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Fisheries Department
FOOD and AGRICULTURE ORGANIZATION
of the UNITED NATIONS
Viale delle Terme di Caracalla, Rome, 00100 Italy
Tel: 39-6-57976654/Telex: 610181 FAO I/Fax: 39-6-5120330

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EDITORIAL

With the release of the FAO Fisheries Circular 815 Rev.4 , the statistics for aquaculture production for 1990 have become available. These indicate the continuing expansion of the sector and the increasing contribution of aquaculture to global fisheries production. At a total of 12.2 million tons in 1990 about 12.5 percent of all fish shellfish and crustaceans are now cultured. Since 1989 production from aquaculture has expanded by 6.8 percent in inland waters and 7.0 percent in coastal waters.

Although Asia still dominates world aquaculture with nearly 85 percent of production, there are signs of growing expansion of culture in other areas of the world particularly in Tropical Africa where inland production has shown an increase of 17percent per year from 1984 to 1990 and in South America with a 13 percent increase per year over the same period. By contrast production has grown by only 5 percent in the temperate North America and Europe. While the majority of this production is still located in Asiatic carps, the industrial sectors for salmon and shrimp have continued to increase and there is a general trend for diversification of products. Many countries, for instance, are conducting trials with indigenous species in inland waters. In coastal waters new species

are entering culture practice as the markets for more traditional products become saturated.

A further trend worldwide is for the intensification of use of natural waters. Two approaches are being developed for this. Firstly, the productivity of natural communities is being enhanced by stocking with material produced through aquaculture. Secondly, culture in cages, pens or sealed coves is being practised alongside classical capture fisheries where the productivity of the natural water is increased by the fertilizing effect of waste feeds. This is contributing to increases in inland fisheries at a time when classical capture fisheries are declining. Intensification of this type in inland waters can be interpreted as a response to the extreme stresses being placed on inland waters in general due to the high demand from a wide range of users. Similar trends can be anticipated in future in coastal areas although suitable sites are already reaching saturation under present culture techniques.

All this shows that, in a period of stagnation and even decline of classical capture fisheries in marine and inland waters alike, the aquaculture sector is alive and well. While, perhaps expanding aquaculture is not at present contributing to a massive growth in the availability of protein as had once been hoped, it is at least enabling the fisheries sector to retain some degree of stability.

Robin L. Welcomme
Chief
Inland Water Resources and Aquaculture Service

SMALL-SCALE RESERVOIR FISHERIES DEVELOPMENT IN CHINA

Xiangke Lu
Fishery Resources Officer
Inland Water Resources and Aquaculture Service

The need to conserve water for irrigation purposes for the development of agriculture and the many other uses of water has led to the construction of water storage reservoirs throughout China on a mass scale starting about four decades ago. More than 80 000 man-made waterbodies of various sizes have been created and these have increased the freshwater area by some 2 million ha. Of the total number of reservoirs constructed, small reservoirs (6-66 ha) represented the overwhelming majority (96 percent).

Since the reservoir system in China has primarily been developed for the storage of water, flood control and hydropower purposes, fishery considerations were missing from the planning and engineering stages until the late 1970s. However, fisheries usually commenced soon after the construction of the dams as it was one of the means to provide livelihood for families and farmers displaced from the inundated areas. The development approach initially adopted was to stock the main waterbody with filter- feeding Chinese carps, provide fishing boats and gears, establish fingerling rearing ponds on a modest scale and later to install fish escape prevention facilities on spillways. This initial approach did not give high returns as it was not based on understanding of the new waterbodies production potential, and, moreover, there were administrative constraints.

The major obstacles in the development of reservoir fisheries in China were: (i) shortage of funds; (ii) administrative problems; (iii) absence of overall national development oriented strategy and plans; (iv) paucity of fisheries infrastructure to produce adequate fish seed; (v) acute shortage of trained manpower and extension services in reservoir fisheries management and (vi) lack of systematic reservoir fisheries research and synthesis of research data accumulated.

The situation improved when the Government decided in 1979 to make the supervision and management of fisheries in reservoirs the responsibility

of water resources departments. Fisheries was also included in the planning of new dams. Within less than 10 years, of the 2 million ha of reservoirs, 1.44 million ha have been developed for extensive culture-based fisheries. In the ten years from 1980 to 1990, fish production, area under cultivation with culture-based fisheries and yield increased from 111 966 t, 1.26 million ha and 88 kg/ha to 359 835 t, 1.44 million ha and 257 kg/ha. The present reservoir fish yield represents about one- tenth of that from pond fish culture.

The extensive stocking approach and capture fishery established in the late 1950s was modified between 1970 and 1990 through trial and error. Major achievements can be listed as follows: the optimum stocking size of fingerlings for attaining the highest survival rate was determined and applied; optimal stocking densities, species composition and harvesting methods were improved. Measures were also taken to alleviate the shortage of stocking material. The success of new approaches and methodologies has been demonstrated in the 5 330 ha Dahuofang reservoir in Liaolin Province, Northeast China where fish yield increased from 22.5 kg/ha in 1979 to 225 kg/ha in 1986. In the 800 ha Qingshan reservoir in Zhejiang Province, East China, the yield has, for the past 10 years, stabilized at 750 kg/ha. Although this stocking and capture approach is the prevalent practice in reservoirs in China, the results vary from reservoir to reservoir depending on productivity, location, management of the reservoir and the level of available inputs.

Over the years much work has been done to intensify fish production in small reservoirs where management is easier. The achievements can be summarized as follows.

(a) Intensive integrated fish farming has lately been extended and applied to numerous individual small reservoirs throughout the country based on the technology acquired from intensive integrated pond fish culture with considerable success. This practice has now been used for the development of a group of small-scale reservoirs located in the same area or under the same administration. An example is a group of small reservoirs in Zhejiang Province, East China where fish production in three reservoirs increased from 150 kg/ha to 10 122 kg/ha. The production of 1 kg of fish required 1.54 kg of rapeseed cake, 5.95 kg of fresh grass, 6.1 kg of cowshed manure, 0.035 kg of inorganic fertilizer and 0.142 kg of lime. Other activities in the integrated approach consist of the raising of livestock, poultry and agriculture products.

(b) Application of inorganic fertilizers (phosphate and nitrogen) directly into the main waterbody of a small reservoir to increase the plankton biomass as feed for filter- feeding Chinese carps is also carried out in many reservoirs in China. For example, in Shaanxi Province in the Northwest of China, where there are 1 445 small-scale reservoirs, fertilization of the main waterbody with inorganic fertilizers was initiated in 2 small reservoirs in 1983. By 1989 this practice had expanded to 494 reservoirs. The fertilization led to an increase in plankton on which filter-feeding Chinese carps fed; an average of 672 kg/ha of inorganic fertilizer was applied over a four-year period which in turn produced 403.9 kg/ha of fish. The conversion rate of fertilizer to fish was 2.69. Reports from other provinces that have taken up this practice showed that to produce 1 kg of silver and bighead carp requires 1.5 to 2.5 kg of inorganic fertilizer. The cost of fertilizer for 1 kg of fish produced was US$ 0.15 in 1990. Documentation relating to the selection of reservoirs for the application of inorganic fertilizers, including types of fertilizers to be used and their ratio, frequency and timing of such applications, and their combined use with organic fertilizers, is available.

