spread so widely throughout government, that it may be difficult or impossible to put management plans into effect. Second, fisheries departments at best fail to communicate very well with other departments; at worst, they may actually be in conflict.

As some migratory species will occur in the EEZs of two or more countries, and as some fishermen do not respect EEZ boundaries, competition for these resources is an important international constraint.

Finally, cultural constraints to fishery management may take the form of avoiding participation in an international management body. The country concerned thereby spares itself the public admission that it hasn't collected the requisite management data.

Constraints such as these permeate fisheries analysis, creating uncertainties in fisheries management. Major uncertainties can be grouped into two types: those that the manager need not learn about to manage a stock well; and those that define untested opportunities to improve yields and economic performance. An obvious example of uncertainty of the first type is how recruitment will behave at very low stock sizes for a stock that has already suffered some degree ofrecruitment overfishing; it might bc scientifically interesting to see what would happen if the stock were depressed still further, but the manager should avoid this circumstance if he knows that recruitment overfishing has already occurred (he should be moving the stock in the opposite direction).

Uncertainty of the second type relates to how management must respond when the optimum policy is uncertain; the optimum can be found only by testing alternative opportunities through management experience. Someone cannot predict how a stock will respond to exploitation. The best hope lies in either spatial replication or quantitative experience with similar stocks elsewhere or the same stock in the past. You cannot predict MSY without exceeding it.

Decision-Making in Fisheries Management

Fundamentally, the purpose of fisheries management is to ensure sustainable yield from fish stocks over time to promote the economic and social welfare of fishermen and their families. To achieve this purpose, government must design and enforce a set of regulations on fishing pressure and fishing patterns, These decisions should take into account the biological knowlegde of the stocks, the condition of the fish stocks, and the dynamics of the stocks in response to the actions being intended (Gulland 1982, 1983).

Fisheries management is a matter of making choices and comparing options, and not just calculating any single quantity, be it MSY, fishing effort to masimise yield-per-recruit or whatever. Therefore. managers must make very difficult and quantitative choices about how much development of fishing to encourage or permit, what specific limit to place on catches (time of fishing, size of fish, total landings. location of fishing), how much money to spend on enforcement of regulation versus enhancement of production, e.g., investment in a government-owned fleet of new vessels, encouragement of private investment, e.g., by the provision of low-interest loans, technical assistance and advice on the use of more effective gears, to the provision of shore facilities, or improved communication between landing places and the main markets.

Fisheries management in developing countries, particularly in South and Southeast Asia. is concerned not only with resource problems but also with people problems. Consequently, it cannot be successful unless viewed in the context of integrated coastal area development and getting support and commitment from fishing communities and other stakeholders.

Much of the failure to implement management measures is due to lack of communication between administrators. fishermen and scientists of which the absence of an assessment is one aspect.

The roles of stock assessment and biological advice in arriving at management decisions and in increasing the need for precision in forecasting the wider effects of management measures are strategic.

To realize that the available data and information usually cannot provide reliable guidance about the best management policy does not take much practical experience with stock assessment methods and models. Assessment calculations based upon historical data often reveal gross uncertainties about sustainable yield, optimum effort levels, etc. In general these uncertainties are not just a matter of annoying imprecision in estimates of a few parameters such as natural mortality rates, but they reflect fundamental tack of experience about how the stock behaves under alternative policy options.

In the face of large uncertainties, fisheries management is necessarily an adaptive process. The decisions and policies developed over time may have a profound influence on how rapidly the uncertainties arc resolved.

Hilborn and Walters (1992) said that there are three basic strategies for dealing with uncertainty in the management of dynamic systems over time. These strategies differ in how models based on historical data are used to guide policy choices. First, one can use the available data at each point at the time to

construct a single "best guess' or "best possible model" based on the data, and then act as though this model were true (or hedge against uncertainty by being more conservative than this model predicts) while counting on any weaknesses or errors, to reveal themselves in future assessment. This is called passive adaptive strategy.

Passive adaptive policies can in fact be optimum when uncertainties are small and/or when the passive decision choice is as well-informed as any other choice would be. However, passive policies may cause the system to be locked into a narrow range of behavior (e.g., stock size and harvest held near the presumed optimum) without any data ever being gathered to help decide whether the optimum is in fact within this range.

Second, one may simply try a variety of alternative policies, more or less at random, in the hope of accumulating experience about which one is best. This is called an evolutionary adaptive or trial-end-error adaptive policy. It has the advantage of not requiring the decision-maker to make any judgement about which model best fits the data available to him at any point in time. If the manager has considerable flexibility to try a wide range of choices, then the evolutionary adaptive approach may lead him to eventually stumble across some very good choices that would never have been identified or noticed through rigorous but narrow analysis of historical data. However, like natural evolution, a trial-and-error strategy is likely to be very wasteful.

Third, one may deliberately try to construct a range ofalternative models that are consistent with historical experience and use these to identify a policy that offers some balance between probing for information (directed experimentation) and caution about losses in short- term yield and long-term overfishing. This is known as actively adaptive strategy. It involves a great deal more effort in stock assessment and modelling than is required for passive policy design. It may involve testing a much narrower range of best bet policy than would be tried in an evolutionary strategy, but possibly a wider range than would be tried in a passive strategy. Thus it is in a sense a compromise between those extremes.

Of course fisheries managers need not go so far as to apply sophisticated analytical techniques, but it is far more important to explicitly consider uncertainty. The most important step in any fisheries policy design is to list alternative hypotheses on one side of the table, alternative management plans on another side and examine the consequences of the different plans under the different hypotheses. This should be done in every policy evaluation.

If we accept that policy design should explicitly consider uncertainty, we still have a long way to go before knowing what methods work best. The concept of adaptive management was first proposed by Walters and Hilborn (1976), and, even though the basic principles have been widely accepted in many fisheries agencies, there are few examples of practical application of these methods.

The biggest constraint on effective fisheries management is the inability to change fishing mortality. Most fisheries disasters are brought about by not being able to reduce fishing pressure once the biological and economic need is obvious. We should therefore devote research and management resources to understanding fishermen and their gears.

Always present managers with decision tables showing biological and management alternatives. The output of a stock assessment exercise should not be recommended quotas or fishing effort. It should be biological consequences ofdifferent actions. Stock-assessment biologists are not likely to be the right people to weigh the risks of alternative management actions.

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The most serious obstacle to effective management stems from the lack of communication among scientists, administrators, decision-makers, and fishermen. It is necessary, therefore, that dialogues be held to promote better understanding among them. There must develop a clear consensus about how important it is to manage the fishery for sustainable long-term yields.

Directions for Future Research

Function of Stock Assessment

The function of stock assessment in the broad sense is to carry out and provide management advice. It seeks to identify the stock present, to estimate potential yields, and to recommend strategies for approaching these yields. As such, it has both short- and long-term goals, i.e., providing immediate information about whether a stock is close to full exploitation, and proposing strategies for manipulating the fishery to achieve the desired catch characteristics. Accurate stock assessment requires available data concerning the stock, but depends upon current understanding of nature and the functioning of biological communities on the one hand and the yield responses of fisheries on the other.

Data Needs and Requirements

Among the data needs and requirements are the following:

(1) Reliable catch data by species and associated fishing effort data

(2) Length composition by species or by groups of species of the catch.

(3) Indices of abundance (catch per unit effort, CPUE), expressed in terms of catch per unit of standardized fishing effort.

(4) Age composition of selected species as a basis for using standard techniques of assessment and for calibrating length-structured models.

(5) Related to these data requirements is the problem ofobtaining satisfactory species identification.

(6) Information on costs of fishing and the value of harvest.

Research Priorities

In the short term, high priority should be given to development of stock assessment methodology through length-structured models. Research priorities should focus on several objectives as follows:

(1) Length-structured models along with a special program of age determination to compare results obtained from the length- and age-structured approaches as a means of validating the length-structured models.

(2) Relationship between yield, effort and species composition (dealing with multispecics stocks).

(3) Stock identification.

(4) Selectivity and catchability of gears.

(5) Adaptive (experimental) management.

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Conclusions

Uncertainty permeates fisheries analysis, this factor should be taken into account in deciding fisheries management measures. In general, the occurrence offisheries disasters is strongly related to the ability and willingness of managers to deal with uncertainty.

Since the available data and information cannot provide reliable guidance about the best management policy, managers have to make very difficult and quantitative choices to set up management measures that can be actually applied.

In dealing with uncertainty in the management of dynamic systems, an adaptive policy as proposed by Walters and Hilborn (1976), seems to be more appropriate than conventional policies that are based on single quantity of MSY, effort which maximises yield- per-recruit, etc. In addition, by minimizing conventional constraints as well as unconventional ones. the effects on fisheries brought about by management measures may be forecast more precisely.

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10.. AN OVERVIEW OF FISHERIES MANAGEMENT IN ASIA PAST, PRESENT AND FUTURE

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Abstract

Asia accounts for more than 40 per cent of the world's total fishing fleet. The increase in the capacity of this fleet highlights the overcapitalization of this fishery. A collapse of fisheries in Asia could be disastrous for the fishing industry as well as for related industries. The rising conflicts among resource users provides an impetus for several fisheries management strategies. The way forward is to avoid falling deeper into the capital trap, work towards lowering enforcement costs, and improve the institutional design for securing legitimacy for fisheries management institutions.

Top fish producers are from Asia

The importance of the fisheries sector to the Asian economy is widely acknowledged. Its significance lies in three main areas:

(1) as a source of animal protein

(2) as a source of employment, and

(3) as an earner of foreign exchange.

Some 150 million people in Asia are economically dependent on fishing and its related activities, although marine fishing accounts for only about one per cent of the worldwide economy. Table 1 shows the distribution of world marine catch by principal producers in 1993. Ten of the 20 top world fish producers are from Asia, with China contributing about 10 million tonnes of fish or 11.9% of the total world catch. These 10 countries together account for almost 43% of the world's fish catch. Southeast Asian countries such as Thailand, Indonesia, Philippines and Vietnam, account for another 10 per cent.

Fishing Fleet

In 1992, Asia accounted for almost 43% of the world's total fishing fleet, way ahead of its more advanced counterpart from the former USSR, Europe and North America. Table 2 shows the distribution by continent of the world's nominal catch and total fishing fleet, In terms of productivity of the fishing fleet, the index for Asian fisheries is quite low at 4.39 mt/GRT compared to the fisheries of South America, Africa and Oceania. With a rapidly growing population, and an increasing demand for fish among Asians, it is expected that the dwindling fish stocks in the region will face even greater pressure.

The facts of the fishing crisis have been well documented. Yet there is little sign that the fishing industry and those who control it are interested in anything other than short-term gain. The general response to declining fish stocks around the world has been to keep using bigger boats and more sophisticated methods so that catches go on increasing. As seen from Table 3 Asia accounts for some 85 per cent of

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the number of decked vessels in operation and about 62 percent of undecked vessels in 1992. In terms of capacity, this represents a 129 per cent increase in the GRT of docked vessels in Asia, compared to a 91 per cent increase in capacity of decked vessels for the world as whole between 1970 and 1992. It appears that Asia is set for the same mistake that Europe, USSR and North America have made with regard to overcapitalization in fisheries. Unless the commercial fishing industry and governments that regulate fishing capacity are prepared to reduce capacity and develop a system of sustainable management for fish stocks, we are heading for an even greater disaster in Asia.

Table 1: World Marine Catch by Principal Producers 1993

Country/Region	*Marine Catch ('000 tonnes)*	*% of Total (World Catch)*
China*	10,066	11.9
Peru	8,410	9.9
Japan*	8,273	9.8
Chile	6,020	7.1
USA	5,595	6.6
Russian Federation	4,154	4.9
Thailand*	3,065	3.6
Indonesia*	2,731	3.2
Korea Rep*	2,619	3.1
Norway	2,562	3.0
India*	2,473	2.9
Iceland	1,718	2.0
Philippines*	1,688	2.0
Korea DPR*	1,640	1.9
Denmark	1,499	1.8
Spain	1,300	1.5
Taiwan*	1,144	1.4
Canada	1,135	1.3
Mexico	1,036	1.2
Vietnam*	810	0.9
World Total Marine Catch	84,262	

*Asian countries

Source: FAO (1995). The State of World Fisheries and Aquaculture, Rome

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Marine fishing accounts for only about one per cent of the worldwide economy, but for many Asian countries the effect of a fishing collapse could be disastrous, as some 150 million people are economically dependent on fishing and its related industries. In Southeast Asia, five million full-time fishers contribute US$6.6 million to the total annual earnings of the region (Martin, 1966).

Table 2:Distribution by Continent of the World's Nominal Catch, and Total Fishing Fleet, 1992

Continent	*Nominal Catch*	*%*	*('000 GRT)*	*s;,*	*Catch/GRT (M)*
Asia	48,427	49.1	11,013	42.37	4.39
Africa	5,203	5.3	699	2.69	7.44
Europe	12,679	12.9	3,018	II.61	4.20
South America	15,913	16.1	817	3.14	19.48
North America	8,652	8.8	2,560	9.85	3.37
Ocean ia	890	0.9	122	0.47	7.29
Former USSR	6,876	6.9	7,776	29.87	0.88
World Total	98,640	100	25,944	100	

Source: FAO (I 995) : The State of World Fisheries and Aquaculture, Rome

Characteristics of well-managed coastal fisheries

Although Asian fisheries contribute substantially to the world's fish catch, one of its unique characteristics is that its fisheries tend to be dominated by small-scale coastal fisheries. The challenge for fisheries administrators in Asian countries is therefore clear: better management of coastal small-scale fisheries. But what are the characteristics of a well-managed coastal fisheries? Some universally accepted properties of well-managed coastal fisheries are described by Miller (1990). These properties can be classified into fwo sets of characteristics:

Resource characteristics

(1) The quality and quantity of resource habitat are maintained.

(2) Catch is stable and changes by only a moderate amount, e.g a factor of less than 1 .3 in successive years.

(3) Market demand. processing capacity, resource yield, and fishing capacity are well-matched.

(4) Annual yield predictions are avoided, but if required they are based on recruit year-class strength and yield per recruit rather than on an assumed stock -- recruitment relationship.

(5) Resource waste is low: discards and by-catch are less than 30% as large as yield to the fishery, and the yield per recruit is at least two-thirds maximum.

Management characteristics

(1) Fishermen or fishermen's organizations take part in framing and implementing regulations.

(2) Regulations in place are enforceable and enforced.

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(3) Reasons for regulations are understood by the fishing industry, enforcement personnel, resource managers and scientists.

(4) The resource managers and fisheries scientists are visible and can be personally identified by fishermen or fishermen's organizations.

Understanding these characteristics is critical for the design and adoption of fisheries management tools in many countries. However, what has happened thus far in many countries is that fisheries management policies tend to be ad hoc in nature. To a large extent, it is a political exercise. Most fisheries management policies were implemented as a response to certain tragedies or events that disrupted the harmony that existed within the fisheries sector. As such, the fisheries management regimes in many Asian countries revolved around the nature of fisheries exploitation itself. The institution of certain fisheries management regimes is therefore seen as a temporary solution to a particular problem in the fisheries. The next section traces the evolution of fisheries management in Asia, discusses changes over the years, and possible future directions.

Fisheries Management in Asia

For many years, the management of fisheries resources has been paid little systematic attention by the countries of Asia. Efforts at fisheries management have largely been exercises in political management, with little basis in the application of the biological, economic or social consequences of management approaches. Limited social science research and very little biological research has been specifically directed at management issues. In the 1990s however, there has been a small but notable change, and fisheries scientists are increasingly directing attention to management issues. The social scientists are now at a point where they can begin to address important issues of fisheries management policy.

The '80s and the early '90s were decades of ambitious industrialization programmes in many of the developing countries of Asia. The approach adopted for industry was also applied to fisheries. Many of the programmes for developing the fisheries failed, and donors "discovered" small-scale fishing as the mainstay of most fisheries resource exploitation in developing countries. Funding for the fisheries subsector, both inland and marine, by bilateral and multilateral donors -particularly development banks -was substantial, with a major emphasis in fishery development/investment in catching and processing capacity (Insu!! and Orzeszko, 1991).

The emphasis ofnational fisheries policy in al! the countries of Asia has been to increase fish production for domestic consumption and export. This has been sought through various devices such as motorization, port development, and introduction of new boats and fishing gear. There have been substantial technological advances resulting from private sector adoption and adaptation of new fishing methods of systems such as trawls. This production development has been supplemented by market development efforts in some countries that have sought to improve the incomes of fishermen and their families. The result has been increased output, to be sure, but the corollary has been major increases in investment in fishing effort.

Another factor that has contributed to the growth in effort has been the role of fishing as an employment of last resort. The fisheries sector has played an important role in absorbing surplus labour. People who cannot find any job either in cities-where both population and employment are high – and in villages, have sought opportunities in fishing. This almost limitless supply of labour has kept incomes generally low and supported labour- intensive but very effective fishing technologies. Only in the late '80s and

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the early '90s has the rapid industrial development of some of the Southeast Asian countries (Malaysia, Thailand. Indonesia and Vietnam) possibly reduced employment pressure on fisheries. But the pressure on fisheries resources has remained high because of more advanced capture technologies.

Many of the nearshore and coastal resources in Asian countries are overfished. Fishermen's incomes have been sustained by price increases, not by increases in productivity. Increases in total landings have often given a misleading picture of the possibilities for further expansion. The force of market pressure continues to attract investment into artisanal fisheries and those who compete with it. Growing fishing pressure has generated growing conflict.

The rising conflicts among resource users provided the impetus for the establishment of several fisheries management strategies in many Asian countries. However, these regimes underwent a series of changes over the years in response to the changing nature of the fisheries in the region. Fisheries management in Asia can roughly be divided into three phases: (I) Pre-1980s (2) During the 1980s and (3) the 1990s and beyond. But most fisheries management policies focused mainly on fishing effort reduction.

Pre-1980s

In the early 20th century, most Asian fisheries were coastal and small-scale in nature. Fixed fishing gears were the gears most commonly used by fishermen. Catches were low, and meant only for local consumption. But in the 1930s, many parts of Asia showed a preference for more mobile fishing gears that allowed fishermen to actively pursue the fish. This was followed by the introduction of purse seines and motorized boats in the 1940s and 1950s. They generally fished in shallow territorial waters within 12 miles from the coastline, mainly catching pelagic species. Fisheries management policies then were confined to limited licensing programs.

In the early 1960s, trawlers were first introduced by the Germans in Asia. The introduction of these mechanized fishing techniques has changed the fishing industry in this region. What was once a coastal, small-scale and self-sufficient fishery, became commercial and export-oriented. During this period, fish catch – including increased landings of small juveniles and by-catches – increased at a record rate. Trawlers caused a tot of damage to fishing and nursery grounds. At the same time, their intrusion to nearshore areas, meant exclusively for small-scale fishermen, created serious conflicts among fishers. Several countries amended their fisheries regulations to reduce the damage created by trawlers and to create orderly fishing activities in their coastal areas. Mesh-size restrictions were introduced. For example, Malaysia's I963 Fisheries Act says that the minimum mesh size for any trawl net shall not be less than 1" internal measure at cod end (Saharuddin. 1995). At the same time, many Asian countries imposed operational zones for trawlers to prevent depletion of their fisheries stocks.

Although fisheries regulations were established, the lack of enforcement and surveillance capabilities of many governments was a handicap. The effort to reduce fishing effort proved ineffective. More trawlers were introduced during this period, driven purely by the short-term motive of profit. Many countries reported cases of overfishing and serious conflict among fishers in the 1970s. The clashes among resource users sometimes took a toll of human life. Result: some existing laws were amended. There was an absolute ban on trawlers in Indonesia in I980 (Susitowati, 1991). At the same time, new regulations were introduced to further tighten the disastrous effects oftrawls. As the experiences of the 1960s and 1970s had shown. individual fisheries management regimes were less effective in controlling overfishing. The era of the 1980s saw a different philosophy for fisheries management in Asia. A combination of various tools was introduced to prevent further depletion of fish stocks in the region.