(c) Shortage of large fingerlings for stocking of reservoirs to increase survival rate has been a long-standing problem in the past. This was due to the paucity of fisheries facilities for provision of adequate numbers and good quality fingerlings and the lack of sufficient funds to purchase stocking material from hatcheries. To overcome such constraints, numerous

strategies were developed and are currently employed in China, including locating fingerling-rearing ponds within the vicinity of a reservoir, cage culture of fingerlings in the main waterbody of a reservoir, rearing fingerlings within small reservoirs so as to provide stocking material for larger reservoirs, and the rearing of fingerlings in reservoir coves for future release into the main waterbody. Technical guidelines for the cage culture of filter-feeding Chinese carps are also available. Such practices have contributed to the alleviation of the shortage of fingerlings to some extent in the development of reservoir fisheries. However, the majority of these practices have been limited to the rearing of filter-feeding Chinese carps relying on the natural feed available within the reservoir where such feed is abundant. The rearing of other species of fish such as common carp, grass carp, Crucian carp and blunt snout bream, requires additional inputs such as supplementary feeds. This has been demonstrated by combining cage culture with cove culture or pen culture in a fenced-off area within a reservoir in Hubei Province, Central China and in the lakes of the Yangtse river basin. This method is also applicable in the cultivation of table fish. Such an approach is considered feasible in large and fertile reservoirs where mass stocking of the main waterbody is costly, resulting in low returns and reservoirs with multiple usage of water, boundaries, ownership and management constraints.

In the field of research, applied reservoir fisheries activities have been carried out by various central and provincial fisheries research institutes and selected universities in the past. Apart from research on the enhancement of production which includes various methods of rearing fingerlings and table fish in reservoirs, fields of study include:

(i) primary productivity, limnology and biological surveys of reservoirs;

(ii) domestication of other fish species that may propagate in reservoirs such as coldwater species (Hypomesus olidus and Coregonus sp.) in reservoirs in Northern China and warmwater species such as Plagionathops microlepis and Xenocypris davidi in reservoirs in Central and Southern China;

(iii) the escape of fish through flood discharges in spillways which poses a threat to reservoir fish stocks. Various fish escape prevention installations such as barrier nets and electric barriers have been designed, constructed and tested and have shown good results;

(iv) the utilization of tail waters and irrigation canals for the rearing of rainbow trout, common carp and grass carp with supplementary feeding, a rather recent development in China's reservoir fisheries. Experiments to date have given promising results;

(v) harvesting methodology and gear for the removal of predatory fish such as Elopichthys bambusa, Erythroculter ilishaeformis and Erythroculter mongolicus.

At present the information and research results are dispersed in various institutes and need to be collated and summarized. There is also some duplication of research effort. To strengthen research in reservoir fisheries, a specialized reservoir fisheries research institute was established in 1984 under the supervision of the Ministry of Water Resources. This institute has at present three research departments, dealing with reservoir fisheries technology, intensive fish culture of reservoirs and environmental evaluation/fishery planning. This institute has received assistance from FAO through a TCP project in 1990.

STIMULATING AQUACULTURE IN SOUTHERN AFRICA - THE ALCOM EXPERIENCE

S.R. Madhu

Information Officer
FAO Aquaculture for Local Community Development Programme (ALCOM)
GCP/INT/436/SWE, P.O. Box 3730
Harare, Zimbabwe

Five years ago, fish farming was largely unknown in the Chipata district of Eastern Zambia. ALCOM (Aquaculture for Local Community Development Programme), in co-operation with the fisheries department of Zambia, undertook to introduce fish farming in selected areas of Chipata. Two ALCOM staff visited farmers, showed them slides and encouraged them to dig fish ponds and stock the ponds with fingerlings. The two ALCOM staff and a government fish culturist regularly monitored the ponds, and provided advice to the farmers.

Initially, the farmers were merely polite to their visitors. Their confidence in fish farming as a worthwhile economic activity was low. Ponds were dug but neglected, sometimes abandoned or sometimes used to grow vegetables instead of fish. But there was also the occasional success story. Change occurred gradually. Today the landscape in Chipata is dotted with fish ponds. Fish farming has spread to other areas in Eastern province, where there are now more than 20 fish ponds. Farmers view aquaculture as a definite secondary option to improve their income. Three extension pamphlets produced by ALCOM in English and Nyanja have proved very popular, and there is a call for more. More importantly, the government is directing fish farming effort on its own. The fish culturist who worked with ALCOM in the early years is now the provincial fisheries officer of the district.

In Luapula province, Zambia, the nature of ALCOM's intervention has been different. Fish farming was introduced here during the late eighties by a Catholic priest, and its expansion was spontaneous. However, the activity was confined to men. A few years ago, ALCOM and the Department of Fisheries encouraged women to take up fish farming. There are now a few score women who own ponds, and many women take an active part in fish farming operations. The January 1992 issue of **Alcom News** details the role of women in fish farming in Luapula.

ALCOM is now focusing in Luapula on improving management techniques. The Department of Fisheries is being assisted with its advice to fish farmers and potential farmers. A number of experiments are being conducted, including the effect of using different stocking densities, the potential of using the plant Crotolaria as fish feed, the culture of male tilapia, and integrated duck-cum-fish culture. A fish farmer logbook is also being printed and used as a monitoring aid: it contains basic information about the farmer and his fish farming experiences.

Introducing and extending fish farming, as in the Eastern Province and Luapula Province of Zambia are only two of ALCOM's pilot activities aimed at testing and demonstrating new methods and techniques by which rural populations may improve their living standards through aquaculture. Eleven pilot projects are now operational: they relate, apart from pond culture, to improved utilization of reservoirs for fish production, extension training, and promoting the role of women in fish farming. ALCOM also assists countries of the region in aquaculture planning and in formulating new projects. Furthermore, an information service disseminates information about ALCOM and aquaculture within and outside the region.

Zambia is one of 10 countries covered by ALCOM. The other countries also belong to southern Africa and are part of SADCC (Southern African Development Coordination Conference) and include Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania and Zimbabwe. ALCOM liaises closely with SADCC in planning and implementing its activities. Mr B.J. Mkoko, Chief Fisheries Officer of Malawi and Fisheries Coordinator of SADCC is quoted

as saying, "ALCOM plays a significant role in aquaculture development in the region".

Executed by FAO and funded by Sweden, ALCOM began a five-year implementation phase in 1991. An earlier preparatory phase helped lay the foundation for the Programme's activities and define its work areas. The Programme is based in Harare, Zimbabwe, and consists of a small multi-disciplinary team of specialists. Five young associate professional officers (APOs) are outposted in Zambia, Botswana, Lesotho and Malawi.