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During the 1980s

The valuable lessons learnt by fisheries administration during the 1960s and the 1970s had led to new insights concerning fisheries management. In the 1960s and 1970s, fish catch increased rapidly through overcapitalization of fishing fleets. Many inshore areas of Asian countries were overfished. In the 1980s, the problems faced by fisheries planners sprang basically from activities ofearlicr decades. Many fisheries administrators were saddled with the problems of resource rehabilitation and resource conservation for sustainable uses. To meet those new demands, a host of integrated fisheries management regimes were instituted to further reduce fishing effort. Major policies aimed mainly at effort reduction. Measures included limited licensing programs, gear restrictions, area closures and further restraints on mesh sizes. One of the most effective tools used during this period was the zoning regulation, which not only specified fishing areas but also clamped down on the type of gears used in certain zones. The net results were improved catch, less poaching, less gear damage and fewer reported conflicts. Examples of zoning regulations in selected Asian countries are listed in Tables 4a, b and c.

Restrictions to fishing zones were also introduced in other countries like Thailand and Myanmar. In Thailand, for example, the 12- mile territorial waters remained closed to trawlers. In Myanmar, under the Marine Fisheries Law, all artisanal fishermen are given priority to fish in all fishing zones (FAO, 1996). To some extent, these zoning regulations were successful in reviving and conserving fish stocks in this region for future uses. However, further refinements were needed to establish a healthy and economically viable Asian fishery. These goals became new challenges to fisheries managers in the 1990s.

The 1990s and Beyond

Prior to 1990, many fisheries management regimes were concerned with intra-generational equity issues (Garcia 1994). In many Asian countries, fisheries policies and regulations were based on a top-down approach and most of these regulation were by-products of colonial legacies. Their legitimacy was always questioned by stakeholders in fisheries. It was for this reason that in many cases, fisheries management failed to achieve its desired objectives. The failures of conventional methods of managing fisheries in many parts of the world are well-documented and publicised.

Table 4a: Zoning Regulations in Malaysia

Zone *Description*	*Distance From Coastline*
A Within 5 miles from shoreline	Reserved solely for artisanal, owner-operated vessels
B 5-12 miles	Reserved for owner-operated trawlers and purse-seiners of less than 40 GRT
C 12-30 miles	Reserved for trawlers and purse seiners greater than 40 GRT, wholly-owned and operated by Malaysian fishermen.
D Beyond 30 miles	Reserved for deep sea fishing vessels of 70 GRT and above. Foreign fishing through joint ventures or charter are restricted in this zone.

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Table 4b: Zoning Regulations in the Philippines

Zone	*Distance from Shoreline*	*Description*
1(municipal waters)	Up to 3 nautical miles from the shoreline of municipality	Only for municipal fishing vessels (3 GT or less with or without power or fishing without boat)
2 (national waters)	> 3 nautical miles	For commercial vessels ('3 GRT)

The unwillingness on the part oflisheries administrators to include fishermen's interests while formulating fisheries regulations and policies partly explains why fisheries management failed badly in many areas. Realizing these past mistakes was actually the best thing that has happened to many fisheries administrators in Asia.

The traditional approach towards fisheries management requires a serious second look. The interests of stakeholders in fisheries cannot be taken for granted. A shift will have to take place in the management paradigms of policymakers. The new fisheries management objectives must focus on more pressing inter-generational equity issues, and its implementation has to be more participatory, taking into consideration the standpoints of the government as well as of fishermen.

Using these two guiding principles of the new order of fisheries management, many scientists and economists today have advocated **community-based management, precautionary fisheries management** and **Marine Stewardship Councils** (MSCs) as new fisheries management approaches, over and above the conventional techniques in place. Although these approaches have been mooted for quite some time now, it is too early to evaluate their effectiveness, as they have not been fully implemented at the ground level, for a sufficient length of time.

The way forward

The way forward in fisheries management is to

1) avoid falling deeper into the capital trap (i.e. the tendency to over-invest in the capacity to capture fish)

2) to lower enforcement costs arising from attempts on the part of some to create property rights to designated fisheries resources and

3) to improve legitimacy for institutions engaged in managing fisheries resources.

The three approaches mentioned above Marine Stewardship Councils (MSCs), community-based management and precautionary fisheries management are seen as possible approaches that can lead fisheries in Asia forward. They will check investment in fish capture capacity, lower enforcement costs and increase the legitimacy of fisheries management institutions.

Prospects for the future

The prospects for the approaches mentioned above may not be the same in all Asian countries. The concept of Marine Stewardship Councils (MSCs) is still very new in all of Asia. Rut it probably has

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greater chances of success in the more developed Asian countries such as Japan, Korea and Taiwan and less bright prospects in poorer countries such as India, China, Indonesia and Philippines. Community-based management, on the other hand, appears to have better prospects in less developed countries such as the Philippines, Indonesia, India. There are also issues with regard to the costs of alternative management approaches. It is often argued that the transaction costs of alternative approaches differ. Which approach is better is ultimately an empirical issue (Nik Mustapha, K. Kuperan and R. Pomeroy, *1996).*

The precautionary approach instills the need to consider the fishery ecology and socio-economic relationship as fragile. Policies should therefore be implemented with caution. This could help improve the way politicians think about or approach fisheries management.

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11. U S EXPERIENCE IN IMPLEMENTING THE PRECAUTIONARY APPROACH TO FISHERIES MANAGEMENT

by Stanley Wang and Andrew Rosenberg

Introduction

Renewable fishery resources, if properly managed, can produce long-term sustainable yields and thus support continuous economic activities and employment. The U.S. caught 5.9 million metric tons of fish in 1994, accounting for 6.3 per cent of the world catch, making it the fifth-ranking nation in fish harvests worldwide. (U.S. Department of Commerce, July 1996). However, the long-term potential yield from U.S. fisheries is estimated to be approximately SO per cent higher than the recent average yield (Sissenwine and Rosenberg 1993). This indicates that large increases in the harvest are possible through improved management that will help recover depleted stocks and diversify utilization of under-harvested stocks. The potential maximum net economic value of the nation's finfish and shellfish resources is, at a minimum, $I .8 billion a year or $60 billion in net present value. (NMFs, Silver Spring, MD, May 9,1991).

The U.S Government has managed the fisheries resources within the country's Exclusive Economic Zone (EEZ) since 1976. The Fishery Conservation and Management Act of 1976 (Magnuson-Stevens act) was passed and implemented in 1977'. By 1995, 36 fishery management plans resulting from the Magnuson Act were implemented. In 1995, NMFS issued 623 notices through the Federal Register to implement FMP fishery management actions and rules for domestic fishing (U.S. Department of Commerce, July 1996).

After two decades of fisheries management under the Magnuson-Stevens Act, the U.S. has a high percentage of stocks at low abundance and over-utilized (NMFS 1996). Forty five per cent of the 182 stock groups whose resource status is known (83 out of 182) have an abundance level lower than what is required for producing the U.S. long- term potential yield (LTPY). Of I91 stock groups with known utilization status, 33% (63 out of I91 stock groups) are currently over-harvested. Many of these over-harvested stocks occur in the Northeast demersal species complex (I 8 stocks) or in the Gulf of Mexico reef fish group (10 stocks).

The high percentage of the overutilized stock groups is indicative of the need for continual improvement and for precautionary approaches to fishery management. It is only in recent years that the U.S. has begun to take a precautionary or risk- averse approach to fishery management. This means that in the face of uncertainties about the stock status, the efficacy of management controls or the prognosis for the managed resource, management actions should err on the side of conservation if the resource is to be maintained.

In this paper, we will describe federal fisheries management under the Magnuson-Stevens Act with special references to precautionary approaches in Section II. Then we will present the U.S. strategies

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The Fishery Conservation and Management Act later renamed as the Magunson- Stevens Fishery and Conservation Act (Magunson-Steven Act)

for resource protection and stock rebuilding as a precautionary approach to fisheries management in Section III, and conclude this paper with a summary in Section IV.

II. FAO Guidelines and U.S. Federal Fishery Management

2. I *FA 0 Guidelines*

The FAO published a set ofguidelines on the precautionary approach to capture fisheries in **June 1995.** (FAO 1995) The guidelines were developed by an international group of 34 fishery management experts'. The guidelines have the following specifications for a precautionary approach to fishery management:

1. "Management according to the precautionary approach exercises prudent foresight to avoid unacceptable or undesirable situations ..."
2. "An important element of the precautionary approach is to establish legal or social management frameworks for all fisheries At a minimum, such frameworks should establish rules controlling access to fisheries (e.g. all boats must be licensed), data reporting requirements, and processes for planning and implementing more comprehensive fishery management."
3. "The precautionary approach accords due concern to long-term effects in specifying management objectives and in developing management frameworks, procedures, and measures. **Thus a** precautionary approach links fishery management intimately with general environmental management."
4. "Precautionary management involves explicit consideration of undesirable and unacceptable outcomes and provides contingency plans to avoid or mitigate such outcomes."
5. The operational interpretation of precautionary management will depend on the scale of the fishing operations and the state of the exploited system.
6. The precautionary method is included in all stages of the management process-management planning; implementation, monitoring, and enforcement; and re- evaluation of the management system.

2.2. *U.S. Legal and Institutional Framework for Fishery Management*

U.S. federal fisheries management is mandated by the Magnuson-Stevens Act of 1996, With jurisdiction over living marine resources extending to 200 nautical miles from the coasts. The National Marine Fisheries Service (NMFS) of the U.S. Department of commerce has the responsibility, to implement the Magnuson-Stevens Act with the assistance of eight Regional Fishery Management Councils created by the Act. Councils are charged with preparing and proposing fisheries management plans (FMP) within the respective regions, and NMFS is responsible for review, approval and implementation of such FMPs.

An FMP must meet 10 national standards specified in the Magnuson- Stevens Act and also be consistent with other applicable laws so that the FMP would constitute an integrated conservation management plan. First, the national standards require the Council FMPs to:

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[2] The international group participated in the Technical Consultation on Precautionary Approach to Capture Fisheries organized by the Government of Sweden in co_operation with FAO. Sweden 6-13 June 1995

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(1) prevent overfishing,

(2) be based on the best scientific information

(3) manage an individual stock or stock complex as a unit throughout its range

(4) be non-discriminatory against residents by states

(5) consider efficiency of resources utilization

(6) be flexible, relative to different fisheries

(7) minimize cost and avoid unnecessary duplication

(8) take into account the importance of fishery resources for fishing communities

(9) minimize by-catch and by- catch mortality, and

(10) promote the safety of human life at sea.

Secondly, the other applicable laws with which FMPs should be consistent, are generally concerned with the condition of marine resources, its impact on the marine fish habitat, and its effects on coastal environment and communities. These laws include the National Environmental Policy Act, the Coastal Zone Management Act, the Marine Mammal Protection Act, the Endangered Species Act, the Paper Reduction Act. and the Regulatory Flexibility Act.

Further, the Magnuson-Stevens Act and its related guidelines have specified procedures f'or both the Councils and NMFS for implementation of the Act. Some examples are: Council organization structure (e.g., membership composition and Council committee organization), FMP development and review procedures (e.g.. procedures for meetings and constituent input). FMP contents (e.g., management objectives and alternative options and environmental impact statement), and procedures for stock rebuilding. (SEC.(302)-(304), Magnuson- Stevens Act, 1996)

Thus, the U.S. federal fisheries management program is based on a wel l-established legal and institutional framework with prudent foresight to prevent undesirable outcomes (e.g. overfishing) and to take an ecological approach to fishery management (e.g., integration of marine-related issues in the fishery management framework). This constitutes one of the basic components of a precautionary approach to fisheries management put forth in the FAO guidelines for the precautionary approach.

2.3 Fishery Management *Plan (FMP) Development*

A Council is responsible for preparing FMPs with proper expertise and technical assistance from NMFS, state fishery agencies, academia and fishery interest groups. The expertise and assistance are recruited to the FMP process through various means:

(1) Appointment of council members with necessary knowledge and expertise to Council committees designated to develop the FMPs

(2) assignment of federal, state and university employees with proper expertise to a plan development team (PDT) working under the Committee

(3) recruitment ofknowledgeable industry members to form industry advisory panels to advise and assist both the committee and the PDT for the FMP development, and

(4) use of a Council scientific and statistical committee to advise on scientific and statistical matters. This ensures that FMP is based on the best information available and also involves the constituents for better communication, acceptance and compliance.

The FMP development process includes five general tasks discussed below:

(I) Identify management problems, specify management objectives, propose feasible alternative management options including management measures.

Management objectives are expressed in quantitative or qualitative terms. In practice. most objectives are qualitative in nature, indicating a direction of improvement toward a desired condition e.g., prevention of overfishing and improvement of efficiency. Options must be considered to attain the management objectives and include a "no action" option. A full suite of management measures is widely available to the council. The following measures are typically considered: Minimum fish size, fishing area closure, fishing season closure, fishing gear restriction, fishing permit requirement, eligibility for limited access to fisheries, effort quota, catch quota, individual vessel effort allocation, and individual vessel catch quota.

It should be noted, however, that the tide has turned in favor of access control, individual harvest rights and mandatory data reporting as regulatory measures for U.S fisheries (Sissenwine and Rosenberg 1993). More FMPs under development have considered and included mandatory reporting, access control, individual rights and transferability. Nevertheless, with uncertainty about the social and economic impact of individual quota systems, the 1996 amendment to the Magnuson-Stevens Act mandates that no new individual quota systems shall be put in place until October I, 2000. (SEC. 303. (d)(I), Magnuson Act 1996) This is considered as a cooling off period for further assessment.

(2) Analyze the management problems, objectives and options

Sources of data for analyses are many. A few examples are vessel perinit data, vessel fishing logbooks, dealer purchase reports, observer sea sampling data and resource survey data. In case of a lack of data. special data can be collected through experimental fishing authorized with special fishing permits and as appropriate, anecdotal information and expert opinion.

Analytical findings are delivered, discussed and debated in the Committee. PDT and/or Advisory Panel meetings. This mobilizes a decision- making process that is an important element in the precautionary approach. Meetings are held and allow comments from the public, implying effective communication to the constituents of the uncertainty and risk associated with fishery management programs. The effective communication could seemingly reinforce trust between the regulators and those regulated, and thus improve the enforceability and compliance that are needed to achieve the management objective, another feature in the precautionary approach.

(3) *Propose the preferred opt ion for adoption by the Council.*

On the basis of the above analysis and with inputs from the public, the Council Committee selects a preferred option for developing an implementation system consistent with MP objectives. The development of the implementation system and strategy is presented in Task (4).

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(4) *Propose a set of regulations and a monitoring and re-evaluation system for the proposed option.*

Regulations are proposed in view of the intent of the policy, taking into account fishery behavior and the predicted change of behaviour. The proposed regulations are formulated by the Committee with inputs from constituents and the legal and enforcement staffs of NMFs and the U.S. Coast Guard.

The proposed monitoring and evaluation systems for FMP are established with proper responsibilities assigned. Two examples are cited below: Under the Northeast Multispecies (Groundfish) FMP Amendment 7. a Multispecies Monitoring Committee consisting of industry advisors and federal/state scientists has been instituted to monitor groundfish stocks, target TAC and recommend necessary adjustments to management measures. Similarly, parts of the Scallop FMP require a plan development team (PDT) to conduct a third-year review of its vessel days-at-sea (DAS) reduction program to evaluate a reduction of effective fishing effort for further consideration of management policy.

Data needed for monitoring and evaluation are specified in the FMP data reporting requirements. The data, in most cases. are parts of the existing data collection system. In some situations, data collection requires a separate data system design. For example, the real-time catch quota monitoring system for summer flounder was designed on the basis of add-ons to the existing dealer reporting system.

(5) Involve the constituents and other interested parties in Tasks (1)-(4) during the FMP development process.

The Magnuson-Stevens Act requires the involvement ofconstituents and interested parties. Any meeting convened by the Council, the Committee, the PDT and the Industry Advisory Panel are required to be publicized and kept open to the public for input and comment. Public hearings are held along the coast in fishing communities for important issues and decisions – e.g., a draft FMP proposed by the Committee and the adopted FMP by the Council before its submission to NMFS for review. A scoping document which initiates an FMP process for a fishery required in Task (1) also requires public hearings. {SEC.(302)(1), Magnuson-Stevens Act 1996))

Important components of the public review include

(1) the purpose and need for the proposed action

(2) the management objective and management approach,

(3) a summary of the proposed action and its alternatives, including every measure and its justification,

(4) a description of the resources and fisheries,

(5) a discussion of the proposed action relative to the national standards and overfishing,

(6) the relationship between the proposed action and the other applicable laws and

(7) an environmental impact statement.

One of the most important elements in an FMP is the specification of the overfishing definition. This specification defines a threshold criterion for triggering Council/NMFS actions to prevent any fishery from overfishing or rebuild overfished resources. It is an underpinning of a risk-averse precautionary approach for conservation that promotes sustainable yields from fisheries. The required actions are also specified in the Magnuson-Stevens Act and the overfishing 602 guidelines. Recent changes in the Magnuson-Stevens Act require an FMP to be developed to end overfishing on any stock currently over-harvested, and rebuild the resource with a planning horizon that does not exceed 10 years. {SEC.304(e)4 A(ii), Magnuson-Stevens Act 1996,) More detail will be available in Section III.

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2.4. *National Marine Fisheries Service (NMFS) FAP Review and Implementation*

NMFS is the agency charged with the responsibility to review the FMP prepared and submitted by the Council. This review determines if the Council's proposed plan is consistent with the Magnuson-Stevens Act and other applicable laws both in content and substance. Are all components of an FMP presented'? Do the components meet national standards including the prevention of overfishing, and are they consistent with other applicable laws?

The review also assesses whether the proposed program can achieve management objectives while preventing overfishing. All aspects of the program (including biological, economic and social impacts; the program's enforceability; industry acceptance; and cost/benefit ratios) are evaluated in terms of management objectives.

In order to ensure timely management action, the NMFS review schedule is regulated by the Act and its guidelines. On or within five days of the Council's transmission of the proposed FMP, the NMFS should issue a notice inviting comments from the public about a Plan or plan amendment proposed by the Council, and allow a 60-day comment period. Within 30 days of the end of the 60-day comment period, the NMFS has to notify the Council of its disapproval and partial approval. Otherwise. the proposed plan or plan amendment would be considered approved. (SEC.304.(a)(l)-(5), **Magnuson** Act 1996). This will ensure timely action as recommended in the FAO guidelines for precautionary approaches.

Upon NMFS approval of a Council FMP, the NMFS also implements the FMP. The implementation consists of three major components: Regulation enforcement, FMP monitoring and evaluation. The enforcement is carried out by MMFS and the U.S. Coast Guard. and in some cases, in co-operation with states. NMFS monitoring systems and evaluation programs are based on the FMP's specification, and considering other NMFS requirements.

III Federal Fishery Management and Overfishing: Robustness of the Precautionary Approach

An FMP prepared and implemented under the Magnuson-Stevens Act shall prevent overfishing as stated in the national standard I of the Act. "Fishery, conservation and management measures shall prevent overfishing while achieving, on a continuous basis. optimal yield from each fishery for the U.S. fishing industry". (SEC.301(a)(I), Magnuson-Stevens Act 1996)

Implementation of the 1976 Magnuson-Stevens Act began and continued without a clear definition of overfishing and specific procedures to prevent overfishing. The related guidelines were also ambiguous on these issues. As a result, overfishing definitions in the early FMPs under the Magnuson- Stevens Act. if included at all, were based on various biological concepts and criteria. The ability, of the definitions to prevent overfishing was hard to assess and evaluate. Consequently, the issue ofoverfishing got escalated as time went on. It become obvious by the 1980s that an overfishing definition with a proper biological reference point was needed to improve the FMP. along with a set of clear guidelines for preventing overfishing. A reauthorization of the Magnuson-Stevens Act and the revised CFR part of602 Guidelines for an overfishing definition provided a comprehensive framework for the prevention of overfishing and for rebuilding overfished stocks.

With this reauthorization and the revised 602 overfishing guidelines, the Councils arc required to specify a quantitative overfishing definition for each stock in each FMP, regardless of the status of the stock

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condition. The overfishing definition must be approved by NMFS and accepted as a threshold level by which a Council and NMFS determine whether and when to trigger necessary management actions to prevent overfishing and rebuild overfished stocks. With the overfishing definition, the Council and NMFS monitor and assess resource conditions for the species within their jurisdiction.

If a stock or stock complex is determined as one that is likely to approach the overfishing threshold level in two years or has already reached that level, the Council within one year of the such determination must prepare an FMP with management measures and regulations to prevent overfishing and to rebuild stocks for NMFS approval and implementation. If the Council does not submit NMFS a fisher) management plan, plan amendment, or proposed regulation to end overfishing and to rebuild the overfished stocks, NMFS must prepared a fishery management plan or plan amendmont and any accompanying regulations to stop overfishing and rebuild the stocks within nine months. The rebuilding plan must be monitored and re-evaluated routinely at least every two years and revised as necessary. (SEC.304(e)(1)-(5), Magnuson Act 1996).