Small Waterbodies

"One of our major activities at present is studying the fisheries potential of small waterbodies" says MrArne Andreasson, Programme Director of ALCOM. "The many thousands of small waterbodies in southern Africa constitute a little-researched fish resource. It needs systematic study and development. We confine our work on small waterbodies to dams and reservoirs. Studies and field projects have been taken up in Zimbabwe, Zambia, Botswana, Lesotho and Malawi."

ALCOM study of small waterbodies in Botswana

ALCOM follows a three-pronged strategy on small waterbodies. First, it seeks to obtain a baseline picture of the fisheries of selected dams: species and numbers of fish present, who is fishing, and what gears are used to catch the fish. Accordingly, fishing surveys are being conducted of selected dams to yield data on composition and abundance of fish stocks, and socio-economic surveys have been conducted to provide information on the communities that fish in the reservoirs. The second step is to develop and test methods by which more fish can be caught from the dams and reservoirs. The third and final step is practical intervention to boost fish production.

Work carried out to date has yielded valuable information on fish stocks and fishing gears in selected dams and on communities fishing the stocks. There have also been a few surprises. For example, studies and field work in Eastern Province, Zambia, show that the dams there to have well-established fish populations which are being actively fished with a variety of gears, and fish yields are quite high. ALCOM has proposed several interventions to improve fish production in Eastern Province, including developing gear to target Barbus paludinosis (a species that is presently under-fished), decentralizing the control of reservoir fishing, and identifying reservoirs that are under-fished and encouraging increase fishing activities.

ALCOM's socio-economic surveys in Botswana repudiate the belief that people there do not like fish. While they are always happy to eat fish, what is lacking, in the absence of a fishing tradition, is knowledge on how to cook the fish. More than 260 small waterbodies in the country have been catalogued. Test fishing surveys carried out for a year within eight dams show strong indigenous fish populations in these dams. A few fishing methods (liftnets and longlines) have been tried, and government technicians have been trained.

In Lesotho, an inventory has been prepared of nearly 400 reservoirs, including 310 small and 75 intermediate sized reservoirs. Test fishing surveys within five dams also revealed a strong assemblage of indigenous species. Here again, socio-economic surveys show that people like the taste of fish.

In Zimbabwe, three dams (Chichewo, Eben and Mwenje) have been used for study. ALCOM is demonstrating methods to assess fish stocks in the

dams, monitor fish catch, collect and evaluate socio-economic data. Three exercises in Rapid Rural Appraisal (RRA) were conducted on the three dams, mainly to involve the local communities in thinking through and planning ways to tap the fisheries potential of the dams, and also to obtain maximum information concerning the three dams as quickly as possible.

A "dam committee" to manage the fisheries has been set up for one dam and a constitution drafted. The RRA exercises have demonstrated their utility in encouraging communities to plan and implement the exploitation of the fisheries potential of small waterbodies.

Thus, following ALCOM'S work on small waterbodies, various options to improve fish production (relating to fishing gear, management and enhancement) have been identified. These options will be tested with the help of local communities, and vital experience will be gained on interventions to increase fish production in small water-bodies.

Fish farmer surveys in Zambia

One of ALCOM's earliest activities (carried out in 1987-88, during its preparatory phase) was the under-taking of three major fish farm surveys within Zambia, namely the Northern Province, Northwestern Province and Luapula Province. Up to 350 farmers were inter-viewed over a period of 10 months.

This was the first time that such exhaustive surveys had been conducted on fish farmers in the region. The surveys have yielded a wealth of data, on the basis of which ALCOM consultant Ulf Wijkstrom has developed a theory on promoting economic growth through aqua-culture. He states that fish farming can best stimulate economic growth when it is introduced in areas where the economy is stagnant and farmers have under-utilized resources of land and water. It can also promote economic growth when the economy is expanding and farmers already have fish ponds. In the second case, culture must be intensive, and a specialized research and development centre must be set up in the fisheries department to encourage intensive culture. ALCOM report No.9 presents Wijkstrom's ideas in detail and also carries detailed recommendations on the setting up of an aquaculture extension service.

Women in fisheries and aquaculture

ALCOM accords strong emphasis to enabling women to fulfil their potential and improve their incomes. It is believed that when women earn more the families live better, whereas higher incomes for men do not always generate the same effect.

Women of Masvingo, Zimbabwe, fetching water

In 1990 ALCOM held an international seminar in co-operation with the FAO Regular Programme at the Rome Headquarters on gender issues in fisheries and aquaculture. The report of the seminar is an important contribution to the literature on the subject, and contains recommendations for governments, donors and FAO on promoting development without gender discrimination. The seminar also led to a new Japan-funded subproject, "Enhancement of the role of women in inland fisheries/ aquaculture development," which is being executed mainly through ALCOM. Under the sub-project, gender-related studies are being carried out in several Member-Nations.

Also in 1990, ALCOM sponsored a study on gender issues in fish farming in Luapula Province, Zambia. It examined the factors that promote or inhibit fish farming by women. A slide presentation has been prepared on the subject.

Active participation by women is now being institutionalized in all ALCOM work.

TRAINING, DEVELOPMENT SUPPORT AND INFORMATION

ALCOM has conducted several workshop and training courses to improve knowledge and skills. Training courses for fish culture and extension staff have been held in Angola and Mozambique. Two project proposals have been formulated for Mozambique, one related to extension and the other concerning carp culture. Assistance is being provided to Angola in formulating an aquaculture development strategy and a project formulation mission has been mounted for Botswana.

On the information front, ALCOM seeks to stimulate increased awareness of aquaculture, improve exchange of ideas and information, and promote debate and discussion on technical, development and management issues. A regular quarterly newsletter, **ALCOM News**, periodic technical reports, extension manuals, slide presentation and exhibitions are part of the information effort. ALCOM's library holdings are also being computerized so that a data base can be developed on aquaculture for the region.

COASTAL AQUACULTURE AND THE ENVIRONMENT

A summary of environmental management guidelines

Uwe Barg
Fisheries Resources Officer
Inland Water Resources and Aquaculture Service

Aquaculture interacts with the environment. It utilizes resources and causes environmental changes. Most interactions have beneficial effects. There have been substantial socio-economic benefits arising from the expansion of aquaculture. These include increased income, employment, foreign exchange earnings and improved nutrition.

Aquaculture operations in many temperate and tropical countries can still be improved. Current aquaculture development efforts need to be strengthened to further improve the management and operation of many aquafarms to ensure their durability and environmental compatibility. Aquaculture development may increasingly be subject to a range of resource-use and market constraints.

There is concern about the potential environmental implications of aquaculture development, comprising the adverse effects of aquaculture operations on the environment as well as the consequences of increasing aquatic pollution affecting feasibility and sustainable development of aquaculture. Unfortunately, environmental problems have resulted from conversion of wetland habitats, nutrient and organic waste discharges, introduction of exotic species, chemical usage, as well as from deterioration of water quality and decreasing availability of suitable sites for aquaculture.