3.1 U.S. 602 Overfishing Guidelines'

Overfishing defined without a standardized method often leads to a professional debate over the appropriateness of a particular overfishing definition. Historically, the task of evaluating whether an FMP is in compliance with national standard ! (to prevent overfishing) becomes a difficult task. often weakening under political pressure and subject to professional judgement. In order to evaluate an FMP effectively, relative to the national standard. NMFS sought to revise the 602 overfishing guidelines during the 1980s.

In 1986. a NOAA Fishery Management Study), recommended that NOAA set up a conservative standard for the fishery and take responsibility for determining a harvest level in each fishery to safeguard against recruitment overfishing. This ensures that the stocks would not be driven down or would be maintained at the threshold ofoverfishing, and it also establishes a maximum biological acceptable catch (ABC), However, Councils and NMFS regions indicated that it was not feasible to derive a single. generic definition of overfishing. Later, guidelines were developed, allowing the Council discretion to define overfishing in each FMP with a specified time frame and specific criteria to approve a definition of overfishing. In spring 1988, a series of Council/NMFS regional workshops was held to discuss the conservation standard and its implementation. A proposed rule was published and finalized as a final rule on July 4, 1989; it revised the 602 overfishing guidelines.

The current 602 guidelines require a definition of overfishing as a level or rate of fishing mortality that jeopardizes the long-term capacity of a stock complex to produce the MSY on a continuing basis. An objective and a measurable definition of overfishing must if possible be specified. Overfishing may be expressed in terms of a minimum level of spawning biomass, a maximum rate of fishing mortality, a formula, a model or other measurable standard that is designed to ensure the maintenance of the stock's long-term capacity. Moreover, the overfishing definition must be capable of monitoring and evaluation by NMFS and be based on the best scientific data. Councils are further required to take risk factors into

[3] The material in this section is drawn from osenberg et al(1994)

account in defining overfishing and focus on identifying and gathering the data needed for the overfishing definition if scientific data are severely limited.

The NMFS applied several criteria to evaluate the Council's definition of overfishing: scientific merit, the likelihood of effective Council action to prevent overfishing, a basis for measuring stock status against the definition, and operational feasibility.

Finally, while an FMP must contain the management measures necessary to prevent overfishing, the key to preventing it is the definition of overfishing, because it sets the threshold level to trigger management action to protect resources. Without a proper threshold, necessary action might not be taken or could bc delayed, even under the newer and more stringent guidelines. NMFS has taken its position on the matter of overfishing definition both in practice and in theory very seriously.

3.2. Status of the U.S. Overfishing Definition

In 1993, NOAA initiated a panel consisting of I5 scientists to review overfishing definitions in U.S. fishery management plans". {Rosenberg et al (1994) and Rosenberg and Restrepo (I995)) The panel reviewed approximately 30 theoretical and empirical studies done worldwide and arrived at the following conclusions regarding the overfishing definition as related to precautionary management reference points and strategies.

(1) Precautionary management reference points are those initiated to prevent recruitment overfishing. In order to be precautionary, it is more appropriate to assume that the spawning biomass or egg production is linearly related to recruit than to assume average constant recruitment at all stock sizes. Limit reference points for biological conservation should set the constraints within which a management strategy must operate and be case specific.

(2) It is useful to define control laws combining several thresholds, instead of a single threshold, to provide protection of resources. A combination of a maximum fishing mortality rate (that is a precautionary biomass level to which the maximum allowable fishing mortality rate is reduced) and an absolute minimum biomass limit may provide good protection for the resource.

(3) Nevertheless, a precautionary management strategy should contain. in addition to limit reference points, a priori decision rules on the acceptable probability (risk) that recruitment overfishing will take place, given the target harvest and the estimated stock status.

With the basic conclusions above, the panel proceeded to evaluate the overfishing definitions existing in the U.S. fishery management plans. The panel first selected evaluation criteria and specified an ideal definition of overfishing. The ideal definition should be a threshold rather than a target level, at least neutrally conservative in protecting against recruitment overfishing, measurable, linked to management actions, unambiguous operationally, and biologically suitable with no obvious need for improvement.

The panel considered and evaluated 117 overfishing definitions for stocks around the nation. Of the 11 7 definitions, 44 for the primary stocks were chosen for detailed analysis. The remaining 73 overfishing

[4] The material presented in this section is drawn from Rosenberg et al(1994) and Rosenberg and Restrepo(1995)

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definitions that were designated as the secondary stocks, were analyzed in less detail. Presented below are the findings of the panel:

Four of the primary stocks (9%) met the criteria for the ideal overfishing definition and many of them (39%) met the criteria with minor improvements e.g., removal of ambiguity or linking to management actions. Seventy per cents of the definitions for the primary stocks were biologically sensible and 64%were at least neutrally conservative. Almost all of the primary definitions (96%) were measurable while 43% had some ambiguity. Only 45% used thresholds separate from management targets in the FMPs. The findings for the secondary stocks are similar.

Based on the evaluation, a sizable fraction of the definitions were considered risky for protecting the resource: 20% of the primary stocks and 9% of the secondary stocks. About a half of these definitions required modifications for a more conservative harvest rate. The other halfcould be improved by relating them more directly to stock productivity.

It was alarmingto have found that less than halfofall the definitions were explicitly linked to management actions. The overfishing definition is intended to set a management threshold for triggering more stringent management actions to protect the resource. Lack of the linkage might delay management actions and thus fail to protect resources.

The panel finally concluded that all of the definitions identified as risky, not measurable, ambiguous or not biologically sensible, should be reconsidered as soon a possible. Overall, the panel recommended that 77% of the definitions for the primary stocks and 88% of those for the secondary stocks be improved in further FMP amendments.

This review revealed that more was required to improve the U.S overfishing definitions to protect and rebuild the U.S. fishery resources under the Magnuson-Stevens Act.

3.3. New England Groundfish Example: Rebuilding Strategy

The New England Groundfish fisheries case study is selected because the fishery resources have been severely overfished and some important new management actions have been taken recently. In this example, the role of the overfishing definition and the 602 overfishing guidelines has been significant for the management of New England groundfish fisheries to date.

The US New England groundfish fishery exploits demersal marine groundfish species off the U.S. east coast from Maine to Virginia. This fishery has been an important source of jobs and incomes for the coastal communities in the Northeast region, New England in particular. However, the fishery resource base has declined to an all-time low in the last three decades. NMFS research trawl vessel surveys have documented a declining trend in the abundance of this groundfish resource from 1963 to the present. (U.S. Department of Commerce, January 1995)

The potential benefit of successful management is great as indicated by Anthony (I 993) and Edwards and Murawski (1993): “Overall groundfish landings were one-third the maximum sustainable yield (MSY). Landings for haddock and yellowtail flounders were one-tenth the MSY. If the abundance of groundfish were rebuilt to provide MSY, the catch could increase by two to three times with one- half of the present effort.” (Anthony 1993) The potential gains in resource rents and consumer benefits from efficient exploitation of the New England groundfish resources by the commercial fishing industries

was estimated to be roughly $130 million and $20 million a year respectively. (Edwards and Murawski, 1993).

3.3.1. *Management System'*

The First Groundfish FMP (1977-1982): Under the Magnuson-Stevens Act, in March 1977, NMFS adopted and implemented the Council's first groundfish fishery management plan (FMP) which included species catch quotas for cod, haddock and yellowtail flounder along with other measures e.g., minimum fish sizes, minimum mesh sizes and spawning area seasonal closures. Under this FMP, the number of U.S. vessels increased dramatically as the Magnuson-Stevens Act eliminated foreign fishing. The increasing number of U.S. vessels caught the quotas rapidly and forced the fisheries to close frequently and for long periods of time.

To prevent long closures and allow small boats to catch their historical share, a system of individual vessel trip limits was added to the catch quotas. Trip limits were eventually abandoned because of wholesale violations and inadequate enforcement resources. The industry called for less restrictive regulations devoid of quotas and closures. The Council responded with a new plan, commonly referred to as the interim groundfish plan.

Interim Groundfish Management Plan (1982-1986): The Council, in order to mitigate management problems, began to prepare an interim groundfish FMP in 1980 that was adopted in 1982 for a limited 3-year span. The interim FMP replaced the catch quotas with minimum fish size and net mesh size regulations for Georges Bank and the Gulf of Maine. Also included was a controlled framework to allow small mesh fisheries e.g., whiting and shrimp fisheries, to continue in the Gulf of Maine. With the implementation of this interim FMP, fishing exploitation rose, landings increased and resource abundance indices declined.

A Comprehensive Groundfish Fishery Management Plan (1986): To follow on the interim plan, a comprehensive groundfish FMP was implemented in 1986. This groundfish FMP set biological targets in terms of maximum spawning potential (MSP), based on spawning biomass per recruit analysis, and was also expanded to include more species in the management unit: cod, haddock, pollock, white hake, redfish, winter flounder, American plaice, witch flounder, and windowpane flounder. Ilowever, this FMP continued a management system and measures which were similar to those adopted in the Interim FMP. The important measures were fish size, mesh size and spawning area regulations as well as a framework for regulating small mesh fisheries. Direct controls on catch or fishing effort Ivere not included. Although this FMP was amended several times, the amendments generally fine-tuned the existing system and added more groundfish species into the management unit. The fishery remained open to access with a ominal requirement for vessel permits.

At the beginning of this FMP in 1986, a Groundfish Technical Monitoring Group consisting of NMFS and state biologists was instituted to monitor the performance of the FMP. In 1988, this Monitoring Group issued a report indicating that the FMP failed to protect major groundfish resources (i.e. cod, haddok and yellowtail flounders) from overfishing.

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[5] The material in this section is primarily drawn from Wang (1993)

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In July 1989, the NMFS reissued the 602 guidelines requiring(l) an overfishing definition to he specified for every fish stock in FMPs and (2) Councils to design and propose a stock rebuilding program for any stock that is overfished by the definition. In Amendment 4 to the groundfish FMP adopted in 199 1. the Council included the overfishing definition for most of the regulated groundfish species, and by those definitions, all stocks of cod, haddock, and yellowtail flounder were overfished. Nevertheless, the Council did not include a stock rebuilding program for the overfished stocks.

It should be noted, however, that the precautionary approach to the prevention of overfishing under the Mngnuson-Stevens Act and the 602 overfishing guidelines sometimes can be frustrated. The Council, on one hand, has the responsibility to protect the resources based on National Standard 1 and on the other hand, must be sensitive to the policy impact on fishing industries based on the National Standard 8. The impact on the industries particularly in view of the short-term need of the industries can be overwhelming and thus bias the Council decision. resulting in downplaying scientific input. It should he noted, also, that the concerns over the short-term impact are expressed through public comments in a transparent decision-making process, a feature of the precautionary approach.

Consent Decree: Following the NMFS approval of Amendment 4 in 1991. NMFS was sued by the Conservation Law Foundation (CLF) for implementing Amendment 4 that did not prevent overfishing of cod, haddock and yellowtail flounder stocks as required in the guidelines. A Consent Decree was reached between NMFS and CLF to reduce the groundfish fishing mortality by 50% in a S-year rebuilding schedule. In response to the Consent Decree, the Council prepared and submitted Amendment 5.

Amendment 5 to the Groundfish ***FMP*** 1994-1 995): The two main purposes of Amendment 5 were (1) to eliminate the overfished condition of the principal groundfish stocks (cod, haddock. and yellowtail flounder) by reducing the fishing mortality by 50% over the next 5-7 years, and (2) to reduce the by-catch of harbor porpoise in the sink gillnet fishery. (NEFMC September 30, 1993).

In pursuing its objectives, the Council amendment expanded the management unit to include all stocks of cod, haddock, pollock, yellowtail flounder, winter flounder (blackback), witch flounder (grey sole), windowpane flounder, American plaice (dabs). redfish. white hake, red hake, silver hake (whiting), and ocean pout. Further, the amendment included the following components as the core management system for the resource (NEFMC September 30, 1993).

(1) A moratorium on the issuance of additional vessel permits during the rebuilding period of 5-7 years with exceptions for smaller and lower power vessels.

(2) An effort control system allocating and limiting individual vessel days-at-sea (DAS)

(3) An effort reduction program to reduce the initial vessel DAS allocation by 10% each year and down to 50% of the initial allocation in 5 years.

(4) A continued mesh size regulation scheme for vessels retaining more than the groundfish "possession limit" that was currently set at 500 pounds.

(5) An interim sink gillnet regulation to reduce harbor porpoise bycatch using four-da), blocks of time during which all gear must be out of the water.

(6) The mandatory reporting of landings and fishing data by groundfish dealers and vessels respectively.

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Amendment 7 to the *Groundfish FMP* (1996-): While Amendment 5 above was under development, the stocks of cod, haddock and yellowtail flounder continued to decline in abundance. In mid- 1994 as Amendment 5 was being implemented, haddock stocks were at record low levels, two yellowtail flounder stocks (Southern New England and Georgcs Bank Stocks) had collapsed and the collapse of Georges Bank stock was imminent, according to assessment scientists in the region. In August 1994, based on the SARC/SAW reports[6]. the Northeast Fisheries Science Center issued a Special Advisory Report (I) to state that the fishing mortality for the final-year of the S-year rebuilding schedule under Amendment 5 would not prevent the stocks from further decline and (2) to advise that fishing mortality rates should be reduced to as low a level as possible, approaching zero, to avert a collapse of cod and improve the prospects of rebuilding the yellowtail flounder stocks. Further, the status of the other groundfish stocks were also considered depressed with many of the stocks being overexploited. (NEFMC Amendment 7. *1996)*.

As a result, the Council initiated Amendment 7 with an objective "to reduce fishing mortality on Georges Bank cod, haddock and yellowtail flounder and southern New England yellowtail flounder to as close to zero as practicable, and also to reduce fishing mortality for Gulf of Maine cod to rebuild the spawning stock biomass of the identified stocks." (NEFMC Amendment 7, February 7, 1996) The biological reference point was F_{01} as the objective for Georges Bank stocks of cod, haddock, and yellowtail flounder and the Southern New England yellowtail flounder stock.

Amendment 7 was approved and implemented in May 1996. The Amendment extended the existing measures of Amendment 5. The limited access permit was expanded to cover small groundfish otter trawl and gillnet vessels between 30 and 45 feet which had an open access permit under Amendment 5. The DAS reduction schedule was accelerated with the new schedule for the 50% DAS reduction shortened by 2 years from a S-year schedule under Amendment 5 to a 3-year schedule under Amendment 7.

Some new measures were added to the above fine-tuned measures to enhance the precautionary approach in New England groundfish management.

(1) Target total allowable catch levels (TAC): Total allowable catch targets for the commercial sector were set for specific cod, haddock, and yellowtail flounder stocks (5 stocks in total) and an aggregate TAC for the combined stocks of the other regulated species (7 other groundfish species). Ifan individual stock or aggregate TAC is reached in any period (e.g. year), the Council must take actions to restrict catches in the next period.

(2) A Multispecies Monitoring Committee (i.e., a groundfish monitoring committee) consisting of industry representatives and assessment scientists from NMFS, states and the Council has been instituted and is charged to track DAS and TAC utilization, assess the groundfish stocks and make proposals on necessary adjustments to the management measures relative to the FMP objectives.

(3) A Certification of the Bycatch Fisheries Program: This program has been put in place to minimize bycatch and the mortality of the bycatch of the regulated groundtish. Vessels with no groundfish DAS quotas are not allowed to fish in Northeast groundtish fishing areas unless the Regional

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[6] The SARC/SAW reports are biological asessment reports and advices for fishery managers and based on the stock assessment studies conducted by a team of biologists from NMFS and states

Administrator certifies that the vessels involved can achieve a groundfish bycatch less than 5% of the trip catch.

3.3.2 Economic Assistance Programs

The U.S. Department of Commerce, the supervisory agency of NMFS/NOAA, initiated two economic assistance programs parallel to but independent of Amendments 5 and 7. In 1994, the first program was initiated tomitigate the impact of Amendment 5 on the fishing industries and communities. This economic assistance program consisting of a $30 million grant was designed to assist the fishing industries and communities by including grants for developing alternative fisheries (i.e., underutilized species and aquaculture), improving fishery infrastructure, training fishermen for alternative jobs, and promoting community development.

The second program under implementation is a voluntary vessel buyback program for reducing the fishing capacity of the groundfish fleet. The buyback program with a budget of $25 million has two parts, a pilot project of $2 million and a follow-up project of $23 million. The pilot project, which has been completed, was to establish program procedures and identify evaluation criteria. Detailed procedures are now available and used in the second project. The procedures include the owner's proposal for selling his groundfish vessel to the U.S. federal government with a proposed vessel price. One criterion to establish the vessel purchase priority is the ranking of the vessels by the ratio of the vessel's groundfish revenue to the proposed vessel price: The higher the ratio, the higher the priority for the vessel to be bought by the federal government. The pilot project with a $2 million budget bought and retired I I groundfish vessels with a total of 9 11 GRT, 4355 horsepower and 2 106 vessel days at sea (DAS). With a linear extrapolation, the $25 million budget is estimated to retire 1 1,388 GRT, 54,438 horsepower and 26,325 DAS. The estimated days at sea quota to be retired is approximately 20% of total DAS quota under Amendment 5[7].

IV Summary

The U.S. Federal Government has managed the fisheries resources within the U.S. EEZ under the Magnuson-Stevens Act since 1977. By 1995, there were 36 fishery management plans (FMPs) in place and in 1995 alone, National Marine Fisheries Services (NMFS) issued 623 notices through the Federal Register to implement FMP management actions and rules for domestic fishing. An examination of the U.S fishery management experience indicates a need for continual improvement and the adoption of more precautionary principles in management systems and strategies.

Even though the U.S fishery management program may not be perfect, it should have enough components to be considered precautionary based on FAO precautionary principles and guidelines issued in 1995. The U.S. legal and institutional framework has been well established and mandated by the Magnuson-Stevens Act and other applicable laws. The fishery management program is not only prudent to avoid unacceptable situations (e.g., to prevent overfishing) but also has a long-term objective (i.e. to achieve an optimal yield. on a continuous basis for each fishery),

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[7] The estimated 26,325 DAS quota to be retired under the $ 25 million vassel buyback program accounts for about 30% of the DAS quota of the active ground fish vessels which used a DAS phone in system in 1995.

The guidelines for the process of the FMP development. review. and implementation are well specified for all FMPs around the nation. Each step of the process is concerned with the achievement of management objectives, national standards and other applicable laws and gives detailed consideration to a variety of issues: Resource conservation and protection. prevention of overfishing, stock rebuilding. use of the best information. uncertainty associated uith a complex environmental system and management outcomes. transparent decision processes. public input and comments, the FMP impact on the industry. industry compliance, enforceability of rules and regulations, and responsiveness and effectiveness of an FMP in dealing with changing conditions. The U.S. FMP process has resulted in different management systems including limited access programs, harvest rights and the transferability of the rights.

An important feature of the U.S. fishery management program is its overfishing definition and its related guidetincs for resource protection. The Magnuson-Stevens Act and 620 overfishing guidelines require the following: (I) Each FMP must define an overfishing definition for each of the species covered in the FMP and the overfishing definition should be specified as a threshold level of biological reference points. (2) Each FMP should establish a management program with a time schedule for preventing overfishing of a stock if the stock is approaching the overfishing, threshold level or for rebuilding a stock if the stock is below the overfishingthreshold level. The implementation of the overfishing definition has made a serious impact on the FMP process and on the status of the fisheries. NMFS has taken action to review U.S. overfishing definitions and implement the overfishing guidelines to protect U.S. fishery resources.

Management of groundfish stocks in New England can be considered an example of the U.S. fishery) management program that has dealt with overutilized groundfish resources since the hlngnuson- Stevens Act with limited success. The Act and the 602 overfishing guidelines along with the involvement of the public (i.e., the Conservation Law Foundation) have altered the strategy for managing the New England groundfish fisheries. The new fishery management program is different from the traditional program in that it includes an overfishing definition for each groundtish stock, a stock rebuilding time schedule with an overfishing threshold level, a limited access program, a vessel days-at-sea (DAS) quota system with a DAS reduction schedule, and necessary enforcement, monitoring and evaluation systems. Also included in the strategy are twoeconomic assistance programs to mitigate the impact of the management program on the industries and to reduce the fishery harvesting capacity of the fisheries. These include a $30-million grant to mitigate the economic impact and a $25-million vessel buyback project to reduce the harvesting capacity.

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12. OVERVIEW AND PRACTICAL IMPLICATIONS OF THE PRECAUTIONARY APPROACII TO FISHERIES MANAGEMENT

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Introduction

The precautionary approach to fisheries management (PA2FM) is a concept which has been under development for some time and has aroused considerable debate at the theoretical or academic levels. The purpose of this paper is to present some ideas on possible practical implications of the PA2FM. both for fisheries managers and for the fishing industry, and to promote discussion of these topics.

For the purpose of this paper "practical implications" are taken to mean :

- considerations which may facilitate or prevent the widespread adoption of the PA2FM;
- operational systems that will have to be put in place to allow practical implementation of the PA2FM.

A number of relevant ideas are discussed on the basis of general observations and literature. A case study illustrates some of these issues.

Because there has been little practical application of the concept so far, much of what follows is based on the author's personal observations or opinions (encountered mainly in the South Pacific and Australasia). They should be viewed as discussion points rather than as concrete facts or assertions.

Management versus development

Many people in the fishing industry, as well as working, fisheries officers and managers, see a clear distinction between fisheries development and fisheries management.

Development is frequently perceived in relation to fishery growth – more fishing units, shore bases and processing factories, increased production and greater exports. Development may be driven entirely, by the private sector, or may involve Government providing financial assistance or investment incentives to the fisheries sector in order to allow fishery exqploitation to begin or to grow. In some countries, Government may get directly involved in commercial fishing ventures, in order to compensate for shortage of venture capital, raise Government revenue generate foreign exchange, or for other reasons. Development tends to dominate the thinking of fisheries administrators and public officials in developing countries.

Management, on the other hand, is often perceived as a response to development, especially if this has been excessive or over-rapid, and frequently takes the form of reaction to a crisis. Fisheries officers may view management in purely pragmatic terms, such as the control of fishery input (e.g. fishing effort, in the form of limits on numbers of fishing units, gears types, closed arcas and seasons) or outputs (e.g. production limits, expressed as quotas, size regulations and species restrictions) to solve an immediate problem. Fishermen or members of industry may see management as a form ofbureaucratic interference with their livelihood, and the placing of obstacles in their way.

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The precautionary approach is generally seen as an 'extreme' form of management. under which these perceived burdens and obstacles will he even more extensive. This view is reflected, for instance, by the NGO declaration from the FAO World Food Summit held in Kyoto, Japan in November 1995. The declaration recognised that improved management of the world's fisheries was a basic requirement to enhancing the contribution of fisheries to food security. At the same time. however, it expressed concern that the precautionary approach to fisheries management might be implemented in such a way as to impose esccssive burdens or constraints on industry.

This divergence seems to characterise feelings about fisheries management in general and the PA2FM in particular, and stems from broader attitudes towards natural resource use and the environment. In many developed countries, active and vocal conservation groups have succeeded in raising widespread awareness of environmental management issues, to the point where one might reasonably imagine that the precautionary approach should be more easily embraced by these societies. For example in Australia the population is increasingly environmentally-minded and all commercial fisheries are managed through sometimes complex arrangements involving Government. industry, and local communities. Even there. however. the precautionary approach is perceived by industry and by many officers of the Australian Fisheries Management Authority as being potentially too restrictive on commercial activity. These reservations may stem from lack of a clear indication of what the PA2FM means in practical terms. Nevertheless it is not surprising that in many developing nations, where the focus is still on increasing the economic returns from fisheries, the precautionary. approach may be viewed with suspicion or lack of enthusiasm.

Perhaps the most immediate practical implication of the PA2FM, therefore, is one of perception. At present, the precautionary approach is widely regarded with doubt and lack ofconviction even by, those who acknowledge that there is a serious problem with present systems offishery management. It may be viewed with outright hostility by those who do not share this perception. Before the precautionary approach can be widely embraced, a shift in thinking is required on the part of both the fishing industry and fishery administrators, so that management ceases to be viewed as being different from, or opposed to, development.

For industry and the public at large achievement of such a change in attitudes may be a long-term process that will probably arise only as a result of broad public education programmes. In developed countries, growing environmental concerns have arisen mainly as a result of resource misuse. Developing countries may have to undergo similar negative experiences before concern over environmental issues such as fisheries management takes root in the minds of the public at large.

In the case of fishery administrators, where acceptance of the PAIFM really needs to be instilled over a shorter time-frame, a change may be needed in the way training in fisheries management is delivered, so that the perception of management as a reaction or response to development is de-emphasised in favour of more holistic approaches which view development and management as components of the same process. The first responsibility of many fisheries officers and administrators is to promote fisheries development. If PA2FM is to be taken up, management concepts need to be better integrated into development thinking.

Indeed such changes appear to be taking place already in some parts of the BOBP region. For instance, the introductory notes to a training course to be run in Sri Lanka in 1996 defined management as "the process of having a fishery perform in accordance with established objectives"'. This contrasts sharply

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with the often-seen more 'traditional' definition of management as "the exercise of controls in order to limit or reduce fishing effort or output". It underlines the fact that management and development should be integrated, inseparable activities, rather than action-and-reaction.

How the PA2FM differs from present fishery management systems

Whereas 'traditional' definitions- or at least implementation of fisheries management are characterised by reaction to and solution ofproblems, the precautionary approach attempts to ensure that problems do not occur in the first place. The PA2FM proposes that development should not proceed blindly, and that restraint be exercised where there is a lack of certainty about the ability of the resource to withstand increased exploitation. The precautionary approach thus puts the emphasis strongly on prevention rather than cure.

The PA2FM also proposes that the burden of proving whether a resource can withstand increased exploitation be shifted from fishery administrators to the developers themselves, thus shifting some of the responsibility for resource assessment and environmental audit on to those who will benefit most directly from its exploitation.

Traditional forms of fishery management rely on concepts such as Maximum Sustainable Yield (MSY) or Optimum Economic Yield (OEY) to provide management targets. However, as our knowledge of aquatic ecosystems gradually improves, and we begin to understand more about their complexity, it is becoming increasingly clear that such concepts may over-simplify the dynamic nature of fisheries. MSY, for instance, is probably not static for rnost resources : it may vary over time as a function of natural fluctuations in the target fish stock and in response to changes in the ecosystem of which the stock forms a part. Sometimes these changes may be human-induced – for instance the establishment or closure of another fishery for predator or prey species of the exploited stock. A simplistic MSY-based production target which is held constant for long periods may therefore lead to "under-exploitation" in some years but, depending on the reproductive characteristics of the resources, could cause serious depletion in others. Over the long term, MSY estimates may go out of date because of other changes not directly related to the fishery, such as the impacts of coastal degradation or global climate change.

In addition, natural systems contain a great deal of variability, and the data that we collect on those systems is subject to sometimes extensive statistical uncertainty. Many fishery scientists now doubt the ability of standard modeling techniques to predict MSY for even intensively-studied stocks with any confidence. Carl Walters, a well-known fishery scientist, told a meeting of Australian fishery scientists in 1996 that he was not aware of any fishery in the world where a sustainable quota could be truthfully said to be assessable within an accuracy of 40% (Walters. 1996)'. This is in stark contrast to, for instance, Indonesia's fisheries development plans which use MSY estimates rnade 21 years ago as a production

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target, and which measure the "remaining potential" (the difference between current production and MSY) to one-tenth of one per cent of these targets (Gillett, 1996)[3].

In the late 1980s, Walters and another well-known fishery scientist, Ray Hilborn, argued that a fishery system can best be understood by perturbing it – for instance, by exploiting it and then measuring its responses to these perturbations. If we are faced with a system that we have not perturbed such as a virgin fishery -we have no way to know what its characteristics are or to estimate what its productive potential might be, because we have no data on the response of the stock to exploitation. In practical terms, therefore, where there is no exploitation, we cannot realistically determine our management targets, whether this be MSY or some other appropriate management goal, as long as these targets are expressed in terms of production.

To counter the shortcomings of management based on static and probably inaccurate MSY estimates, Walters and Hilborn suggested the use of 'adaptive' or 'experimental' management as a means of better tailoring the exploitation of a resource to its productive potential. Under the adaptive approach, increasing levels of exploitation are allowed to take place but are carefully monitored, and their impact on the resource is measured. Management steps are taken in response to perceived changes in the resource by frequently adjusting effort or other parameters in the fishery. In this way the MSY or some other management target is approached in an empirical f&ion, sometimes from the 'other side' after having been exceeded. The adaptive approach permits increased exploitation in times of stock abundance and decreased exploitation when resources are diminished, and thus gets away from the idea of a permanently fixed, unchanging MSY-based production target.

Unfortunately one of the problems with adaptive management is that it assumes that effort can be easily controlled and can be reduced when required. Sadly, experience shows that this is often not the case. When effort reaches levels that are too high for the fishery, it can be extremely difficult or impossible to pull back. Fishermen and businesses may have invested heavily and the enforcement ofregulations that will reduce their incomes or force them out of the fishery may be socially or economically unacceptable. It may prove politically easier to provide susbsides which allow the fishery to keep operating at higher-than-ideal levels ofexploitation. Once it reaches or exceeds production targets, therefore, the management of the fishery ceases to be simply a question of fish biology or population dynamics, and takes on political and socio-economic dimensions which may present problems that cannot be solved in a manner consistent with resource conservation.

The PA2FM recognises this difficulty, and advocates the converse of adaptive management. Instead of using fishing effort as a means of gathering data, the PA2FM attempts to constrain exploitation in the face of inadequate data. Because of this approach, the PA2FM may be better viewed as a form of risk management than production management. Garcia (1995)[4] suggests that instead of setting management goals in terms of a fishery's productive potential, it may be more appropriate to set the risk ofeconomic

[3] Gillett, R.D. (1996), Marine Fishery Resources and Management in Indonesia with emphasis on the Extended Economic Zone, Workshop on Strengthening Marine Fisheries Development in Indonesia. Directorate General of Fisheries /FAO

[4] Garcia, S.M. (1995). The Precautionary Approach to Fisheries with reference to Starddling Fish Stocks and Highly Migratory Fish Stocks, FAO Fisheries Circular No.871

or biological collapse at what we consider to be an acceptable level. FAO (1995)[5] develops this idea further by advocating the use of 'minimax' and 'maximin' approaches which use probabilities tables depicting the relative risks of different management strategies in order to select the most acceptable management option.

Precautionary fisheries planning and monitoring

The PA2FM requires that, instead of proceeding blindly, fisheries development should be constrained so that exploitation does not exceed predetermined limits. These limits may be applied to a number of different factors in the fishery-total production, mortality rates, inputs, rate of fishery growth, probability of stock collapse, etc. The basic requirement, however, is that even for new or obviously underexploited resources, fisheries development should be planned rather than haphazard. As mentioned earlier. this requires that the processes ofdevelopment and management, often seen in the past as being independent or counter-acting, should be integrated under the PA2FM, so that management becomes a component of development which itself proceeds according to predetermined methods and goals.

In practical terms, this means that if the precautionary approach is to be followed, formal fishery plans must be put in place, even for unexploited or under-exploited resources. Development targets and limits must be set and mechanisms established that will put a brake on the growth of the fishery when they start to be approached. Similar steps must be taken for those fisheries which are already being exploited. and must be accompanied by additional and possibly difficult measures to reduce exploitation levels if these are thought to be too high.

Fishery development and management plans should not regarded as static and unchanging. They should specify overall management objectives and specific goals for the fishery but these should be subject to revision and modification as information accumulates and the fishery becomes better understood. The plan should include management measures to be applied in response to specific events in the fishery. These measures should be pre-determined, and non-discretionary, although this in itselfmay be difficult to reconcile with the idea of adaptability and flexibility. There is always the danger that provision for revising and updating management plans might be used as an excuse for avoiding politically difficult management actions when they are needed.

A fundamental requirement for any kind of fishery planning is basic data on harvesting practices and catch levels. Probably the most important practical requirement of the PA2FM, therefore, is the implementation of adequate fishery monitoring systems. In the case of fisheries'involving the licensing of larger commercial and industrial vessels, the principal means of doing this should be through the imposition of compulsory logsheets for fishing vessels under which fishing skippers or owners are required to submit appropriate catch and effort data both regularly and promptly. Non-compliance with this requirement can be used as grounds for non-renewal offishing licences and is a particularly powerfull tool in regard to foreign vessels.

[5] FAO (1995). Precautionary Approach to Fisheries. Part 1: Guidelines on the Precautionary Approach to Capture Fisheries and Species Introductions. FAO Fish Tech Paper 350/1.

Depending on the nature of the fishery, it may also be desirable to supplement logsheet data collection systems with the use of on-board observers, port samplers. or other independent means of gathering data on fishing operations. This not only allows checking on the compliance of fishing vessels with data reporting requirements (for instance, logsheet data can be checked against unloading data at canneries or processing plants to ensure that no false repot-ting has taken place) but also permits gathering of supplementary information on such factors as size composition, reproductive condition and by-catch and discard practices.

Other research activities may also need to be instituted in line with the requirements of PA2FM. This is especially so in regard to smaller-scale or artisanal fisheries where logsheet-based data gathering systems would be impractical or unacceptable and where for whatever reason, licensing is not an appropriate management tool. Depending on the situation, the focus may need to be on biological or socio-economic information-gathering. The cost ofgathering this data may be substantial and may represent an additional burden for fisheries administration and / or the fishing industry.

Irrespective of how it is carried out and financed. the purpose of data gathering should be to allow development and retinement of fishery management plans, monitoring of the status of the fishery. evaluating the impact on the fishery of the management measures taken, and further refinement of the fishery management plan in response to this knowledge.

The PA2FM and overfishing

Although MSY or OEY are frequently cited as fishery management targets, there is a wide range of production levels at which a fishery can be sustained. If effort is maintained at low levels, catch per unit effort (CPUE) will be high, even though total yield may be low. At higher levels of effort total yields will increase as CPUE decreases, until the MSY is reached. Once this point is surpassed. total fields will start to fall again as CPUE continues to decline. and the fishery experiences growth overfishing. With still higher effort the fishery may suffer recruitment overfishing which can lead to stock collapse.

Of these four scenarios, the first three can exist as stable states producing sustainable levels of production. The third condition is sometimes referred to as “sustainable overfishing” and is a state in which both total yield and CPUE are lower than they could be, but in which participation in the fishery and the distribution of benefits from it are maximised.

Overfishing is rarely stated or even considered as a management objective, but in fact sustainable over-fishing is not an illogical management target if the economic goal is to distribute income as widely as possible. Furthermore, subsidising a fishery in order to place it in a state of sustainable overfishing may in some circumstances be a valid and efficient economic strategy (and in fact is a de facto result of the subsidies that are currently causing overfishing of many of the world fisheries). Unfortunately, fisheries in this state, especially open-access fisheries, can and usually. do progress to the next phase, which is unsustainable overfishing and stock collapse. Because of this risk, the concept ofsustainable overfishing is incompatible with the precautionary approach to fisheries management.

A characteristic of the precautionary approach when applied to fisheries that are currently being over-fished is that. even though it may reduce total landings. it should lead to improved economic performance of fishing units by improving per-vessel catches. This comes about because the PA2FM attempts to ensure that fisheries are not exploited above their MSY due to the unacceptably high levels of risk this

entails. The net result of applying the PA2FM to a heavily fished stock, therefore, is that CPUE will increase (although normally this would be at the expense of some vessels having to leave the fishery).

Whether this characteristic would be perceived positively or negatively depends on circumstances of the fishery in question, and Government's broader social and economicgoals. Ifwide income distribution is a stated economic target, as it is in many poor or developing countries, then reducing the numbers of people who benefit directly from the fishery may be an undesirable outcome.

Resistance to the precautionary approach

As noted earlier, major parts of the fishing industry and even many fisheries managers are apprehensive that the PA2FM will unreasonably constrain fishing activity, cause unnecessary economic loss or hardship, or burden the industry with extra costs and administrative obstacles.

A major concern is the 'burden of proof' aspect of the PA2FM, under which the onus is shifted to developers to demonstrate the capacity of the resource to withstand any increased exploitation they may intend. It is not yet entirely clear how this provision will be implemented by countries who formally adopt the precautionary approach. However, similar requirements have been imposed on other industries. For instance, most major construction or infrastructure development projects are now required to carry out environmental impact assessments and adjust their projects to minimise or compensate for these impacts. The 'burden of proof requirement of the PA2FM may be comparable to such requirements. Fishing industry managers are concerned that this will impose major cost burdens on them.

Many fisheries managers, for their part, doubt that the fishing industry can be trusted to carry out resource or environmental impact assessments thoroughly and honestly when these may produce results which are counter to the industry's own best interests. Mechanisms whereby such assessments could be carried out and then reviewed by the appropriate fishery management authority are still to be developed in most countries. If assessments were to be carried out directly by industry, there would be a need either for pre-determined standard methodology to be developed, or for a qualified, disinterested body to review the assessments and determine whether they had been conducted diligently and objectively. Arbitration procedures would probably need to be set up to deal with disputes over the veracity or reliabi t ity of impact assessments.

An alternative to industry carrying out resource or impact assessments directly would be to have these tasks carried out by fisheries management authorities or joint Government/industry bodies, and charge the cost back to industry, or otherwise build them into the overall costs of fishery management. There is a growing trend in some countries to transfer the cost of managing fishery resources onto the resource users and principal beneficiaries, and away from the general public. This is typically done through levies on fishermen, for instance through a tax on catches or quota allocations, Such a system removes many of the objections to the concept of industry carrying out its own analyses, but creates a new set of problems in that it requires fishery management agencies to have access to practical skills, facilities and resources that they may currently not possess.

Irrespective of the means through which the 'burden of proof' provisions of the PA2FM are put into practice, there is a danger that they could add significantly to the total cost of fisheries management and that at least some of this cost could be transferred to industry. This factor is unlikely to encourage industry support and may be used to provoke anti-fisheries management opinion on the grounds that

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Depending on the nature of the fishery, it may also be desirable to supplement logsheet data collection systems with the use of on-board observers, port samplers. or other independent means of gathering data on fishing operations. This not only allows checking on the compliance offishing vessels with data reporting requirements (for instance, logsheet data can be checked against unloading data at canneries or processing plants to ensure that no false reporting has taken place) but also permits gathering of supplementary information on such factors as size composition, reproductive condition and by-catch and discard practices.

Other research activities may also need to be instituted in line with the requirements of PA2FM. This is especially so in regard to smaller-scale or artisanal fisheries where logsheet-based data gatherings\ stems would be impractical or unacceptable and where for whatever reason, licensing is not an appropriate management tool. Depending on the situation, the focus may need to be on biological or socio-economic information-gathering. The cost ofgathering this data may be substantial and may represent an additional burden for fisheries administration and / or the fishing industry.

Irrespective of how it is carried out and financed, the purpose of data gathering should be to allow. development and refinement of fishery management plans, monitoring of the status of the fishery, evaluating the impact on the fishery of the management measures taken, and further refinement of the fishery management plan in response to this knowledge.

The PA2FM and overfishing

Although MSY or OEY are frequently cited as fishery management targets, there is a wide range of production levels at which a fishery can be sustained. If effort is maintained at low levels, catch per unit effort (CPUE) will be high. even though total yield may be low. At higher levels of effort total yields will increase as CPUE decreases, until the MSY is reached. Once this point is surpassed, total yields will start to fall again as CPUE continues to decline, and the fishery experiences growth overfishing. With still higher effort the fishery may suffer recruitment overfishing which can lead to stock collapse.

Of these four scenarios, the first three can exist as stable states producing sustainable levels ofproduction. The third condition is sometimes referred to as “sustainable overfishing” and is a state in which both total yield and CPUE are lower than they could be, but in which participation in the fishery and the distribution of benefits from it are maximised.

Overfishing is rarely stated or even considered as a management objective, but in fact sustainable over-fishing is not an illogical management target if the economic goal is to distribute income as widely as possible. Furthermore. subsidising a fishery in order to place it in a state of sustainable overfishing may in some circumstances be a valid and efficient economic strategy (and in fact is a de facto result of the subsidies that are currently causing overfishing of many ofthc world fisheries). Unfortunately, fisheries in this state, especially open-access fisheries, can and usually do progress to the nest phase, which is unsustainable overfishing and stock collapse. Because of this risk, the concept ofsustainable overfishing is incompatible with the precautionary approach to fisheries management.