FAO is about to publish the **Guidelines for the Promotion of Environmental Management of Coastal Aquaculture Development** based on an overview of selected published experiences and concepts. This document is intended to assist those who are involved and interested in the planning and management of environmentally-acceptable coastal aquaculture development. Potential adverse environmental effects of and on coastal aquaculture practices are addressed with consideration of main socio-economic and bio-physical factors. Methodologies are presented for the assessment and monitoring of environmental hazards and impacts of coastal aquaculture. Selected environmental management options are described for application both at policy- and farm-level.

These guidelines are summarized in Boxes 1-4. The full document will be published as FAO Fisheries Technical Paper, No. 328. Rome, FAO, 1992, 100p. plus annexes. Readers intested inobtaining a copy should write to: Fishery Resources Officer, Inland Water Resources and Aquaculture Service, Fisheries Department, FAO, Rome.

BOX 1 Suggested General Principles and Policies

General Principles	Coastal aquaculture has the potential to produce food and generate income contributing to social and economic well-being.
	Planned and properly managed aquaculture development is a productive use of coastal areas which should be undertaken within the broader framework of integrated coastal area management plans, according to national economic objectives and national goals for sustainable development.
	The likely adverse consequences of aquaculture and other coastal developments on the social and ecological environment must be predicted and evaluated, and measures formulated in order to contain these consequences within acceptable pre-determined limits.
	Aquaculture and other activities in coastal areas should be adequately regulated and monitored to ensure that adverse effects remain within pre-determined limits and to detect when contingency and other plans need to be brought into effect to reverse any trends which could lead to unacceptable environmental consequences.
Policies	Sound utilization of the ecological capacity of the coastal area to produce aquatic products and generate income.
	Development of policy and management mechanisms to reduce conflict with other coastal activities.
	Prevention or reduction of the adverse environmental impacts of coastal aquaculture and other coastal activities.
	Management and coordination of aquaculture activities to ensure that their adverse impacts remain within acceptable limits.
	Reduction of health risks from the consumption of aquaculture products.

BOX 2 ACTION REQUIRED TO ENHANCE UNDERSTANDING OF THE INTERACTIONS BETWEEN COASTAL AQUACULTURE DEVELOPMENT AND THE ENVIRONMENT

Benefits	Emphasize the socio-economic and ecological benefits of coastal aquaculture. Collect and provide information on opportunities and achievements in coastal aquaculture development.
Adverse effects	Enhance awareness and understanding of the potential adverse environmental effects of coastal aquaculture. Address both the biophysical and socio-economic aspects of environmental interactions associated with coastal aquaculture activities.
	Distinguish between the species cultured, the farming methods applied and the prevailing ecological characteristics of the aquaculture site. Encourage research on ecological interactions of coastal tropical aquaculture.
	Emphasize the risks of self-pollution and other negative feed-back effects. In particular, address the self-pollution risks of increasing aggregation of aquafarms in coastal embayments.
	Consider aquaculture as one of many activities in coastal areas. Multiple resource use in coastal areas in many cases results in serious pollution of coastal waters. Highlight possible threats to aquaculture due to increasing pollution in coastal areas.
	Address potential negative social implications of aquaculture and other developments, in particular human health risks, resource use conflicts and possible marginalization of low-income groups.
Factors	Determine the factors affecting environmental compatibility of coastal aquaculture in your project or country. Specify causes of environmental mismanagement and constraints to sustainable development of coastal aquaculture.

BOX 3 ACTION REQUIRED TO PROPERLY ASSESS ENVIRONMENTAL HAZARDS AND IMPACTS OF COASTAL AQUACULTURE

	Assess the capacity of the coastal ecosystem to sustain aquaculture development with minimal ecological change.
Pollution assessment/monitoring methods	Promote understanding of the environmental capacity concept. Encourage application of modern scientific methodologies for the assessment of coastal pollution such as the hazard assessment approach and adequate monitoring schemes.
	Apply, where possible, pollution assessment methods specific to aquaculture. Ensure appropriate use of these methods, based on proper understanding of their applicability and limitations. Encourage further development of assessment methods suitable to aquaculture practices and ecological conditions in tropical environments.
	Integrate aquaculture-specific monitoring schemes into existing coastal water pollution assessment activities. Select appropriate monitoring parameters and suitable sampling stations.
	Employ remote sensing techniques and geographical information systems (GIS) to assess large-scale spatial and temporal environmental changes due to aquaculture and other developments in coastal areas.
Implementation of EIA	Enhance awareness on advantages and limitations associated with the implementation of environmental impact assessment (EIA) procedures.
	Consider that assessment studies on the social and economic impact of development activities may be carried out separately or as an integral part of an EIA. Both types of impact assessments are essential when formulating coastal aquaculture programmes and projects.
	Select or adapt an appropriate EIA sequence according to prevalent environmental and development requirements and according to the availability of information and implementation capacities.
	Apply the EIA process to all major aquaculture development proposals. Provide information to applicants/developers on options for mitigatory and adaptive measures to be included in project proposals.
	Incorporate EIA into integrated coastal area management strategies.

BOX 4 ACTION REQUIRED TO IMPROVE ENVIRONMENTAL MANAGEMENT OF COASTAL AQUACULTURE DEVELOPMENT

	Select/implement environmental management options to suit specific requirements for environmentally-acceptable development of aquaculture and other activities in coastal areas.
Environmental protection	Improve/develop, where required, planning and management processes for protection of coastal environments. Formulate appropriate environmental protection policies.
Integrated coastal area management (ICAM)	Participate in the formulation (or improvement) and implementation of integrated coastal area management (ICAM) plans. Provide aquaculture-specific data for the information base required for ICAM. State goals and set priorities for coastal aquaculture development. Identify existing and potential coastal resource use conflicts between aquafarmers and other coastal resource users.
	Participate in zoning activities leading to the designation of coastal resources and space. Indicate coastal areas appropriate or desired for aquaculture development possibly based on aquaculture-specific site selection surveys.
	Encourage broad participation in development and implementation of coastal programmes and coastal area management. Aquafarmers, artisanal and other resource users, the scientific community, and non-governmental organizations should participate or be consulted, as appropriate, in ICAM activities, along with representatives of key government bureaux who have a stake in coastal management.
	Communicate frequently with other coastal resource planners and managers, stakeholders, scientists and policy-makers. Use conflict resolution techniques such as facilitated policy dialogues and mediated negotiation. Contribute to the establishment of an institutionalized coordination office or cooperation network.
	Help ensure long-term funding for ICAM, through durable commitment of those involved in aquaculture and their enforcement of aquaculture-specific regulations adopted.
Environmental legislation	Promote formulation of flexible and specific legislation to support aquaculture development.
	Environmental regulations must ensure accessibility and environmental protection of areas and resources required for coastal aquaculture development, and be formulated with due account of the variety of aquaculture practices and diversity of environments.
	Help formulate constructive environmental regulations for coastal aquaculture, where necessary, such as requirements for EIA, waste discharge limits and waste treatment specifications. Apply incentives and deterrents to reduce existing environmental degradation from aquaculture activities.
	Adopt and apply the EIFAC/ICES codes of practice on introductions and transfers of marine and freshwater organisms. Movement of species from and to aquaculture sites should be controlled through inspection and certification.
	Coastal aquaculture products should conform with safety standards for seafood before they are offered for human consumption. Establish quality control for aquaculture products. Control use of aquaculture chemicals such as antibiotics and pesticides.
Planning and management of coastal aquaculture development	Formulate/improve coastal aquaculture development and management plans.
	Strengthen sectoral capacities for adequate coordination of coastal aquaculture development efforts. Help ensure continuous and well-targeted support to coastal aquaculture development.
	Co-operate with national development planners to ensure proper integration of coastal aquaculture development objectives and plans into national economic and agricultural development programmes.
	Emphasis should be given to compatibility of policies and plans aiming at the development of aquaculture and other sectors as well as environmental protection.