A characteristic of the precautionary approach when applied to fisheries that are currently being over-fished is that, even though it may reduce total landings, it should lead to improved economic performance of fishing units by improving per-vessel catches. This comes about because the PA2FM attempts to ensure that fisheries are not exploited above their MSY due to the unacceptably high levels of risk this

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economic development is being sacrificed or subject to unreasonable bureaucratic requirements. Under such circumstances the PA2FM may continue to be widely perceived in a negative way and resisted.

Another area of concern over the PA2FM is the way in which it would apply to multi-species fisheries. Many fisheries, especially those in the tropics, take more than one species, either as targets or as by-catch. These different components of the catch have different population dynamics and productive potentials and are harvested at different rates. In many multi-species fisheries one or more target species may be over-exploited while others may still be able to withstand increased exploitation, but the fishing gear is unable to selectively target these latter. An example is the international tuna fishery of the Western-Central Pacific Ocean, where bigeye and albacore (1995 harvest : about 300,000 tonnes) are thought capable of yielding higher catches. In such cases there is concern within the fishing industry that the PA2FM will result in the placing of limits on under-exploited resources in order to conserve over-exploited resources. The first landed value of this fishery was estimated at around US$ 1.7 billion in 1995, so the potential losses to industry are high if the PA2FM were indeed to have the effect of capping or reducing production.

A case study

Small-scale longlining for tuna is developing as a domestic industry throughout the Pacific Islands region. Many of the region's 22 countries and territories aspire to have locally-based fleets fishing within their national waters and exporting the catch by air to Japan to supply the high-price sashimi market. At least ten countries of the region now hnvc such locally-based fishing fleets, all of which have developed in the last five years.

The tuna resource in the Western Central Pacific Ocean is a shared one. For those Pacific Island countries with large EEZs (and some are very large) a part of the tuna stock may be considered resident, and may be manageable at a national level. For many countries. however, tuna resource management needs to be carried out on an international basis if sustainable use is to be achieved. Tuna resources in some countries, especially those with smaller EEZs, may be impacted very significantly by fishery developments in "upstream" or neighbouring countries.

In 1992, the Government of one country of the region undertook a review of its efforts to develop a local tuna longline fishery (in fact the study was supported by FAO). The review recommended changes to national licensing policy with the aim of putting in place a cap on the number of vessels operating in the fishery. At the time about 55 boats were operating, most of which were locally owned, with a few on charter or under foreign licence arrangements. After considerable internal debate, and the views of industry and other Government Departments were canvassed, the Fisheries Department set the cap at 50 licences, even though the FAO review had suggested a maximum number of 80 vessels. Preference was to be given in the licence allocation process to locally-owned vessels.

The cap was not determined on the basis of resource considerations. Tuna resources in the country's national waters were not felt to be threatened by this number ofvessels, and in any case such an attempt to manage the resource would probably have been futile in the absence of parallel management efforts by neighbouring countries. In fact a more cynical approach might have been for the country to over-develop its local tuna fleet in the hope that this would be supported by in-migration of fish from neighbouring countries.

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Rather. the 50-vessel limit was a conscious and deliberate attempt by the Fisheries Department to prevent over cnpitalisation of the fishery and to establish a situation in which a smaller number of vessels would operate more profitably, instead of having a larger nurnber of vessels with marginal operating economics. It was hoped that this approach would allow the fishery to be sustainable even in the face of falling catch rates, and avoid the problems of vessels going out of business and the possible failure of onshore processing and export activities. The Department judged that the cost of the fishery failing or undergoing economic decline would be greater than the revenues that would be foregone by limiting total catch through a cap on vessel numbers. The industry supported the Department's approach, since it meant no new entrants to the fishery to compete with the existing vessels.

Unfortunately not everybody supported the precautionary approach that the Fisheries Department was attempting to apply. The National Investment Bureau formally complained to the Ministry of Trade and Industry that the Fisheries Department was impeding economic development in the country and that much . needed foreign investment was being blocked. The Fisheries Department's own data. which suggested that the resource was capable ofwithstanding higher levels ofexploitation, was used against the Department as an argument to raise the cap. Several local businessmen who had been planning to buy longliners used their political influence to seek additional licences. Letters were written to newspapers. and the issue became a matter of national debate which was taken up in the Cabinet.

To his credit, the then Minister for Fisheries resisted considerable political pressure and supported the Department in maintaining the cap, despite the fact that he had ministerial authority to change it at any time. Two years later, however, he was replaced by another Minister who quickly succumbed to the continuing pressure by issuing licences to an additional 30 fishing vessels. Indications arc that further licences will be approved in the near future.

These latest decisions were made quite recently, and it is too early to judge what their impact will bc on the resource or on the economics of individual fishing vessels (although one can say with reasonable confidence that both will be negative). However this story, while inconclusive, illustrates several of the general points previously made regarding the practical application of the PA2FM

First, total production was deliberately not being maximised because other management goals. specifically higher per-vessel catch rates and profits, were considered more important. However as in many developing nations, the widespread perception in this country is that natural resource production **should** be maximised, not optimised. Maximising production is a stated goal of the national development **plan** and the Fisheries Department found itself under attack from other branches of Government for its attitude. Self-defence was made all the more difficult because the Department acknowledged that the resource **could be** exploited more heavily than it was permitting.

Secondly, in this case industry was supportive of the precautionary cap on the number of fishing licences. However this was only so because the fishery was not greatly over-subscribed and no major reduction in vessel numbers was planned. Ifthe cap had involved a major reduction in vessel numbers, a situation of confrontation with the industry would probably have arisen and it is unlikely that the cap could have been imposed. This illustrates what is probably the PA2FM's most important feature from the viewpoint of practical implementation, which is the need to put in place a management plan before the fishery starts to be over-exploited or over-capitalised.

Third is the difficulty ofevaluatingthe usefulness of the PA2FM and proving this **usefulness** to detractors. The precautionary approach was applied in this fishery for only two years, but **even** if it had been applied indefinitely it would have been very difficult to assess whether the approach was having a

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positive impact or not. If the fishery had continued to operate without economic or resource-related problems, as it may have, then critics of the approach would almost certainly have argued for an increase in the number of vessel licenses, which would have made the approach less precautionary. This gradual process of attrition would probably have continued over time to the point where management of the fishery could no longer have been precautionary.

Fourthly, although the Fisheries Department tried to follow a precautionary approach, this was done in a non-precautionary environment. The country has no formal system in place to support or reinforce precautionary measures -in fact, quite the opposite. Decisions in regard to vessel licensing, and indeed all other fishery management measures, are at the discretion of the Minister, who in this case eventually applied his judgement in favour of a less precautionary approach. The lesson here is that the PA2FM will rely on rigid, non-discretionary decision-making systems if it is to be successful in the long-term.

Although the PA2FM was applied in this case, it is no longer in place, and the chances of reinstating it are poor. There are now at least 80 vessels in the fishery and there may soon be 100, which may represent excess capacity. However reversing the growth of the fishery and reinstating the 50-vessel cap would be politically difficult or impossible. The alternative is to do what happens in many other fisheries : allow some or all of the vessels to go broke, causing economic hardship and loss of jobs (perhaps including those of some politicians); or look at artificial ways to bolster the economics of fishing through direct financial assistance or via tax reliefand other forms of indirect subsidy, thus maintaining pressure on the resource through the operation of an economically unviable fishery.

All this is not to say that the precautionary approach was the wrong one to follow in this case : it almost certainly was the right one, and if maintained may have led to the creation of a model fishery. Unfortunately, the systems are not in place in the country in question to support the PA2FM at the present time. This is probably also true of many other countries, whether developed or developing,

Conclusions

The above discussion does not pretend to be exhaustive or, for that matter, based on a great deal of practical information. The precautionary approach to fisheries management is largely conceptual at the moment and there is not a lot of practical experience on which to draw. Rather, the paper attempts to bring together ideas and comments from a variety of sources to illustrate what some of the practical considerations relating to the PA2FM may be. In some cases these are real, while in other they may be the product of differing perspectives.

In general there appears to be widespread uncertainty about the ways in which the PA2FM could be implemented, and the impact it may have on the fishing industry. Fishermen are often conservative by nature and may be reluctant to accept innovation until it has been demonstrated to be beneficial to them. This is particularly so with a proposed management regime which threatens to reduce total landings, increase management costs and place extra financial and administrative burdens on developers.

Doubt about the PA2FM is not confined to the fishing industry, however. Many fisheries managers are also concerned that the precautionary approach may place unrealistic burdens on industry, These views exist even in countries where the need for fisheries management is accepted. and where management of most fisheries is in place (even if the systems are recognised to be imperfect). One might imagine that in countries which have yet to prioritise fisheries management, the PA2FM might be regarded with even more reserve.

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If the PA2FM is to gain widespread acceptance, therefore, there will be a need for broader publicity and understanding of its aims. As regards the general public, this will be a long-term process linked with general environmental awareness. In the case of fishery managers, there may be a need to examine delivery offisheries management training to cmphasise precautionary considerations as well as the role of management in the fisheries development process.

As regards practical implementation of the PA2FM, much hinges on improving the fisheries development process so that it takes place on a planned basis. Linked to this is a need to establish or improve data collection and research programmes which can feed back into the management plan, allowing management decisions to be taken according to predetermined criteria, as well as permitting periodic revision of the plan based on accumulating knowledge.

The PA2FM may be inconsistent with economic development policies in some countries, although in many cases this might be due to economic aims which do not realistically account for the finite limits to living marine resource utilisation. Whichever is the case, however, there may be a need in some cases for the PA2FM and national economic development goals to be reconciled.

13. OPERATIONALISING AND IMPLEMENTING THE CODE OF CONDUCT FOR RESPONSIBLE FISHERJES

by John Kurien

The Code of Conduct for Responsible Fisheries is indeed one of the most important international instruments devised for wholesale management of the living aquatic resources of our planet.

The Code arises out of the Declaration of Cancun made at the Conference on Responsible Fishing sponsored by the Government of Mexico in 1992. The Code has been formulated to be consistent with the 1982 UN Convention on the Law of the Sea, the UN Treaty for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, the strategy endorsed by the 1984 FAO World Conference on Fisheries Management and Development, the I992 Rio Declaration and Agenda 2 I of UNCED (U.N. Conference on Environment and Development).

What does the code contain?

The Code sets out voluntary international standards of behaviour for responsible practices in fisheries. based on the general principle that the right to fish carries with it the obligation to do so in a responsible manner. Only this can ensure effective conservation and management of living aquatic resources. with due respect for the ecosystem and for biodiversity. The Code recognises the interests of everyone concerned with fisheries as well as the interests of consumers and other users. It calls on states and all the various interest groups to apply the Code and give effect to it.

The Objectives

The objectives of the Code are to establish principles and criteria to formulate national policies for responsible fishing and fisheries activities. It thus intends to serve as a reference document for the exercise ofresponsible fisheries by providing standards ofconduct for all persons engaged in the fishery sector.

The Structure

The Code has a part that comprises the general principles together with six thematic articles on fisheries management, fishing operations, aquaculture development, integration of fisheries into coastal area management, post-harvest practices and trade, and fisheries research.

General Principles

The statement of general principles asserts that users of aquatic resources should conserve the aquatic ecosystems. It states unequivocally that fisheries management is for present and future generations. It calls on states to protect the right of fish workers to a secure and just livelihood and to involve them in policy formulation. It advocates transparency in decision-making processes.

Thematic Articles

Among the thematic articles the one on fisheries management is one of the first. The precautionary approach is accepted as a guiding principle for fisheries management: the absence of adequate scientific

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information should not be used as a reason for postponing or refraining from measures to conserve and manage a fishery. The fishing operations articles are fairly comprehensive covering fishing practices, gear selectivity, energy optimization, marine environment, atmosphere protection and artificial reefs and fish aggregation devices.

The articles on aquaculture urge states to ensure that aquaculture will not impair the livelihood of local communities and their access to fishing grounds. It also suggests that the active participation of fish farmers and their communities be promoted in developing responsible aquaculture practices. The articles on integration of fisheries into coastal area management permit the evolution of holistic ecosystem management.

The articles on post-harvest practices and trade cover questions of responsible fish utilisation and international trade, which give top priority to fairness, equity and environmental concerns. and call for laws and regulations governing the fish trade. The articles on fisheries research stress integrated and multi- disciplinary research and the setting up of appropriate institutional frameworks to promote this. They emphasise that the role **of** traditional knowledge and technologies needs to be investigated and strengthened.

What does adopting the code imply?

When the Member States of the FAO unanimously adopted the Code on 31 October1995, they were also collectively endorsing two things. First, they were tacitly admitting that living aquatic resources could no longer sustain the rapid and uncontrolled exploitation and development they had been undergoing over the past four decades. Secondly, they were enthusiastically endorsing the urgent need for news approaches to management of these resources that would reflect conservational and environmental concerns.

It is this second factor that gives the Code its significance. But unlike other international agreements. the Code has no legal sanctity. Consequently, even states that unanimously endorsed the Code at the 1995 FAO Conference, are not under any compulsion to implement or operationalise the Code. Herein lies both the strength and the weakness of the Code. It can be cast aside as a collection of unnecessarily convoluted norms. Or it can become the centre-piece and the inspirational foundation for states and sub-regional or regional fisheries organizations that wish to formulate sustainable management measures for a new era of responsible fisheries. If this latter course of action is adopted, the Code may well become an instrument to chart the voyage into a new century of sustainable fisheries development and management.

Operationalising the code

Operationalising the Code becomes a task (the burden of all stakeholders in the fisheries) once a commitment is made to accept it as a new frame of reference. Clearly, mere endorsement of the Code by the state will not suffice.

The FAO published the Code early 1996 in all its official languages and made it accessible through Internet on a WWW home page. It has also disseminated the Code through the FAO's marketing services and its associated organisations (GLOBEFISH, INFOFISH, INFOPECHE, INFOPESCA, INFOSAMAK), so that fishery users, processors and traders would be infonned about it. Some 3,800

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fisheries organisations have received copies of the Code. It has also been disseminated through well-known fisheries magazines and newspapers. The UN and the FAO are producing a joint publication which will contain the provisions of UNCLOS relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, the Code and the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas.

The message of the Code needs to be effectively communicated and also fully imbibed by all the actors in the fish economy – fishworkers, investors, traders, processors, bureaucrats, politicians and others, Educating everybody about the Code is therefore the most primary task for operationalising it. There is no standard practice for this task. For those who drafted the Code, every word in it is important – they are unlikely to easily concede any "dilution". However, though the Code is not a legal document, its involved and cautious phraseology makes its essence elusive. We need many attempts to translate, summarise, simplify, illustrate and visualise the Code.

Implementing the Code

As a first step to promoting implementation of the Code. the FAO sent a circular to Governments and private bodies, entreatingthem to publicise and apply the Code by adopting responsible fishing practices. Suggestions were made about initiatives that could be undertaken for particular countries, regions and circumstances. The appointment of a focal point was suggested, also the setting up of mechanisms to facilitate coordination and monitoring of various initiatives to implement the Code.

Partly due to this initiative, some countries have already started formal programmes to redesign their fisheries policies and management practices in line with the provisions of the Code. The United States, Canada and Morocco are said to be among the first to take these initiatives.

Requests for authorization to translate the Code into other languages also point to the seriousness with which it has been received.

Another task to be undertaken will be to ensure that all states ratify the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, so as to bring it into force as soon as possible. This is being done only gradually, and the pace needs to be speeded up. To date (February 1997) only IO countries have ratified the Agreement. In Asia, Myanmnr is the only country to do so.

To assist developing countries to implement the provisions of the Code, the FAO has elaborated an inter- regional programme for external assistance. A programme containing 10 components was submitted to donors. Norway, Netherlands and the UNDP have to date expressed interest in considering support for some of the components. Project documents are being prepared for these.

The FAO, in collaboration with some member states. is also engaged in preparing a series of "Technical Guidelines for Responsible Fisheries." Canada, New Zealand, Sweden, and Australia have collaborated by hosting Technical Consultations to develop some of the guidelines pertaining to the thematics of the Code, particularly fisheries management and fishing operations.

The need for responsible aquaculture is gaining popular response the world over, particularly in Asia. A number of activities to support of implementation of the Code's article on aquaculture are being undertaken by Asian- based organisations such as SEAFDEC, NACA and ICLARM, and networks like INGA.

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Non-Governmental organisations (NGOs) who took part in the formulation of the Code are trying to spread the Code's message in order to create pressure from below to get States to take measures to adopt its provisions.

International organisations working closely with fishworkers have also taken initiatives to publicise relevant aspects of the Code. They include the International Labour Organization (ILO), the International Federation of Free Trade Unions and the International Collective in Support of Fishworkers.

Giving a new meaning to fisheries management and development

An important clarification is in order at this stage. How different is "responsible" fisheries from the approaches wc have all followed thus far? Is "responsible" only an additional new adjective for the old game of fisheries development and management?

The Collins Westminister dictionary defines "responsible" as accountable, trustworthy and rational. The title, "Code of Conduct for Responsible Fisheries" may therefore be expanded to read:

The orderly collection of principles and norms that direct and provide guidance for behaviour to achieve accountable, trustworthy and rational fisheries.

The three words that elaborate the meaning of "responsible" can be further paraphrased thus: *being able to explain one's actions; being reliable and accurate; and being sane, equitable and fair*

An honest introspection will show that on all the above counts, the past behaviour at all levels ofvarious **actors in** world fisheries can hardly be considered responsible!

The challenge for change is a big one. We need to take it, not leave it.

14. IDENTIFICATION OF UNRESOLVED AND NEW ISSUES IN FISHERIES MANAGEMENT

by Kee-Chai Chong & John Kurien

In many developing countries of Asia, fisheries development has been driven and guided by fisheries acts, ordinances and regulations that were either developed by the countries themselves (Thailand) or inherited from colonial rulers (Sri Lanka). These acts were promulgated on the basis of conditions prevailing then, and were development-oriented rather than management-oriented. The acts and ordinances served their purpose at that time very well because fisherfolk were few and the resources abundant. But this situation changed with development and modernization and the growing pressures on fisheries.

In spite of2-3 generations of intervention in fisheries development, and some "management" measures initiated in response to overcrowding, competition and conflicts among fisherfolk user groups, the problems of fisheries communities largely remain unresolved, and new issues are emerging at the same time. Any management measures introduced reflect government responses to conflicts. It is not proactive management per se.

This paper seeks to identify unresolved and new issues in fisheries management in developing countries of Asia.

Development over Management

Developing countries in Asia are still locked into the fisheries "development" mode; they regard "management" as an attempt to place curbs on production. In other words, they perceive only the regulatory dimension of management; those aspects of management that pertain to conservation and active rejuvenation or rehabilitation of the resources and the ecosystem are addressed only peripherally.

In countries where the conservation and rehabilitation aspect of management has been in vogue for nearly two decades, its adoption by the state has been hastened by strong socio-ecological and political pressure from small- scale fishing communities. These communities have demanded the state's unequivocal intervention in the regulation, allocation and conservation of resources because of the ill-effects of state-sponsored development based on inappropriate technology.

Consequently, the list of unresolved issues in fisheries management is likely to be large because it includes issues never even taken up by the state. The new issues therefore read more like an agenda for solving unresolved issues.

So far, efforts to address fisheries issues have depicted problems rather than solutions. Any fisheries discourse pays far greater attention to the problem than the solution. Solutions proposed, ifany, come at the very end, when audience attention has already been lost. Further, many government-sponsored assistance programmes do not remain in force long enough to be "institutionalized". Government institutional commitment and regular follow-up are low.

Moving from the development mode to the management mode does not come naturally, Many interest groups in society would like the development mode to continue.

Often, in Asian countries, plenty of lip-service is paid to management, while actions continue in the development mode. To quote Gen Sardjono, former Director General of Fisheries of Indonesia, after he

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announced the 1980 trawl ban, "We need to take two steps back to make a big leap forward". If we examine what was done in the name of developtnent – particularly the heavy investments in inappropriate harvesting technology and infrastructure we would firmly advocate management.

Unresolved Issues

Effective Enforcement of Regulation and Conservation Measures in Coastal Waters

Most countries have enacted legislation for regulating and conserving coastal fishing-- typically through zoning arrangements; entry restrictions; closed seasons and closed areas; mesh regulations and gear restrictions; bans and curbs on certain fishing methods; protection ofcertain species. Inability to enforce such legislation is the rule rather than the exception. What is it that prevents enforcement of well meaning laws? Is it lack of technique or lack of will?

As pointed out earlier, the organizational set-up and institutional structure in many countries is not conducive to fisheries management. The organizational structure is compartmentalized. There is no fisheries management unit; if one exists, it lacks staff, funds and equipment.

Proper Allocation of Resources and Rights of Access in Coastal Waters

The coastal fishery has largely been an open-access fishery. Consequently, no catch limits have been set. We hear only of continuing increases in fish harvests, side by side with an increase in boats, fishing gear, fish-finding devices etc.

Only in a few countries are customary rights acknowledged and recognised by the state. Most often, the major stakeholders who traditionally eke out a livelihood from fishing are treated on par with a small minority of outside investors who regard the fishery as a source of quick and easy profit. The state's inability to prioritise rights of access to coastal waters leads to conflicts in which the majority stakeholders are marginalised. What measures can be undertaken to overcome this peculiar circumstance, where those with short-term interests in the fishery corner most of the benefits? Till date, the question of use and user rights has remained unresolved.

Effective Enforcement of Rights Over Exclusive Economic Zones

Most countries extended their EEZs in the 1970s. However, the inability to prevent encroachment and illegal access, and monitor the access of licensed vessels, has been a major cause for worry, and in some countries a cause for conflict as well. Is the main problem a lack of investment and technology for monitoring compliance? Is it the lack of regional and sub-regional cooperation agreements? Will this change in the context of the UNCLOS agreement on straddling and migratory stocks?

Protection of Critical Habitats

Mangroves, seagrass beds and coral reefs are examples of critical habitats that have been degraded of destroyed, often in the name of "development" of one sort or another, without realizing the crucial role they play in enhancing the biological productivity of the coastal waters. To what extent is ignorance of habitats the cause of such destruction? Are factors outside the fishery primarily responsible for the degradation? That the public regards the sea as a huge and available receptacle for wastes, has not helped in their protection.

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New Issues/Initiatives

Sub-Regional and Regional Co- operation for Management

In the light of UNCLOS, the Agreement on Straddling and Highly Migratory Stocks and the Code of Conduct for Responsible Fisheries, such co- operation attains significance. What institutions already exist? What is the scope for new institutions to be formed? Even the future of FAO regional fisheries bodies has to yet be resolved.

Fitting Participatory Management into the Overall Management Picture

The importance of local-level community management is now increasingly recognized. The usefulness of these approaches is beyond question. What needs to be sorted out is the manner in which local, village- level or port- level management institutions can be fitted into a large state-supported management framework. Are there examples in Asia where attempts to achieve this have met with reasonable success?

What are the implications of participatory community-based systems of management? Where the government has sole authority to manage fisheries, is it willing to share this authority with the fisherfolk? Are the fisherfolk themselves willing and ready to take on management responsibility? These are pertinent questions which need to be resolved. Different groups of users and stakeholders have different objectives in managing the fisheries. A consensus has to be worked out about the overall objective of management.

Initiating Aquarian Reforms

The overall regulation of effort may be insufficient in a context where access to the resource is asymmetrical – investment capability varies widely. Priorities must be worked out over the allocation of access rights to the resource. An aquarian reform is needed, where the "rights to boats, fishing and first sale of fish are given only to the persons who actually fish." Such an allocation of rights may have to be seriously contemplated to limit entry into the coastal fishery, particularly in countries that have large numbers of artisanal fish workers. This class of owner-workers then becomes the key participant in local-level co-management. Is this a technically feasible and politically viable solution? What are the preconditions for aquarian reform?

Proactive Measures for Resource Enhancement

Rather than wait for depletion and degradation to initiate conservation, what must be considered is planned and proactive participatory measures for 'resource enhancement which will create new fish habitats. Examples are artificial reefs made from vessels deemed "illegal" following aquarian reforms. redundant boats, mangrove replantation, sea ranching, "no-go" bio-reserves, coral reef and seagrass rehabilitation. Can these be organised through State initiative alone? What is the role and relevance of local level participation in ensuring sustainable success for such initiatives?

In many coastal areas, boats are available for sale. These could be purchased to be used as platforms for sea-farming or mariculture of molluses such as oysters, mussels and scallops. These fishing boat-converted platforms can be towed out to sea and left there and towed back into sheltered waters during bad weather or impending storm outbreaks.

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Integrating Fisheries Management into Coastal Zone Management

The coastal waters being the "tail-end" ecosystem, resources management within it must necessarily be linked and integrated into the larger contest of management of both the aquatic and the terrestrial components of the coastal zone. What legislative support is needed for this? Should the initiative for CZM come from the fisheries sector?

Involving Women in Resource Management

It is well known all over the world that women play an important rote in fisheries. The masculinization of fisheries was a result of the development mode-the rote of women was relegated to one of producing fishermen! This emphasis needs to be changed. The potential of women as effective natural resource stewards should be tapped. How this is done will differ from society to society. What are the ways by which this can be achieved?

Considering Coast-Oriented Employment Opportunities

Since most countries in developing Asia are tabour-surplus economies, the option for employment outside fishing is likely to be restricted. Resides, the occupational or marketable skills of fisherfolk are limited. However, reducing the pressure of human numbers on the fishery must be a tong-term strategy for fisheries resources management in developing Asia. Creating employment opportunities in coastal areas which are oriented to fisheries or allied to fisheries, may therefore be the more plausible and appropriate solution for redeployment of educated youth and older men from fishing into other productive and socially useful employment. To what extent does effective redeployment depend on the overall economy? Is such employment creation socially acceptable?

Conclusion

An exhaustive list of all the unresolved and the new issues that confront fisheries managers in Asia would be difficult to make. Suffice to say that the tasks of fisheries management are daunting, and can't be undertaken single-handedty by the managers. Morever, one should note that management decisions are often influenced by "political" considerations. So techniques alone will not suffice for success. Tenacity of purpose and tact in implementation are a prerequisite.

Management decisions do not "hold" amidst conflict. Identifying common interests and building a consensus among different user and stakeholder groups in the fishery, especially on management objectives, and setting up participatory agreements, are part and parcel of the process of moving towards a precautionary and responsible approach to fisheries development and management.

The identification of unresolved and new issues in fisheries management

15. DO FISHERIES STATISTICS GIVE THE FULL PICTURE? INDONESIA'S NON-RECORDED FISH PROBLEMS

by Nick Willoughby, Daniel Monintja & M Badrudin*

Abstract

Fisheries statistics are a calculated guess about how much fish has been landed. This paper describes an attempt to set up an 'expert system' in Indonesia to assess whether there is a serious non- recorded fish problem, and the potential magnitude of this problem; and to determine to what extent a group of senior fisheries scientists and statisticians can help improve fisheries statistical collection.

The statistical system of the Directorate General of Fisheries (DGF) has three types of fisheries catch surveys – for big business enterprises (system I), for medium-sized fisheries (system 2) and for small- scale tisheries (system 3).

Our expert system was asked to consider the possible importance of

- By-catches and discards in the longline and shrimp trawl fisheries (system 1)
- unreported trans-shipment on the high seas (1)
- fish caught in joint ventures which should be landed in Indonesian ports, but is discharged elsewhere (1);
- fish which is sold or traded through non-government markets (1 ,2 & 3)
- non-recorded fish which the fishermen and their families eat (mainly 2 & 3)
- catches by illegal methods (3);
- others such as sport fishing, beach gleaning etc.(1 ,2 & 3)

This paper describes how the Indonesian statistical system tackles possible problems. The estimated size of the non-recorded fish deficit is thought to be more than 1,000,000 tonnes/year - 1 /3 *of* the total recorded catch. The levels at which total allowable catches may be set should take these significant non-recorded parts of the catch into account – a precaution against the unknown!

Introduction

Statistics are viewed with suspicion by many people. Why?

Part of the reason is that some people manipulate statistics for their own purposes. They may end up with correlations which although perhaps excellent in statistical terms have little meaning in the real world. Example: the suggestion that, because at one stage the rising sales of washing machines in the USA coincided with the rising murder rate, washing machine ownership causes murder!Silly relationships like this bring little credit to people who use statistics, and have given rise to Mark Twain's phrase -- 'There are lies, damned lies and statistics'

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However, lies are intended to deceive or confuse. Fisheries statistics are seldom intended to do this - though even with my minimal statistical training, I would hesitate to say 'never'.

Fisheries statistics are, at best, a calculated guess of how much fish has been landed, not how mush has been caught

There are many stories of absurd statistics, which have slipped through the national nets of quality control. Three quick examples will demonstrate this:

1. In the Gambia, West Africa, in the 1980s, the Fisheries Department ran out of money to pay ferry operators. The ferry staff did not allow fisheries staff to cross the main river dividing the country. to collect statistics from the northern side. The data analysts on the southern side of the river merely added up the catch forms they were given . . . and the national fish catches apparently fell suddenly to half their usual levels (R Cordover, pers.comm)

2. In Malawi, Southern Africa, in the early 1970s, we changed the weight recording system from pounds to kilograms, but forgot to issue one set of recorders with a new balance. Was it any wonder that the catches per unit effort from their area seemed to be twice as high as anywhere else? (Willoughby, 1975)

3. Portuguese catches of tuna during one year in the early 1980s suddenly shot up by three orders of magnitude over previous levels. We all know the massive catch variations one can get in shoaling pelagic fisheries.. but the statistician was entering his kilograms of tuna as tonnes by mistake (Willoughby, 1981)

These examples show 'operator error' - not a deliberate intent to deceive

Unfortunately, in some countries there may be significant pressure on fisheries statisticians to demonstrate that fish catches are rising every year. Much of the time this will be true, because more fishermen and more boats mean more catches. This outcome may suit short-term political goals, but what about the long-term effects? Statisticians are seldom expected, or able, to comment on the state of the stocks from year to year. Or the probability of what will happen to the national fishing industry when (not if) stocks eventually crash.

The situation might develop like this:

1. The stock assessment biologist calculates the levels of the 'standing stocks' for the species groups, and suggests sensible levels for the 'total allowable catches' (TACs) which are accepted by Government.

2. The fisheries statisticians monitor landings and calculate the amount of fish landed this will always be less than the fish caught.

3. If the landings are less than the TACs, greater effort and investment in the industry are urged;

4. Ifthe catches are in fact greater than the TACs without the statisticians and fish biologists knowing it, the fisheries are likely to be heading towards economic and biological collapse caused by over-fishing.

This potential disparity between recorded landings and catches can be considered to be an unresolved issue in fisheries management (and part of the reasoning behind FAO's "Precautionary Principle")

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This paper describes an attempt to set up an 'expert system' in Indonesia to assess:

* Whether non- reporting or under-reporting of catches is a problem;
* The possible magnitude of the problem, and what can be done about it if it is significant; and
* Through this exercise, to discover whether and how a group of senior fisheries scientists and statisticians can help improve national fisheries statistical collection.

One of the key problems is identifying areas of under-reporting of catches and landings

The National Statistical Collection System

As the largest archipelagic country in the world (80,000 km ofcoastline), Indonesia probably has one of the most difficult of fisheries to assess in statistical terms. The Directorate General of Fisheries (DGF: Direktorat Jendral Perikanan, DJP) has a statistical system which assesses landings by using three types of fish landing surveys:

* One for big business enterprises- including large-scale tuna longlining and shrimp trawlers:
* One for medium-sized fisheries, including most inboard engine boats. This addresses small pelagic fisheries;
* One for small-scale fisheries– including all non-motorized and artisanal activities.

Early frame surveys indicate that an estimated 925,000 full-time fishermen and 925,000 part-time fishermen take part in fisheries. (Table 1)

Table 1: Number of Marine F'ishermcn in Indonesia (DCF, 1994)

Full-time fishermen (fisheries the only source of income)	925,000
Part-time fishermen (fisheries the major source of income)	650,000
Part- time fishermen (fisheries a minor source of income)	275,000
Total	1,850,000

Their recorded marine landings in 1994 were 3,080,000 tonnes, nearly 90% of which was fish (Table 2)

Table 2: Marine Landings Recorded in Indoesia (DGF, 1993)

	Weight (mt)	% of total
Fish	2,675,000	87
Crustaceans(mainly shrimp)	295,000	6
Molluscs	93,000	3
Other animals	7,000	
Seaweeds	110,000	4
Total	3,080,000	100

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Our expert system was asked to consider the possible importance of under-recorded elements in:

* By-catches and discards in the longline and shrimp trawl fisheries (system 1);
* Unreported trans-shipments on the high seas (1);
* Fish caught in joint ventures or on charter vessels which should be landed in Indonesian ports. but is in fact discharged elsewhere (1)
* Fish which is sold or traded through non-government markets (2,3)
* Non-recorded fish which fishermen and their families eat (mainly 3)
* Catches by illegal methods (3)
* Others?? Sport fishing, illegal imports, beach gleaning etc. (1,2,3)

Survey Method 1: Big Fishing Business

It is probably easiest to examine first the problems of fisheries statistics collection from big businesses. These include the large-scale shrimp trawlers operating in the Arafura Sea, tuna longliners, joint venture and contract operators, and some of the larger pole and line fisheries. These firms fill out their own catch return forms, which are apparently accepted by the DGF's Statistics Unit with the single proviso that the declared catches will be converted to live weight equivalents.

These larger mechanised fisheries are particularly prone to four types of"problem catches" which will be under- recognised in national statistics.

· By-catches – defined as all non-target species, such as shark from a tuna longline fishery (by-catch may in many instances be retained rather than discarded)

· discards – fish thrown away at sea. such as undersized fish from a shrimp trawl

· trans-shipments at sea

· trans-national landings e.g. fish caught in Indonesian waters and landed as 'high seas' fish in other countries.

1. By-catches. Many commercial companies deny that there are significant by-catches from their operations. In tuna long line fisheries, by-catch declarations usually consist of 'other tuna-like species and marlins' most of which are kept as non-discarded by-catch. However, the by-catch declarations very seldom include sharks, which must therefore become discards.

   Longliners frequently allocate the shark portion of their catches to the crew as bonuses. The shark fins are cut offand the carcasses thrown overboard-sometimes in very significant quantities. Our experts suggested that sharks and tuna be caught in approximately equal proportions by longliners fishing in Indonesian waters. Tuna catches (mainly of yellowfin and southern bluefin) in 1994 amounted to 90,000t. If we assume that the bulk of these tuna were longline fish, we should also assume that 90,000t of shark were killed but not recorded.

2. Discards. The fish from the targeted shrimp trawl industry in the Arafura Sea are also collected and 'may be eaten by the crew or frozen for sale later'. Independent observers suggest that a lot of'trash fish' in fact becomes unrecorded discard. If half the total shrimp landings come from the trawl industry, this would be 100,000t of shrimp, and the 1:9 shrimp-fish catch ratio suggests

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that perhaps 900,000t of fish arc caught as well. Even if the shrimp trawlers land (or their staff consume) half of this fish – which must be viewed as unlikely – we arc still left with perhaps 400,000t of mixed trawled fish as discards. Not only would this fish have been part of the total stocks calculated as being 'available', but the trawling procedure also damages further quantities of un-caught fish, and affects the sea bottom environment, making it less suitable as a habitat.

3. Trans-shipments. An enormous amount of fish is trans-shipped legally from catcher vessels to carrier vessels at sea. This saves fishing time and sailing time for the catcher vessels. Unfortunately. without a very large observer programme it is quite possible that large amounts of fish can be trans-shipped without the knowledge of the country of origin of the fish -- despite log-book procedures. This was not a feature ofunder-recording which any of the expert panel could quantify, though there was a general feeling of unease about trans- shipments.

There was also a single observer report of under-recording on a tuna long-liner. Under present joint venture rules, Indonesian vessels have observers on board only for the first year of the programme. Even when observers are on board, their reports of landings have been found to differ significantly from officially recorded landings. A member of the expert team reported l2t of'official' versus 20t of'observed' southern bluefin tuna on one occasion. Thus it might be that total tuna declarations are little more than half the actual catches -though the information is too sparse to confirm this.

The same expert suggested that a 'considerable quantity' of shrimp and tuna is illegally trans-shipped to Singapore from Indonesian waters. but was unable to suggest quantities for this aspect.

It would he reasonable to assume that trans- shipment happens to the detriment of Indonesia, hut it has been impossible to put figures against this.

4. *Trans-National* Landings. Many foreign boats, notably frotn the Philippines, are reputed to fish in Indonesian territorial and archipelagic waters, although they have licenses to fish only in the EEZ waters (Mathews and Monintja, 1997, Monintja and Mathews, 1996). This means that they fish in waters reserved for medium and small- scale fishermen, and land the fish elsewhere, sometimes as 'high seas' fish. One expert suggested for each tuna landed in Indonesia from the north eastern sector of the country three were landed in the Philippines, and that the quantities involved could be as much as 60,000t of tuna per year from this sector alone (Mathews Monintja, 1996). An estimate of double this, or 120,000t of tuna 'lost' nation- wide, has been suggested.

Survey Method 2: Medium-sized Fishing Businesses

This survey is for motorised medium boats (5- 1 5GRT) mainly engaged in the fishery for small pelagic species. One main landing site is chosen per regency (county); the main gears are identified; and the catches of 5 boats per gear per landing site are counted. Total landings are derived by the use of multiplication factors.

These fisheries usually operate close enough to their home bases that all the fish they catch will be retained as saleable. through the use of ice and/or salt. Some of this fish is reputed to be of very low quality on arrival at port. but nevertheless apparently finds a market. Thus most of the problems of by-catches and discards are negligible. Problctns with trans-shipments and trans- national landings could still occur, though neither was reported from definite knowledge by the panel of experts.

Landing at Non-Government Markets

Although there is a good range of fish markets and harbouring sites in Java and Sumatera. from which precise statistics could be expected, there was some concern that in other parts of the country this might be less certain. Boats might land some of their catches away from auction sites (at which they would have to pay extra fees) and these portions of the catches would be unrecorded. While it is not possible for Jakarta-based statisticians to estimate the importance of this practice, if any, it was suggested that the heads of provincial statistical services might already factor these effects into their records before forwarding their figures to Jakarta. No estimate for this possible under- recording effect is therefore included here.

Three other minor problem areas were raised.

Pole & Line Baitfish

Small fish from lift nets (bagan tancap, bagan perahu) are used very widely as live bait for pole and line fishing operations at a ratio of about 1kg baitfish to 5-10 kg of skipjack. It is unlikely that the batifish are recorded before use. On the basis of 89,000t of skipjack landed in 1994, and assuming that most of it was caught by pole and line vessels, perhaps 10,000 t of unrecorded baitfish could have been used.

Glut Catch Effects

Several points were raised with regard to the effects of glut catches, especially of small pelagics, on accurate statistical recording. During times of excess catches (glut), the fishermen were allowed to take lots of fish home from the boats, apparently without it being counted. Helpers at the market (usually small boys) helped themselves liberally to the glut fish. Since the small pelagic fishery makes up by far the largest proportion of national catches (approximately half of all marine catches), and much of this is caught during fairly narrow seasons, it would be reasonable to assume that at least a small proportion is not properly recorded. If this was only 1% of the 1,000,000t catch, the apparent loss would be 10,000t. What is considered to be a conservative estimate of 5% is given here as 50,000t or small pelagics un-recorded during periods of glut.

Personal Catches

One expert pointed out that medium-sized purse seiners set their nets only once every day. While not seining, the crew would usually hand-line for personal fish, and sometimes catch significant quantities. This would not usually be registered on return to shore. While this might be important at a personal level, it might be thought that it does not contribute a very large quantity to the total catches. If we assume that 20% of full-time fishermen are in the purse seining component of the industry (i.e. about 200,000 men) and that each catches 1 kg of personal fish/day on half the days of the year, a further figure of 30,000t of fish/year is likely to be unrecorded.

Survey Method 3: Small-Scale Artisanal and Subsistence Fishing

Small-scale fisheries surveys include all non-motorised and artisanal activities. As with all artisanal fisheries, the landings are scattered throughout the country, and extensive sub- sampling must take

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place. Villages are chosen for recording with a probability proportional to size. Only one village is chosen per district (kecamatan) and five households in each are interviewed every three months. The amount of fish brought home as wages is supposed to be recorded in the surveys. The report forms are analysed in the provinces, then sent to Jakarta for compilation.