BOX 4 CONTINUED

Environmental farm management	Promote environmental management at farm or project level. Consult with aquafarmers on specific environmental problems and mitigatory measures adopted. Provide opportunities for exchange of related experiences. Provide information and training to aquafarmers on options for improved environmental farm management.
	Help to improve current aquaculture practices in terms of adequate site selection, efficiency in farm operation and maintenance, and continuous monitoring of biological and hygienic conditions on the farm. Avoid over-stocking.
	Formulate coastal aquaculture projects which are environmentally acceptable.
Use of mangrove wetland	Discourage, where possible, the use of pristine mangrove wetland for aquaculture. Provide instructions governing the use of mangrove wetlands.
Use of feeds and fertilizers	Improve on-farm feed management practices. Improve fertilization and feeding strategies. Avoid over-use of fertilizers and feeds.
	Encourage adoption of feeding regimes adjusted to specific feeding habits and behaviour of the species cultured with due consideration of water quality and water movements in the farming unit. Monitoring of feed application and, where possible, feeding response of cultured stock is essential.
	Continue research on pond metabolism. Encourage development of diets and feeding methods adapted to semi-intensive farming systems in developing countries.
	Continue efforts to improve physical and nutritional properties of manufactured feeds for use in both warmwater and coldwater aquaculture. Emphasis should be given to applied research on dietary nutrient requirements of warmwater fish and shrimp species.
Waste management	Encourage the development of low-cost waste treatment technology for use in intensive land-based coastal aquaculture in developing countries.
	Promote integrated polyculture practices to reduce waste loadings.
	Explore ecological and economic feasibility of site rotation.
Chemical usage	Avoid usage of hazardous chemicals. Emphasize measures to prevent water-quality deterioration, disease outbreaks and pests. Detailed on-farm record-keeping on chemical usage is essential.
	Discourage prophylactic use of antibiotics. Reduce environmental risks through minimal and alternating application of drugs.
	Establish, where needed, aquaculture health management services to cover requirements for quarantine, diagnosis, treatment, monitoring and product quality control.
	Control market availability of potentially hazardous chemicals through registration and licensing. Aquafarmers must be provided with comprehensive information on environmental risks and appropriate use of chemicals.
Contamination of aquaculture products	Promote further development of economically viable methods for depuration/sanitation of contaminated shellfish products. Monitor contaminant levels in shellfish grown in areas subject to pollution and blooms of toxic algae.
	Prepare contingency plans for aquaculture areas threatened by events of harmful algal blooms, and advise aquafarmers on possible countermeasures to reduce risks of damage to cultured stock.
	Promote aquaculture production in unpolluted waters and low risk areas. Increase public awareness of the safety aspects of consuming seafood. Apply, where unavoidable, temporary bans on harvesting or marketing of contaminated shellfish.

RURAL AQUACULTURE FROM MYTH TO REALITY

Manuel Martinez-Espinosa
Fishery Resources Officer (Aquaculture)
Inland Water Resources and Aquaculture Service

The development of rural aquaculture has long received the enthusiastic attention of Government decision-makers, planners and technicians; yet in recent years some development Agencies are giving the subject an increasingly lower priority. How can such a drastic change in the concept of the activity have occurred? The ready reply is: Too much has been put in and too little has been obtained; results are much below expectations.

In fact, the rapid expansion of "industrial" aquaculture (shrimps, salmons, etc.) has shifted and almost eclipsed the interest in rural aquaculture. Worldwide, a quick glance at the specialized magazines clearly reveals an overwhelming number of symposia, meetings, workshops, fairs addressed to high technology and high yield aquaculture. Nevertheless, this is to be expected, given that aquaculture has become an important food production activity which must respond to market regulations.

What happened to the other type of aquaculture, that addressed to small farmers (extensive aquaculture) or medium farmers (extensive and/or semi-intensive), that known as rural aquaculture? [1]

Is it worthwhile that governments and development agencies keep utilizing resources to develop rural aquaculture? The obvious answer is **yes**, for two reasons. First, the rural sector still needs it. Second, it has been proved that there are different ways of operating more effectively. Aquaculture still offers a useful contribution to resolving the alimentary problems and to upgrading the quality of life of rural people, but **the approach applied so far to development projects must be changed.**

No single answer can be given to the questions above. Regions such as Africa and Latin America (where rural aquaculture development has been more problematic) are not uniform from the geographical, social or cultural point of view, nor is the technology applied in so many different countries and conditions. We can try, however, to put in order the main issues normally discussed when treating this matter and discover the existing relationships among them.

Summarizing Harrison (1991) [2] on the matter: On one side we have the beneficiaries who are unwilling to adopt the technology (**technology transfer/ motivation**) and on the other the governments who have neither the resources nor institutional strength to maintain what the development agencies have initiated (**sustainability**). In between there are the technical, biological, economic and environmental problems.

Historically, the problems described above were dealt with as follows: at the beginning the aquatic organisms were studied, then the interest extended to such fields as engineering and economy. Later, the recipient of the technology, man, and his social and cultural reality, were included in the analysis. In recent years increasing importance has been given to the study of the role played by promoters of development: governmental institutions and external aid agencies. At present, on one hand the environmental issue is receiving increasing attention, and on the other the need to study the relationship between the aquatic organisms, the beneficiaries of technology and the promoters is becoming more evident.

Although governments have different reasons for developing rural aquaculture, the purpose to help certain social sectors with alimentary and economic problems prevails. A common error made by planners (Governments, developing agencies, Non Governmental Organizations) has been the identification of the people in need and the formulation of an aquaculture project to help them. This is not enough. A

proper diagnostic might recommend to limit the project's range of action to a sub-group or community complying with the minimum requirements for a project to be successful.

The enthusiastic promoters should accept that rural aquaculture is no panacea for solving the problems of rural social emargination. Sometimes it is more convenient to utilize elsewhere the resources available to a project to assist a certain community. That does not necessarily imply other agriculture or husbandry activities. It might be more advisable (and this is the view of farmers and promoters) to invest these resources in some off-farm venture. It has been proved that it is an error to focus the attention on the **farm** economy ignoring the **household** economy which includes, besides farm production, off-farm employment, non-farm production, and petty trading.

Recent contributions in this field throw light on the subject. The ALCOM [3] project has carried out in Zambia a fish farming survey with some surprising results. Even with very low productivity (less than 500 kg/ha/year), underemployed farmers with unutilized land from economically depressed areas do not abandon the activity. The marginal effort made by the farmer has in fact a value near to zero, while the fish production is a very important income for the average economic level of the zone. In another survey made by the same consultant[4] in Paraguay, the off-farm employee condition was identified as the major factor for the adoption or desertion of the activity. The farmer engages or continues in fish culture if the benefits are superior to those he can obtain through off-farm employment. This has been confirmed in interviews with poor communities in the East of India.

The FAO Investment Centre [5] distinguishes between production-oriented and poverty -oriented projects. It is obvious that they both "produce", but differentiation based mainly on the typification of the various target-groups (diagnostic) has specific consequences in the strategy applied to the respective types of projects. Even within the latter group, the diagnostic could reveal the existence of very poor communities or households unable to respond to any opportunities a project might provide. Maybe additional resources required to make possible their integration could be used more effectively in other types of projects.

Other **less visible** factors could explain the failure of many projects. Much has been said on the farmer's rationality and the reasons he has to engage or continue the activity even though the promoting development agency has already retired. More simply the beneficiary does not desert if his expectations are fulfilled. Some projects claim in their final report that expectations were accomplished, without making an appraisal of the scenario "without the project", when fish culturists will have to face problems (invisible at the moment) originating from completion of certain cycles such as pond reconstruction or renovation of fish stocks.

Most studies carried out so far on the subject share the opinion that problems arise from the first phase of project formulation, the **identification**. The proposed solution is to make a diagnostic defining so-called convergency areas where interests of development promoters (Governments and International Agencies) coincide with those of potential beneficiaries. Practical difficulties in making a good diagnostic are many. Multiple attempts to develop valid methodologies have been made trying to avoid both the extremes of "scientific or social tourism" or "full immersion". Nowadays **rapid rural appraisal** (RRA) methods are beginning to give promising results when applied to aquaculture projects with the intent of minimizing erroneous interpretations frequently due to time limitations.

It is also found in the project formulation phase that many problems related to **motivation** and **sustainability** (the two pillars of rural aquaculture development) derive from the **assumptions** (risks) made. When doing so several aspects are pondered:

land tenure, legislation, market imperfections, the real capacity of Government to implement plans and the degree of motivation communities may have to adopt the activity. Experience has proved that most of these assumptions are very often unrealistic or based on over-optimistic appraisals, and therefore they are not accomplished irreparably thus affecting project results.

These and other equally important lessons are beginning to form a conceptual framework as a guide for the development of the sector. Specific features of countries, zones and communities hinder the use of a recipe or instruction manual suitable to every case. Some programmes such as ALCOM in southern Africa, formulated on the basis of these experiences, are producing important contributions for the implementation of this new concept of rural aquaculture development in different countries and circumstances (see article by S.R. Madhu on this subject in this issue). The International Center for Living Aquatic Resources Management (ICLARM) and the German Agency for Technical Cooperation (GTZ), have made important contributions to the field of small-scale integrated agriculture-aquaculture systems [6]. Other projects such as that on privatization of fingerling production in Madagascar, and another on extension for development of rural aquaculture in Zimbabwe, both executed by FAO, have the imprint of this new perception of the problem. It is to be expected that this tendency will go far in dispelling the myth of rural aquaculture.

1. The term **rural aquaculture** is being revised due to valid objections about the convenience of its use. Alternative terms which have been proposed such as **extensive aquaculture or small-scale semi-intensive aquaculture**, are also questionable from other points of view not discussed here because they are beyond the scope of this article. The classic term of rural aquaculture used here is based on the traditional meaning rather than the etymological origin.

2. Harrison, Elizabeth. 1991. Aquaculture in Africa: Socio-economic dimensions. In: Social and Cultural Barriers to the Development of Aquaculture in Africa, Phase I. Project ODA-A02.

3. ALCOM (Aquaculture for Local Community Development Programme). Executed by FAO and funded by Sweden (SIDA), focuses its activities on countries of southern Africa.

4. Wijkstrom, Ulf. 1991. How Fish Culture can Stimulate Economic Growth: Conclusions from Fish Farming Surveys in Zambia. FAO-ALCOM. Report No. 9.
Wijkstrom, Ulf. 1992. Una perspectiva económica de la piscicultura de tilapia en Paraguay. Proyecto TCP/PAR/0051. Informe interno.

5. FAO Investment Centre. 1992. Sociological analysis in agricultural investment project design. FAO Investment Centre No.9.

6. ICLARM and GTZ. 1991. The context of small-integrated agriculture-aquaculture systems in Africa: a case study of Malawi. ICLARM Stud. Rev. 18, 302 p.

FAO NEWS ITEMS

To enhance coastal aquaculture development and research capabilities in the **Democratic People's Republic of Korea,** technical assistance including training of research staff and physical facilities was provided to the existing National Shallow Sea Farming Research Station of Kosong through a UNDP/FAO project. The project has now terminated and the station is equiped with an operational hatchery for producing/rearing of spat of abalone and other species of shellfish for stocking coastal waters, and a laboratory to conduct seafarming research. The Network of Aquaculture Centres in Asia (NACA) has also carried out a regional abalone training course at this newly upgraded research station.

[FAO Fisheries Department, Rome (DRK/86/005)]

The **Democratic People's Republic of Korea** has an estimated 60 000 ha of inland waters available for intensified aquaculture and aquaculture-based fisheries. Development and management of these existing open waterbodies is of priority in the country. To assist the Government in the realization of these objectives, institutional strengthening assistance was provided through a UNDP/FAO project to upgrade the research capability of staff and research facilities of the existing Freshwater Aquaculture Institute located in Sungho. The project has established a soil/water quality analysis laboratory to undertake hydrobiological investigations; a nutrition and feed formulation laboratory for finfish and shellfish seed and brood stock; a fish disease laboratory to conduct diagnostic studies and a breeding/genetics laboratory to undertake breeding and hybridization experiments.

[FAO Fisheries Department, Rome (DRK/88/002)]

One of the major constraints in the development of fish culture in **Viet Nam** is the acute shortage of fingerling supply and the lack of good quality hormones required for induced spawning of broodstock. To upgrade the capacity of technical staff and the standards of the physical facilities of the existing workshop of the National Aquaculture Service Company to the level necessary to produce hormones (HCG and LHRH), a three-year UNDP/FAO project (VIE/88/005) was launched in October 1990 to address the problem of hormone production for induced fish breeding. The implementation of the project is presently proceeding as scheduled.