This was the area of fishing, which first stimulated the convening of the expert panel. It was first calculated that if each member of each fisherman's family (average size 4 persons) ate l kg of fish per week, which was not recorded, this would amount to:-

$$1{,}850{,}000 \times 52 \times 4/1000 = 384{,}800t \text{ of fish/year}$$

15% of the total recorded marine fish catch! If they ate 2kg/week (which might not be unreasonable) this would obviously increase the actual catches from Indonesian waters by 700.000t or 30%. However, the DGF statistical system does record fish provided as wages. though the multiplier effects on apparent catches if the figures were only slightly incorrect would be very great.

The expert panel also had many comments on the likely truth of the artisanal fisherfolk's replies to statistical questionnaires -- and in many cases these were accepted as areas of concern by our DGF panel representative.

Frame Survey Multipliers

The most recent frame survey of villages was held 20 years ago (though it is due to be up-dated next year), so the total numbers of fishermen may be grossly underestimated. It seems unlikely that only 1% of an archipelagic country's population utilises the marine resources directly. Furthermore the multipliers used are from agricultural rather than fisheries surveys, so the fishing population might even be twice as great as currently estimated, i.e. 4 million fisherfolk rather then 2 million. It could be expected that many of these would have fishing only as a minor or seasonal income, but it would still be reasonable to inflate the apparent catches to allow for 4kg of fish/fisher/week, as in the calculation above, to add a further 380,000t of general small fish to the national catches.

Household Survey Recalls

There were also serious doubts concerning the recall ability of householders on the amount of fish recorded as having been given as wages in surveys conducted only once every three months. This could be checked easily, but no firm data are available at present, so no additional estimate as a result of the query has been included here.

Local Fishery Targets

Some of the expert panels suggested that provincial statisticians were under pressure, perhaps subconsciously, to try and show an increase in landing records each year. This needs to be investigated further. As with the 'landing at non- government markets' above, no estimate of under-recording has been included here.

Benefits to the Fisherman from Under-Reporting

In many surveys and questionnaires, the respondents are known to under-state the amount or value of their produce, because correct figures would mean hefty taxes. Respondents may want to land their fish

Table 3 : Possible Under - Reporting Estimates

Fishery Type	Component	Possible Scale of Under-Pcporting (tons)
I. Big Business	By-catches	90,000
	Discards	400,000
	Trans-shipments	Probable - could be large
	Trans-national landing	120,000
	Sub-total	**61 0,000++**
2 Medium Business	Landings at non-govt markets	No estimate - could be large
	Pole & line baitfish	10,000
	Glut catch effect	50,000
	Personal catches	30,000
	Sub-total	**80,000++**
3 Small Business	Autoconsumption	No estimate - could be large
	Frame survey multipliers	380,000
	Household survey recalls	No estimate
	Local fishery targets	No estimate
	Under-reporting **by** fishermen	No estimate
	Illegal catch methods	No estimate
	Sport ftshing etc	No estimate
	Sub-total	**380,000++**
	Total	**1,080,000++**

anywhere except a government landing site where not merely is the auctioneer paid a fee, but a percentage of the profits is automatically deducted as tax. Or the respondent may want to simply go home with his catch.

Worldwide experience suggests that the likelihood of obtaining accurate artisanal fish catch statistics through verbal recall questionnaires is poor, and sometimes 0%. This is an area in which local acceptability of the recorders and the local knowledge of their seniors would be very important. No estimate of under-recording can be provided.

Catches by illegal Methods

No fisherman will say that his catches have come from illegal fishing methods (meaning dynamite of cyanide in Indonesia). If it lands at a fonnal market, he simply ascribes it to some reasonable legal gear.

An important impact of illegal fishing methods is the damage they do to the remaining stocks and the environment. Dynamited or cyanided coral can no longer be a sustainable habitat; the killing of fry and juveniles by these methods can be likened in some ways to recruitment over- fishing. No estimates can be sensibly made of the small tonnages lost as a result of these methods, but they may be the most insidious in terms of reducing the long- term national yields of several prime reef-dwelling fish species such as groupers and wrasses.

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Sport Fishing, Beach Cleaning ctc

In some countries, most of the revenue from fishing comes from commercially managed rod and line sport fisheries, These are insignificant in Indonesia, but the weekend fisherfolk who supplement their family diets with fish caught from rod-and-line or beach-gleaned shellfish will certainly not be considered part- time fishermen. No estimates of their takings are included here, though they would certainly run into tens of thousands of tonnes.

Under-Recording Summary

A summary of all these possible elements of under- reporting is provided in Table 3. The team was only able to suggest:-

- approximate under-reporting figures for seven elements,
- an additional three might be large but unknown contributors, and
- five more were identified, but estimates could not be made.

Despite the vagueness of these statements, the team concluded that in spite of the complexity and sophistication of the statistical system, *the under-recording problem for Indonesia's marine fisheries is probably at least 1,000,000 tonnes/year or an additional 33% over that currently recorded.*

Identification of Unresolved and New Issues in Fisheries Management

Let us therefore think of the under- recorded fish landings as an un-resolved problem of fisheries management. The estimated under-recording suggested by the panel is of the order of one third of the total national marine catches, and it could be substantially more than this. The features which have led to the production of these figures should be factored into the setting of total allowable catches (TACs) by the DGF. But how could this be done?

It is suggested that the level of landings as defined by the fisheries statisticians should be maintained as the official Government figures. However, catch level estimates should be raised so that the relationship between stock assessment estimates and commercial license allocations for total allowable catch purposes (calculated and set respectively by other divisions within DGF) should take full account of these quantified concerns by senior scientists.

Standing stocks and total allowable catch levels in Indonesia have been subjected to downward revision recently as a result of a recent reappraisal carried out by Indonesia/FAO/DANIDA in 1995 (FAO, 1996). On the basis of this, it was suggested that total available stocks might be much less than those thought to be present in 1991(Martosubroto et al.,1991). The national MSY levels are now thought to be about 3.6 million tonnes plus tunas, against the previous estimate of 5 2 million tonnes plus tunas. This revision has serious implications for fleet investment and infrastructure support policies, which must be addressed by the DGF staff.

We can take precautions against 'the unknown' as part of accepting that some features of stock assessment are too vague. and that landing statistics do not measure catches accurately. The precaution would then be to lower TAC levels appropriately. Under these circumstances it would be better to have:

(1) a transparent policy to set up a system to measure the actual amounts of each species landed by each gear (already in place - national fisheries statistics),

(2) then the wisdom of senior wise men is called upon to make additions (multipliers or actual tonnages) to a second set of statistics.

(3) On the basis of these second calculations, and in comparison with TACs calculated by the research and development parts of the industry, the number of licenses to be issued for the next fishing period would be calculated.

Approximate though such a system would be, it should be more realistic and responsible than allowing licenses to be issued to the limit of the TAC, while 'knowing' that actual catches are greatly in excess of recorded landings. This is what the Precautionary Principle is all about!

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16. ENCOURAGING FISHERFOLK TO MANAGE THEIR FISHERIES: HOW COMMUNICATION AND AWARENESS CAN HELP

by Rathin Roy
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There is a crisis in fisheries all round the world. While increasing human populations want more and more fish to eat, fishers around the world are having difficulty in meeting the demand because they are catching less each year despite increasing efforts. With awareness of the problems growing, people and governments are now becoming concerned whether the seas, rivers and other water bodies will be able to meet the demand for fish in the future. Which brings us to what the Bay of Bengal Programme, like several other organizations, is trying to do: fisheries management. The issue looked at in a broad sense is rather simple:

* fish are a natural resource, which grow, reproduce and die;
* fishers capture fish;
* if they catch fish faster and in larger quantities than the stock of fish can grow and reproduce, then catches are affected and so is the stock;
* as fish grow scarce they are more expensive to catch and become pricier;
* which gives an incentive to fishers to try harder, and that only makes matters worse.

The answer is to be rational and to ensure that fishers capture only so much of a stock of fish which enables them to keep doing it! But, of course, there is more to it, fish stocks can be affected not just by the act of irresponsible capture, but by the quality of their environments, which in turn are affected by humans through population of waters, destructive fishing methods and so on. So, to cut a long story short, what is of concern is what people do to fish and their environment.

Fisheries management is not so much about managing fish, which left alone seem to do just fine; it's all about managing the way people and fishers capture fish and affect their environment. Fisheries ***management is really people management.***

Before concerning ourselves with how, or if, communication and awareness-building can help with fisheries management, it would be useful to better understand the problem itself.

Why bother with fisheries management?

Fish is food, and for a lot of people the major source of their animal protein. Some have traditionally eaten fish and feel deprived when they cannot get enough. others like the taste, some others are beginning to eat fish instead of other meats for reasons for health. With populations increasing, and expected to double some time during the next two decades, depending on whose calculations you care to believe, the demand for fish is going to increase worldwide. The problem is that marine fish catch peaked in 1989 and has been stabilizing since.

Aquaculture, the growing of fish in controlled conditions in enclosed waters, and mariculture, the ranching of fish in natural open waters, are seen by some as an answer. Although their contribution to fish production is growing, the industry is already beset with its own problems, such as water and land use conflicts. pollution of water. and diseases.

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When supply cannot cope with demand, prices rise. It is the poor and often traditional consumers of fish, who find fish disappearing from their food baskets.

Increasing populations of fishers, using more efficient craft and gears, targeting decreasing and stressed populations of fish, is a good recipe for conflict. And conflicts abound in the fishing world.

The need to sustainably provide people with fish as food, ensures the profitability of an industry that provides livelihood to millions of fishers, quite a few of whom are considered poor even amongst the poor. To do so in a socially sustainable manner, by reducing conflicts, is the major reason why everyone concerned with fisheries is talking and worrying about management. Something has got to be done! The question is, how?

Purpose of fisheries management

Fisheries management enables communities and governments, together with their fisheries agencies, to have control over a number of important factors. Namely:

- The exploitation, conservation and sustainability of fisheries resources
- The profitability of the fishery to fishers and others in the industry
- The way in which the fisheries resource is allocated among the community
- The need to address wider social issues, such as conflicts, unacceptable fishing methods, by-catch issues and the environmental impact of fisheries on the environment.

The alternative to management is free access to the resource by all interested parties without any limitation. In such situations, there is historical evidence that fishers tend to increase their capacity to fish through increase in numbers of craft and gear and fishing intensity, with a consequential decrease in catch by individual fishers. The profitability of the fisheries decreases and fish stocks get depleted.

But there is more to the objectives ***of fisheries management.*** At the best of times, fisheries management is a delicate balancing act. The environment sets the limits of the maximum (ecologically) sustainable yield, the means of production determine the maximum economic benefit that can be derived from the ecosystem, and the fishing community and society have to choose options that provide maximum socially feasible yields to meet their needs. The nature of fisheries management goes beyond exploitation of a resource in an ecologically sustainable manner, and the reaping of maximum economic benefits to the art of the possible, determining what is socially feasible. The complexity of multitiered objectives is further aggravated by the fact that there are often, at least in multispecies, multigear, tropical fisheries in the Bay of Bengal region, several stakeholders, each of whom has his own needs and aspirations and, therefore, differing objectives.

Whose problem is it?

Fishing is the business of fishers: If fisheries management means changing the very way fishing is practised, we are talking about changing the behaviour of fishers. Government fisheries agencies do not fish, but they regulate fisheries, and often promote them. Fishers, whose livelihood comes from fishing, would not fish unless there is a market for the fish they catch. Fishers in Bangladesh who target juvenile *hilsa,* for instance, do it because there is a ready market for it; for some, it is traditional fare

which they like. For most others it is the only form of the prized *hilsa* they can afford. Customers, through their purchasing power, drive demand with their preferences and dislikes.

Then there are groups and agencies with environmental, human rights and socio-economic concerns who object to, advocate and agitate against certain types of fisheries and their impacts. It is easy to write them off as troublemakers and adversaries, but they have a voice, and often can mould public opinion and move the legal system to bring the fishing industry to a grinding halt. So, it would be foolish to ignore them, even more so because in many cases they may be right or have a valid or legitimate point. All these and still others are stakeholders in fishing, and it is also their problem.

Too often in the past there has been a tendency to see fishing and fisheries management as the task of the government fishery agency alone. The fishery agency determined what needed to be done, enacted rules and regulations, and then spent enormous amounts of time and money to try and enforce rules and regulations. People rarely support laws and regulations governing their lives unless they believe in them. And it is difficult to believe in something in whose design and development you have had no role. Participation is not just a fashion in development; it makes sense, ensures better development acceptable to all, makes enforcement easier, and reduces costs to the government by getting the involved stakeholders to manage their own business.

Fisheries management deals with multiple stakeholders, and sustaining a fishery resource requires the active participation of all stakeholders, sitting together, setting objectives, devising means and methods, agreeing on fisheries management plans and finally implementing and enforcing what they have agreed to. It is time fisheries agencies set aside their notions and perceptions and realized that participatory, negotiated fisheries management is not just the way to go, but the only way to go.

What kind of a problem is fisheries management?

Traditionally, fisheries management has been done by fisheries biologists, resource assessment experts, fishery agency officers, police and the Coast Guard, all of whom have important roles. However, fisheries management is all about how to catch fish, where and when to catch them, which fish to catch at what size and, most importantly, how much to catch, to ensure basically two things:

- One, that the fishery resource will be sustainable into the future; and
- Two, that the business of fishing will continue to be profitable

Looked at this way, fisheries management becomes more complex – it is about livelihood and survival, it is about who has the right to fish and how much of it; in other words, it is about the allocation of user rights. These are political, social and economic issues, which are not only highly emotional issues but issues about which people are ready to fight. The fact that most water bodies in which fishing is practised are common property resources makes matters more complicated. Anybody with craft and gear, technically speaking, can go out and fish in the sea or in a river. How do you go about managing and controlling an activity which, by its very nature, is an open resource with unlimited entry?

Fisheries management, stripped of all its drama, reduces to not only deciding what and how much fish can be caught but who should catch it. Since we are talking about a limited but renewable biological resource, it is obvious that the people who can benefit from it are also limited. The problem is that this means there will be people left out of sharing the pie, as it were. Traditional fishers, who have fished for generations, and often know no other form of occupation, have at least a historical or traditional right to

fish. And they are the majority of fishers in the Bay of Bengal region. With the recent boom in fishing, particularly in offshore fishing and coastal aquaculture, a lot of 'outsiders' have got involved in, and invested in, fishing and aquaculture. And this has naturally generated envy and ill feeling. Particularly in the case of coastal aquaculture, when 'wasteland' overnight stat-s generating large earnings for outsiders, it is only reasonable for the local person to wonder 'Why not me?' and look for environmental, social and economic reasons upon which to build their challenge.

In fisheries, unlike in agriculture or forestry, the ecosystem is more complex, and while science has developed a lot in the past it is still not easy to come up with answers quickly to questions such as how much of this species can we catch to ensure sustainability?' Given this problem, we are dealing with a situation where no one stakeholder has the 'right' answer. To a certain extent everything is negotiable. This is even more so the case when we include the socio-political and economic aspects of the problem. The nature of the beast is such that the only hope is to bring stakeholders together to negotiate management.

What makes such negotiations complex is that several stakeholders are involved, with different perceptions of the situation, the problems and the solution options. The stakeholders, as they involve fishers, fisheries biologists and consumers, to mention just three, also have different levels ofawareness of the issues. Worse, the different stakeholders have different levels of organization and political clout. For example, a small non-governmental group, or a seemingly insignificant group of activists, can get good media coverage, use legal leverage and sway local, national and international public opinion and bring enormous political pressure to bear, unlike a fishery agency shackled by rules, regulations and bureaucracy.

To summarise. fisheries management, by its very nature, requires the involvement ofmultiple stakeholders, with differing levels of awareness and political power, to reach negotiated agreements. The issues are multidisciplinary, are not firmly grounded in clear logic, and the state of the knowledge does not allow for black-and-white answers to questions. Stakeholders often see each other as adversaries rather than as groups on the same side working together to solve the same problem. One group's benefit is seen as another group's gain, and this is unacceptable. So, how do you go about promoting, facilitating and enabling fisheries management? And, what role can communication and awareness-building play in all this?

What can communication and awareness-building do?

Given the nature of the problem, the first task would be to bring the stakeholders together, to better understand their problems, to agree on:

* the need for, the benefits of and the methods of fisheries management
* the objectives of fisheries management;
* the solutions;
* who does what and how; and
* how it should be enforced

Which is quite a handful, to say the least.

Let us take it one step at a time. A problem in fisheries that requires management can manifest itself in many ways. Catch per unit effort could be declining, the size of fish caught could be getting smaller.

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more juveniles are being caught , or even fish not targeted by the fishery are being caught, all leading to waste of resources, poor landings, and reduced earnings and profit. There could be conflict between groups targeting the same species or fishing in the same area?. Or, as in the case of aquaculture, the people living in the coastal region could be complaining about the environmental and social impacts of aquaculture.

The first task would be to identify all the stakeholders: those interested in the activity, those dependent on the activity, those affected by it, those opposed to it and those in government whose responsibility it is to regulate it. This can only be done by communicating with the stakeholders, starting with the most obvious ones, and evolving a stakeholder map through discussion about the activity and its various stakeholders.

Problems affect people but rarely are enough justification to bring people together to solve them. This is especially so if stakeholders see each other as adversaries, and this is often the case in fisheries. They will come together only if they stand to gain by doing so. and then it will be only if they have commonly held beliefs and aspirations. To find these commonalities, communication helps by understanding each stakeholder's perceptions of the situation, problems, aspirations, interests and solution options and by culling out the areas of agreement from these. Once stakeholders can be shown that commonalities of purpose exist among them, there is incentive to come together to first talk about the agreements, and then to discuss adjustments to differences. Thus, communication can be a tool not only to bring people together but to generate new platforms or fora for discussion.

When stakeholders gather around the table to talk and negotiate. the success of such consultations depends on whether:

they are speaking the same language (in terms of world views and levels of awareness), and

they feel powerful enough to make a difference.

In other words, a scientist and a fisher can discuss a concept, like maximum sustainable yield or the need to declare a closed season in spawning areas during particular seasons, only if they understand each other's perceptions of the ecosystem and each other's logic frames. If they are different, no amount of persuasion will help. In such situations, communication can help improve the understanding of perceptions. worldviews and frameworks of logic. Appropriate awareness-building can bridge the difference by building new structures of learning on traditional foundations of knowledge.

The second criteria for success deals with empowerment there cannot be a fruitful consultative and participatory negotiation when powerful government scientists and bureaucrats are pitted against ordinary fisherfolk. The fishers, in order to arm themselves, will need to be helped to organise themselves and be empowered further by government, by giving them control and use-rights over the resources they have relied on for their livelihood security for generations.

Negotiations for conflict resolution are complex as they are. To expect the involved parties to be able to run them and come up with mutually beneficial solution options for consideration is far- fetched. There is a need for mediators or facilitators who, using communication , group dynamics and negotiation skills, will mediate in the negotiations and consultations and help the stakeholders in reaching agreements and decisions.

Finally, good two- way communication builds understanding and trust among. stakeholders and acts as the lubricant to facilitate improved management implementation. monitoring and enforcement. For too

long, communication and extension have been a one-way exercise of those who know, imparting their knowledge to those who do not; sharing the Word, as it were.

What communication and awareness-building cannot do

Awareness does not guarantee practice. People who know about and understand that smoking is not good for them do not always stop smoking! It takes more than just communication and awareness-building to do fisheries management. Fishers will not reduce fishing effort unless, say, price structures or alternative employment opportunities give them the opportunity of increasing their incomes. Communication and awareness-building are necessary but not sufficient conditions. Communication and awareness-building are neither public relations nor propaganda – you cannot use them to fool all the people all the time. Good communication and awareness-building cannot sell a bad programme or an idea indefinitely, nor can it make up for inadequacies and incompetence in other parts of the fisheries management package.

17. GUIDELINES FOR GROUP DISCUSSION

Workshop participants divided themselves into three groups to discuss three subjects: "Selling the idea of precautionary fisheries management"; "Operationalising fisheries management";and "Implications of PA2FM for small-scaleiartisanalfisheries". A list of questions was prepared as guidelines to help initiate discussion. Each group made a I S-minute presentation on its findings through a group leader. Here is a list of the questions and a list of the members of each group.