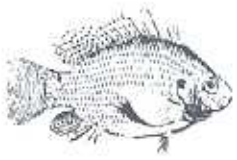
[FAO Fisheries Department, Rome (VIE/88/005)]

The Fish Farming Centre (FFC) in Jeddah, **Saudi Arabia**, established in 1982, is staffed by the Saudi Ministry of Aquaculture and Water and the FAO, and is concerned with fish and shrimp culture. FFC conducts research and development and provides training and extension services. Maintaining a comprehensive reference library, FFC provides information in Arabic and English on its own activities, together with literature and equipment guides. Its formal training courses include pathology, aquaculture engineering, feed and live food preparation, shrimp hatchery operation, and cage construction. In its first decade the FFC has concentrated on developing techniques for rearing tilapia in seawater and for shrimp culture. Some 230 g market size tilapia have been produced in small cages at 42 ppt after 20 days of old acclimation from freshwater. Penaeus monodon reach an average 20 g at 0.46 kg/m2 in 140 days in 42 ppt seawater. A similar biomass of 15-20 g shrimp has been reached in 140-160 days with the local species, P. indicus. FFC is now working on the commercialization of its research findings that the polyculture of tiger shrimp and rabbitfish (S. rivulatus) enhances the growth and survival rate of both species.

[FFC, Saudi Arabia (UTFN/SAU/010/SAU)]

FAO-supported on-farm research studies in **Mexico** during 1990-91 showed no difference in the growth and survival of cage-reared white shrimp (Penaeus vannamei) when fed a variety of high quality compound pelleted shrimp feeds or no external diet. The 81-day feeding trial was conducted using juvenile shrimp (ca. 1.69 g average initial body weight) stocked at a density of 7 animals/m2 within triplicate 1.5x1x1.2 m experimental cages (1.5 m2 cage bottom area with animal access to bottom sediment) located within a 11.5 ha semi-intensive commercial shrimp pond in Chiapas, Mexico. With the exception of the control group (receiving no external artificial diet input) the shrimp were fed one of eight different diets, including two commercial shrimp feeds and six in-house produced pellets containing dietary protein levels ranging from 15 to 45% with or without dietary vitamin/mineral fortification. The average final body weight of shrimp at the end of the culture trial for all treatments, including the control, ranged from 11.855 to 12.685 g. It was also interesting to note that the growth of the experimental cage-reared shrimp was not very different from that of shrimp cultured in the pond in which the cages were sited; pond shrimp were fed a 25% protein commercial shrimp ration and grew from 1.1 to 13.4 g after 85 days at a density of 8.6 animals/m2. For further information on the study contact Dr Carlos A. Martinez Palacios, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de Mexico, Mazatlán 82240, Mexico [Fax: (52)69-826133].

[FAO Fisheries Department, Rome]



The FAO, in collaboration with the **Network of Aquaculture Centres in Asia** (NACA), is currently supporting with TCP funds a regional study on environmental assessment and management of aquaculture development in the Asia-Pacific Region. At present, appointed National Environment Coordinators of 17 countries participating in the regional study are assessing the environmental problems affecting aquaculture development in their countries as well as problems created by aquaculture practices on the surrounding environment. At a preparatory workshop, held in Bangkok in September 1992, it was agreed by the National Environment Coordinators and the TCP project team that each country would prepare detailed case studies on priority species groups and culture systems. The TCP project team, consisting of a socio-economist, an environmental management specialist and a legal expert, is to analyse and summarize the findings of the country studies and, subsequently, to prepare a synthesis document containing recommendations for a strategic programme indicating actions/activities or projects to solve the problems identified in the areas of research, planning, legislation and extension/information. This synthesis document will be discussed and approved during a final workshop planned for the second half of next year. It will be attended by the National Environment Coordinators and sectoral aquaculture development planners representing the Government administration from each participating country.

[FAO Fisheries Department, Rome (TCP/RAS/2253)]

The culture and partial processing of the red seaweed Eucheuma in the **Philippines** is already well established. To diversify seaweed production and improve the productivity of coastal communities, a **UNDP/FAO** project has begun which aims to assist in the development of Gracilaria culture, processing and coastal resources management at the community level. To date, two of the five demonstration sites proposed for socio-economic studies and Gracilaria farming trials in the Sorsogon area (Baracay and Barcelona) have been identified and operations have started. In-service training of project technical staff has also been implemented. Previous biological and socio-economic studies on seaweeds carried out by the Bureau of Fisheries and Aquatic Resources (BFAR) and the University of the Philippines (UP) form the baseline for the project's activities.

[FAO Fisheries Department, Rome (PHI/89/004)]

Two new FAO Technical Cooperation Programme projects were signed in September 1992 to support fish culture development in **Cuba**. The first one will assist the Cuban Government to selecting and improving the Oreochromis aureus lines available in the country, and in introducing new species of tilapias to be employed in semi-intensive or intensive culture. This project will also look into the selection of new species and varieties for culture in brackishwater environments. The project will include technical assistance and training of Cuban personnel in the characterization of strains using electrophoretic analysis.

The second project will assist in the development of tilapia culture in pens in the coastal lagoons of the southern part of the island. Oreochromis aureus has already entered the coastal lagoons. The introduction of pen culture of a suitable variety of tilapia may allow a better use of these coastal ecosystems but the viability of this practice has still to be demonstrated. The project will test new strains from a biotechnical as well as from an economic point of view. Since it will be necessary to produce the seed of these new strains or species, this project will be linked to that mentioned above which will produce seed at the Pavon station and send it for acclimatation to a coastal shrimp culture facility prior to confinement in pens.

The expected duration of these projects will be one year.

[FAO, Fisheries Department, Rome (TCP/CUB/2253, TCP//CUB/2252)]

The UNDP-funded "Support for Rural Aquaculture Extension" project in **Zimbabwe** has been supporting the activities of AGRITEX in rural aquaculture and in small waterbodies in order to promote their management taking also into account the possibilities of stock enhancement. This project, which works in parallel with the regional project ALCOM in Zimbabwe will end in June 1993. The last half- year report received highlights the problems for the fisheries and especially for the aquaculture sector posed by the very severe drought which is now devastating southern African countries. The report indicates that fisheries in small waterbodies have proved to be more resilient than livestock and crops in some of the worst hit areas where the dams remain almost the only food-producing activity.

In this period the project has continued its training activities and the preparation of training materials for AGRITEX staff. While rural aquaculture suffered most as the drought became more and more severe, the project has made considerable progress in the area of small waterbodies exploitation with activities in 25 dams in Murehwa, UMP, Mutoko, Mudzi, Mount Darwin, Chinhoyi, Mwenezi and Chibi districts. Extensive consultation with interested groups have been held and AGRITEX has now prepared new methodologies to improve licensing, recording of catches, monitoring and advising the rural groups. A study has been launched with ALCOM to evaluate techniques for fisheries surveys in the dams. The rod and line survey continued in spite of the drought and the first analysis indicates high yields of over 150 kg/ha year just from simple rod fishing with some dams showing higher figures and probably becoming the major source of fish protein in the area. The project is also assisting AGRITEX in the establishment of a Geographical Information System which will be linked to a future AGRITEX project funded by UNDP. Proposals have been made to deal with the drought-related problems especially for the restocking of the dams which have dried out. This may also provide an opportunity for a more controlled stocking of some dams in the light of the experience gained in the last years by this project and ALCOM.

[Fisheries Department, Rome (ZIM/88/021)]

An FAO Technical Cooperation Programme feasibility study has concluded that the feasibility of freshwater aquaculture in **Barbados** should be tested by pilot activities on tilapia and freshwater prawn culture and has prepared a draft project proposal for the purpose. The cultivation of sea moss (Gracilaria sp.), currently imported as the raw material for the preparation of a local drink, is also a possible development to benefit fishing communities during the off-season.

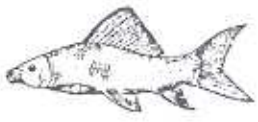
[FAO Fisheries Department, Rome (TCP/BAR/9151)]

In the first issue of the FAO Aquaculture Newsletter the start of the activities of the Italian-funded AQUILA II project was announced. Last July the project moved to new headquarters at the Directorate of Aquaculture of the Fisheries Secretariat in Mexico City. The activities of these first months of operation of the project include:

- a rapid analysis of the status of aquaculture in 12 countries (Bahamas, Belize, Barbados, Commonwealth of Dominica, Dominican Republic, Grenada, Guyana, Jamaica, Saint Lucia, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago) which will receive assistance from AQUILA II in this second phase. The report of this mission is being now finalized.
- the formulation of a proposal for a subregional project for the Caribbean to be submitted by CARICOM to EEC and other donors;
- a revision of the aquaculture sector analysis for the 19 Latin American countries which had prepared a similar document in the first phase of AQUILA (discussed at the planning meeting in Caracas in 1989). This revision has been combined with the analysis of short and medium term research needs for aquaculture which is also seen as a contribution of the project to the follow-up of the SIFR exercise (see note on FAO contribution to the SIFR follow-up) and which could assist the countries and the donors in improving the channelling of funds for aquaculture research in Latin America.
- the publication of six documents which had been left pending by the sudden termination of the first phase of the project.
- the organization of a study on nutrition and feeds in aquaculture in Latin America coordinated by Dr Carlos Martinez Palacios, which incorporates experts from Brazil, Chile, Cuba, Ecuador, Jamaica, Mexico, Panama and Venezuela and which should result in the formulation of specific project proposals on this subject for the region. The study has been initiated with the preparation of national reports.
- the holding of a workshop on aquaculture in lakes and reservoirs to define the strategy of AQUILA II in support of the area, the report of which is being finalized.
- the Third Course on Planning and Management in Aquaculture, of seven weeks'duration, held at the University Simon Bolivar of Caracas, Venezuela. The two previous courses where organized by AQUILA I in Mexico and Costa Rica, and
- a workshop held in Mexico City to review the problems linked to shrimp diseases in Latin America and to devise a strategy for the project and the region on how to deal with this matter. The deliberations of the workshop will help prepare a proposal for submission to the Life Sciences and Technology for Development programme of the Commission of European Committees (CEC) for collaboration in research between Latin American and European institutions.

The next issue of the FAN will include a more elaborated article on all the activities indicated above, prepared by the staff of AQUILA II.

[FAO, Fisheries Department, Rome GCP/RLA/102/ITA)]



Environmental management of aquaculture development is also being promoted in **Cyprus** through an FAO Technical Cooperation Programme project which aims at (i) enhanced national expertise on economically and environmentally acceptable coastal aquaculture technology, (ii) appraisal of environmental feasibility and development potentials for aquaculture in Cyprus and (iii) formulation of a legal framework for regulatory and administrative measures in support of sustainable aquaculture development. The TCP environmental management consultants from the Institute of Aquaculture, Stirling, Scotland, assessed nutrient enrichment in certain coastal areas where aquaculture waste loadings were blamed by the growing tourism industry to be the cause for increased growth of a seaweed (Cladophora sp.). It could be proved that nutrient enrichment in groundwaters and coastal waters was due to increased input of agricultural fertilizers. An environmental management framework for sustainable aquaculture both in coastal and watershed areas was suggested. The FAO Legal Office continues to assist the Government of Cyprus in the preparation of an appropriate formal framework for environmental legislation.

[FAO Fisheries Department, Rome (TCP/CYP/9512)]

The **Study on International Fisheries Research** (SIFR) was one of the results of the First Fisheries Development Donor Consultation held in 1986. Seventeen agencies joined in its financing. The aim was to produce a diagnosis of the fisheries and aquaculture sectors on which to base a plan for short- and medium-term development-oriented research to be considered for funding in a coordinated way by the donor community. The teams in charge of the exercise produced a draft report which was examined at the Second Consultation of Fisheries Donors which took place in 1991. The agencies indicated that further work was required on the indicative plan which was not sufficiently specific, and some of the participating agencies expressed the desire for a more direct participation of the recipient countries in determining the priorities for research. They also requested the six agencies of the Steering Committee (World Bank, UNDP, CEC, IDRC, NORAD and FAO) to prepare specific actions for the diffusion of the information about SIFR and for the improvement of the Indicative Action Plan.

In this respect FAO is starting several activities. In the field of aquaculture two exercises have been launched so far; one covering Latin America and the second Africa. Funds to include also Asia are being sought by FAO. The study for Latin America involves 19 countries and that of the African continent 5 countries bordering the Mediterranean and 15 countries of Africa South of the Sahara. The reports resulting from these exercises will be discussed towards mid 1993 with the countries concerned at meetings of the COPESCAL and CIFA Working Parties on Aquaculture and at a special meeting organized by the MEDRAP II project.

An expert consultation on the **Utilization and Conservation of Aquatic Genetic Resources** organized by the FAO was held in Grottaperfetta, Italy from 8 to 14 November 1992. The objectives of this consultation were to review existing information on fishery genetics as related to exploited aquatic population in order to provide FAO with guidelines and information on how to advise Member Nations on the utilization and conservation of their fishery genetic resources. The meeting was attended by about 40 international experts. Among the activities planned to reach the objectives of the consultation were the following:

- to view the literature on genetic resources of aquatic organisms, especially those species that are harvested or cultured,
- to identify needs for management of aquatic gene resources and identify areas where management bodies can direct policy or make recommendations,
- to evaluate existing management programmes and effectiveness of existing institutions and legal measures,
- to discuss need and potential mechanisms for an international network of concerned professionals.

A report of the consultation and background papers are to be published in the FAO Fisheries Technical Paper series in 1993.

[FAO Fisheries Department, Rome]

In **Burundi**, a five-year project funded by UNDP started last year with the objective of increasing animal protein availability at rural level. Efforts have focused on the assistance to already-existing Government agriculture extensionists and to 225 pilot fish culturists. Project personnel, jointly with US Peace Corps members, assist beneficiaries in the construction and maintenance of ponds (100-500 m2) with a compost crib where all organic wastes are deposited. Stock density is 1-2 per m2 of Tilapia nilotica. These fish culturists are an example for others in their respective area of influence. The project also aims to promote consumption of freshfish, as prevailing habits are for inclusion of fish as condiment in diets. An interesting relationship between site elevations and yields has been found. As a result, the culture of this fish above 1 800 -2 000 m of altitude has been discouraged.

[J.P. Marquet, Bujumbura (BDI/89/019)]

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