Group 1: Selling the Idea of Precautionary Fisheries Management

Members of Group 1

Mr Md Azizul Karim. Ms Tuti Sisulowati, Mr Dato' Wahid Jalil, Dr S M Garcia
Mr Sunil Sud, Mr S Muranto, Dr Johanes Widodo. Mr George Chong,
Mr Abdullah Sunan, Mr Sakul Supongpan, Mr Ramian Matondang

1. Who in your system takes basic decisions on the need for fisheries management measures and sets in motion the process which leads to management?
2. What criteria or concerns suggest the need for fisheries management? How do such concerns come to the notice of policy makers? flow do the criteria they use get established?
3. What are the factors that may make policy makers hesitate taking the precautionary route to fisheries management? Can we better understand the forces that affect policy makers and the decisions they take?
4. How do we convince policy makers of the need for precautionary fisheries management? How best can the idea be sold to them? Logic? Political pressure? Environmental concerns? Examples from other countries? Pressure from stakeholders?
5. What are the information needs of policy makers to help them to decide on fisheries management? How easily is such information available to them?How timely is the information?
6. What kinds of information can be used to help policy makers take management decisions in a precautionary frame?
7. What are the ways of visualizing the status and trends of fisheries and their habitats to convince non- technical policy makers to take decisions in favour of precautionary fisheries management?
8. What are the analytical tools necessary to generate information to help policy makers take decisions in a precautionary frame?
9. What kinds of data would need to be collected, how and by whom to feed such analysis'?
10. What changes could be recommended to existing data gathering and information generation processes to facilitate timely provision of information to policy makers to help them in their decision making?

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Group 2: Operationalizing Fisheries Management

Members of Group 2

Mr Md Masudur Rahman, Mr Sihar Siregar. Ms Ir Enni Soetopo, Dr Nick Willoughby, Ms Khatijah Hj Noordin. Mr Mohamed Faiz, Mr Gary Preston. Mr A A Kulatunga, Mr Nasiruddin Siregar, Dr Kee-Chai Chong

I. What are some of the more successful fisheries management initiatives in your countries?

2 State the conditions and factors which made such initiatives work well. Is it possible to suggest a checklist of conditions and factors fisheries managers should look for or create to implement successful fisheries management initiatives?

3 Who actually manages fisheries? For example, in your countries:

- Who identified fisheries that need management, and how do they decide which fisheries need management?
- Who develops fisheries policy and what factors go into policy- making?
- How is the policy converted into law, rules and regulations, and by whom?
- What measures are taken to make fishers and other stakeholders aware of the need for, the benefits of and the methods of fisheries management?
- How are stakeholders involved in the actual process of fisheries management?
- Who enforces fisheries management and how? Do stakeholders play an active role in this?
- What are the processes by which laws, rules and regulations relating to fisheries management are reviewed from time to time? What suggests the need for such changes and how does it come to the notice of the fishery agency?

4. Can we think of innovative easy-to-implement fisheries tnanagement methods. from the examples of others and from the indigenous knowledge and local experience of fishers'?

5. Based on your discussion can you recommend:

- Changes in the way institutions concerned with fisheries management function to facilitate the process?
- Changes in laws, rules and regulations to facilitate the process of fisheries management?
- How state, provincial and local level institutions can be involved and empowered to manage their fisheries?
- How can stakeholders of fisheries be encouraged to participate in fisheries management?
- What kinds of incentives and dis-incentives may encourage participatory fisheries management?

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Group 3: Implications of PA2FM for Small-Scale/ArtisanaI Fisheries

Members of Group 3

Dr John Kurien. Dr Nik Mustapha R Abdullah, Mr John Fitzpatrick,
Mr S Jayasinghe, Mr Jate Pimoljinda, Dr Stanley Wang,
Mr Robert Napitupulu, Mr Zainuddin Siregar, Mr Rathin Roy, Mr Rene Verduijn

1. Given the socio-economic conditions of artisanal fisherfolk is it really possible for them to manage their fisheries, which more often than not means reducing fishing effort, while still assuring themselves of food and livelihood security?

2. Artisanal fisherfolk have traditionally practised some management measures. Why did they do so? What information, factors and conditions provoked them into taking such measures? How did they get their fellow fishers to join them in such action? How do we learn from fishers?

3. Given our understanding of the above, how can we sell the idea of management and precautionary management to artisanal fisherfolk? What kind of justifications would they need to change? How best can such information be communicated to them?

4. Given that most artisanal fishers are not organized, at least in a fishery sense, what are the implications to management ofdealing with the unorganized sector? Can traditional organizations and social formations be strengthened and utilized for fisheries management purposes?

5. How do we encourage participation of fishers in fisheries management? Is it possible to be participatory without having the power (or, being empowered) to take control of one's resources and destinies? How easy is it to empower fisher communities and organizations in the present political context?

6. Community-based management lends itself to the management of locale-specific, sedentary species of fish. How do we promote regional and inter-community organizations to address the management concerns of shared fishery stocks?

7. Given the socio-political nature of people's organizations, who can have the political legitimacy to organize fisheries? How best can this be done? What can we learn from the experiences of co-operatives in this regard?

8. Participatory stakeholder approaches to management require consultation and negotiation to reach management decisions and implement them in a collective manner. How do we ensure equity in such consultations and negotiations when different groups are at different levels of organization and power? Can awareness alone empower?

9. Can we recommend approaches and methods to involve artisanal fishers and to get them to help in managing their fisheries? Are there any success stories in the region from which we can learn?

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18. SUMMARY OF GROUP DISCUSSIONS

Three working groups were formed to discuss the following broad issues:

* Promoting the idea of PA2FM
* Operationalisation of fisheries management
* Implications of PA2FM for small- scale fisheries

Each group was provided with a series of questions on fisheries management issues in countries of the region (Chapter 17). These may be summarised as follows:

* What criteria or concerns determine the need for fisheries management?
* How are fisheries management measures established?
* Who manages fisheries?
* What information is needed in support of fisheries management?
* How can management-related information be best communicated to decision-makers and-those involved in the fishery?
* How can fishery management arrangements be improved?
* What factors promote or impede the precautionary approach?

The groups debated the questions listed in the "Guidelines" as well as other relevant issues. The conclusions of each group may be summarised as follows.

- It was noted that the PA2FM is a subset of the Code of Conduct for Responsible Fisheries (CCRF) which all countries of the region have adopted. The CCRF requires that we concern ourselves not only with the resources but also with people who use the resources. Section 6-l 8 of the CCRF specifically requires preferential protection of the artisanal sector.
- While both people and institutions may have been involved in instituting fishery management arrangements, most decisions were taken centrally. Government, whether Central, Regional or Provincial, was identified as the main decision- maker. The process is generally triggered by a Parliamentary initiative which may be prompted by Parliamentary constituencies (many Parliamentarians come from fishery areas) and use information from them, fisheries associations, NGOs, fishery consultative committees. It could also be triggered by day-to-day interaction between sector operators and fishery administrators.

Major fishery management problem areas identified were:

* Management decisions inconsistent with technical requirements or advice;
* Conflicts between different fisheries sectors (usually large-scale and small-scale)
* A lack of awareness of the need for resource management;
* Non- compliance with fisheries laws and regulations by fishers;
* Inadequate enforcement of laws;
* Conflicting development/management objectives within Government; Inadequate organizational structures for management purposes;

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- Inadequate legal instruments or frameworks to allow management;
- Lack of reliable information on fisheries or resources;
- Inadequate international co-operation to deal with trans-boundary problems.

The following actions were required to convince decision-makers and resource users about the need for improved management:

- Improve the information available and submitted to policy makers;
- Use contacts between management authorities and the fisheries sector to promote PA2FM;
- Raise awareness of the need for marine resource management among the general public (not just fishers), especially through use of the media;
- Promote longer-term concerns in fishery sector operators.

A general insufficiency in research in support of PA2FM was recognised. Such research should address not only biological aspects of resources but also economics and social sciences. As well as looking at management options, it should deal with risk assessment, and take account of trends in demography, technology developments, future demands for food and for access to fisheries, rural and urban development issues, etc. The results of the research should be passed on systematically to decision-makers and to industry.

The groups recognised that any measures leading to long- term concerns for the resource by users, such as introducing fishing rights and allocations and increasing security of access to resources, would be valuable. For industrial fisheries these might include long-term licensing, while for artisanal fisheries territorial user rights may be appropriate. The importance of formalising the rights of small-scale fishermen was emphasised. This might be done by purely legal means (e.g. statutory local reef ownership) or through a system ofpayment of user fees for the right to fish. This would instil among fishers a stronger feeling of ownership.

Given the intense nature of coastal fishing in the region, it was concluded that effort reduction would be unavoidable in many areas. Historical precedence plus the basic principles of equity, fairness and right to livelihood argue strongly that, in case of conflict between large-scale and small-scale fisheries, Government should cause large-scale fishery interests to move offshore or even into non-fishery investment options. This was considered to be not merely an exercise in zonation but an implicit allocation of rights, supported by the CCFR and PA2FM.

Merely reducing effort in large-scale fisheries would nevertheless not solve all problems in the small-scale sector. The need to promote PA2FM would still exist. Management measures introduced into small- scale fisheries would be accepted only if they were applied across the board to all fisheries, and if stakeholders were to be involved in the decision-making, monitoring, implementation and enforcement processes. This would require devolution of some (but not all) powers to resource users. Stakeholders including Government should decide on the specific powers to be vested with resource users. Stakeholders including Government should decide on the specific powers to be devolved, and spell out the rights and responsibilities of various parties. It was noted that devolution is a two-way process. It originates from the Government and is requested by stakeholders.

Finally it was pointed out that there were several impacts on the coastal zone, which often interact and have detrimental effects on the coastal environment. There is a need to introduce integrated coastal area

management measures (also in a precautionary way). Given the dependence of fishers on the coastal ecosystem, they should have a say in coastal zone development and management and could justify a key initiating role therein, based on their adoption of the PA2FM.

Group 1 discussion: Promoting the PA2FM

Q1a - Who takes the basic decisions and sets the process leading to management measures?

The group identified Government as the main decision-maker whether at Central, Regional or Provincial level. It was clear that while people and a number of institutions may be involved in the process (see below), decisions were taken centrally.

Q1 b - What triggers the decision-making process?

Generally, the process is triggered by a Parliamentary initiative. This initiative in turn may be prompted by (and may use information from) the constituency (as many parliamentarians come from fishery areas), the fisheries associations, the NGOs (formally or informally contacted), as well as from consultative committees established for that purpose. The initiative may also result from the day-to-day interaction between the sector operators and the fishery administrators. The role of NGOs differs between countries – it can sometimes be very important and formal. It can also be informal. In some cases, public hearings are used as a triggering mechanism (i.e. are at the origin of the decision process).

Q2 - Considering thefactors that might be cited as problems in introducing the PA2FM, how can we better convince policy-makers and decision-makers about the need for PA2FM? How can fishermen also be convinced?

The group identified the required action as follows:

a. Improve the information available and submitted to policy makers (see below for details on the type of information required).

b. Use all opportunities of contact between management authorities and the sector to promote PA2FM. For example, when fisheries or resource crises erupt, when rehabilitation projects (see below) have to be taken up, when development planning is undertaken.

c. Use the media (especially NGOs and the private sector) to advertise issues and reach Parliamentarians.

d. Promote long-term concerns in operators. In order to increase long- term economic considerations, managers may introduce fishing rights and allocations, increasing security of access to resources. For industrial fisheries, long-term licensing has been mentioned. For artisanal fisheries, some territorial user rights could produce the same effect. While not recommending any approach in particular, the group recognised that any measure that raised long-term concerns for the resource by industry would be appropriate.

In case of depleted coastal resources and coastal conflicts, projects for community and resource rehabilitation (as in Thailand) could provide a golden opportunity to introduce PA2FM together with reorganisation of people, introduction of devices to keep large-scale fishing out of the coastal area (e.g. artificial reefs), organising local enforcement, strengthening local organisations, integrating community

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support (e.g. clean water supplies, alternative job creation, etc.) The assumption is that people will be more receptive to PA2FM when such projects are being executed. It was also noted that introducing such an approach before the resources are degraded would really be precautionary and probably more effective. It was also noted that in order to avoid dissipation of the benefits this created, a cap on fishery capacity should be established. as also participatory mechanisms to enforce it.

Q3. What kind of information is reuired to convince decision makers, and what would be the nature of such information?

The group recognised a general lack or insufficiency in research, leading to appropriate arguments to promote PA2FM. Such research should address not only biological research on resources but also economics and social sciences. It should not only assess resources and fisheries. look at management options and deal with risk assessment, but should also produce relevant and timely forecasts. In doing so, it should take into account trends in demography and technology development and future demands for food, for access to fisheries, rural and urban development, etc.

The information produced should be supplied systematically to decision-makers and industry. It was recognised that the systematic development of management plans would help in institutionalising the information process, "forcing" (a) managers to request it ahead of time and (b) scientists to keep the information up-to-date and focusing on key issues. Such management plans should preferably be organised on an area basis or by species groups (as opposed to species by species), particularly in the case of multi-species fisheries/resources.

The group noted that in the case of shared or trans-boundary stocks the problems and solutions were similar but that the Government had an even more important and exclusive rote than in purely national resources.

Q4. What are theanalytical tools needed to generate the needed information?

The group singled out the role of fisheries models including bio-economic and socio-economic parameters and dealing with micro- and macro-economics as well as uncertainty. The group stressed, however, that even though the need for more complex models was recognised, the results generated by these models including use of information/communication specialists when available – should be conveyed in a simple and effective way to decision-makers (and the sector).

Management plans should be formulated. Fishery committees should be formed wherever possible to promote active people participation in management.

Croup 2 Discussion: Institutionalizing Fisheries Management

The 1 O-person group contained representatives/resource persons from Bangladesh, Indonesia, Malaysia, Maldives, New Caledonia, BOBP, and Sri Lanka. The group tried to see whether any regional consensus or pattern could be determined in management problems or initiatives.

Q. 1 What are the more successful fisheries management initiatives your countries?

There was a good deal of discussion on what had been said during the meeting, resulting in the identification of three major areas of initiatives:

- Bans on eco-unfriendly fishing gears and methods
- Strengthening legal frameworks to support management needs
- Sound communication systems between government and fishing communities.

Q.4 Are there examples of innovative, easy-to-implement management methods?

This was discussed at the same time as Q. | to try and pin down the difficulties as a way of determining the successes. Most group members knew of problems within their systems caused by the following factors:

- Political decisions that conflicted with technical requirements or advice;
- Conflicts between sectors of fisheries (usually large-scale and small- scale);
- A lack of awareness of the need for management and the value of the resources to others;
- Non-compliance with fisheries laws and regulations by both large-scale and small-scale fishers;
- Inadequate enforcement of laws on both sectors;
- Conflicting objectives, sometimes within government, sometimes at the departmental level;
- Inadequate government structures for management purposes;
- Inadequate legal instruments/frameworks to allow departments to manage as required;
- Lack of credible information from statistical services;
- Inadequate international co-operation to deal with straddling stocks and poaching problems.

Q.2 What conditions andfactors made these methods work **well?**

This question was not discussed. Group participants felt that a checklist ofconditions and factors needed to create successful management initiatives was not realistic. Management was often reactive rather than proactive, thus less precautionary than perhaps desirable.

Q.3 Who manages fisheries? a) Who identifies the need for management?
b) How do they decide which fisheries need management?

Government fisheries departments.

Q.3b Who develops the policy and what factors go into policy- making?

Fisheries departments, with occasional external inputs.

Q, 3c How is the policy converted into laws, rules and regulations and by whom?

Policies are given to legal drafting systems (Attorney General's Department) for conversion into legal language. Laws have to be passed by the government. Depending on how the law is framed, Ministers act on rules, and departments on regulations. They can carry out changes without further recourse to the government law machine.

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Q.3d What measures are taken to make fishers and other stakeholders aware of the needs, benefits and methods of fisheries management?

Fisheries department extension services are usually responsible, though they still practise a top-down approach.

Public awareness campaigns should be carried out, using all forms of media available in the country concerned: print literature, radio, television, video, comics, posters etc.

Q.3e How are stakeholders involved in the process of fisheries management?

Most answers reflected the top- down nature of fisheries management in the region. In broad terms, stakeholder involvement was minimal (small-scale) though.

There were several instances in which particular groups played a part. Newer fisheries (less established) tended to have a greater stakeholder involvement in their development and management.

The group did not discuss 3f or 3g.

Q.5 On the basis of the discussions, *can you recommend change;;? Actions?*

The group did not look at the sub-questions individually, but suggested the following areas where further action was needed:

Public education and awareness – a multi-media campaign to alert the entire public (not just fishers) to the value of marine resources and the way they should be tapped.

A cost-benefit analysis of what might happen if no action is taken, and the management system is allowed to drift.

Traditional user rights and the idea of 'user pays' generated heated discussion, with differing scenarios painted by different individuals on the basis of their experiences. The end point was recognition of the need to formalise traditional user rights, either by purely legal means (statutory local reef ownership), or by local payment for the right to fish, giving the fishers a greater sense of ownership rights.

Group 3 discussion: Implications of PA2FM to Small- Scale/Artisanal Fisheries

1. The group began by discussing the concept and definition of "small- scale/artisanal fisheries". They concurred with the modified version of what was presented by Dr Serge Garcia in his keynote paper.

A fishery can be broadly understood as a small-scale/artisanal fishery if it has a reasonable number of the following characteristics:

* Fishers have a good understanding of the ecosystem they work in
* Their occupation is ecosystem-based
* Simple technology
* Low capital investment
* High skill intensity

* Low job mobility
* Inter- generational and experiential learning/skill transfers
* Multi-species/multi-gear fisheries
* Highly seasonal occupation
* Linked to agriculture and other coastal occupations
* Dispersed habitats
* Household level of activity
* Owner/operators and labourers in other boats
* Near-shore fishing
* Traditional fishers for several generations and recent arrivals

The group pointed out that given the ecosystem-dependent nature of the activity, the technologies that SSF have evolved over time would tend to have a management orientation because:

* They would be tuned to the local ecosystem
* They would necessarily be simple; efficiency would be relatively low.
* They would be eco-friendly, by the very fact that the technologies have existed for generations without destroying the system

Thus it was felt that SSF are already in a way practising PK2FM and so would be very open to the idea.

2. The group then looked at whether there was sufficient justification to promote PA2FM amongst the SSF sector. The bulk of fisherfolk in the BOBP region are small-scale and their contribution to fisheries production is often considerable. Small-scale fisheries, because of several factors, are increasingly under stress and are displaying symptoms of stock stress and even depletion. There is reason from a resource managetnent point of view to promote PA2FM.

   Most importantly, PA2FM is a subset of the Code of conduct for Responsible Fisheries (CCRF) which all countries have adopted in the region. And CCRF requires that we concern ourselves not only with the resources but also with people who would tap the resource. Further, Section 6-18 of the CCRF obliges us to preferentially protect the artisanal sector.

3. Given the crowded nature ofcoastal areas and the intensity of small-scale fisheries in the region, the only real management option seems to be to reduce fishing effort. So there is a choice of whose effort needs to be reduced -- small-scale, large-scale or both. Based on the principles of equity, fairness and right to livelihood, the group felt strongly that governments should choose the option of requiring the large-scale fisheries to either move more off-shore or even get out of fisheries and move on-shore to non-fishery investment options. This the group felt was not merely zonation but an implicit allocation of rights, supported by the CCRF and PA2FM.

4. The Group felt that merely reducing effort in the large-scale fisheries adjacent to the small-scale sector, making more of the resource available to small-scale fisheries. would not solve all the problems. There would still be a need for PA2FM to be promoted in the small-scale sector, They felt that any management measures introduced amongst small-scale fisheries would be accepted and have legitimacy only if such tneasures are applied across the board to all fisheries.

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5. The next issue discussed by the Group related to approaches to introducing PA2FM in small-scale fisheries. Given the scattered and dispersed nature of SSF, the difficulties of enforcing management and the diversity of SSF, the group felt that the only feasible option would be to involve SSF stakeholders effectively in the decision making, monitoring, implementation and enforcement ofmanagement measures. The Group pointed out that this would require devolution ofpowers. It emphasised that the stakeholders, including government, should clearly decide on what powers should be devolved and what should not be devolved, then spell out the rights and responsibilities of stakeholders.

6. Finally the group looked at the coastal contest within which small-scale fisheries and fishers exist. It was pointed out that there were several uses of the coastal zone which often interact and exert detrimental effects on the coastal environment. Given the "tailend" location of coastal areas, they were often used as their countries' garbage bins, with everything finally finding their way to the coast. The Group felt that given the dependence of fishers on the coastal ecosystem they should have a say in coastal zone development and management. The Group recommended that there was a need to introduce integrated coastal area management measures (also in a precautionary way) and that SSF could use the precautionary approach to demand a key role on ICAM for fisheries and fishers.