

ISSUE NO. 34

JUNE 1989

A PUBLICATION OF



For Fisheries Development

BAY OF BENGAL PROGRAMME

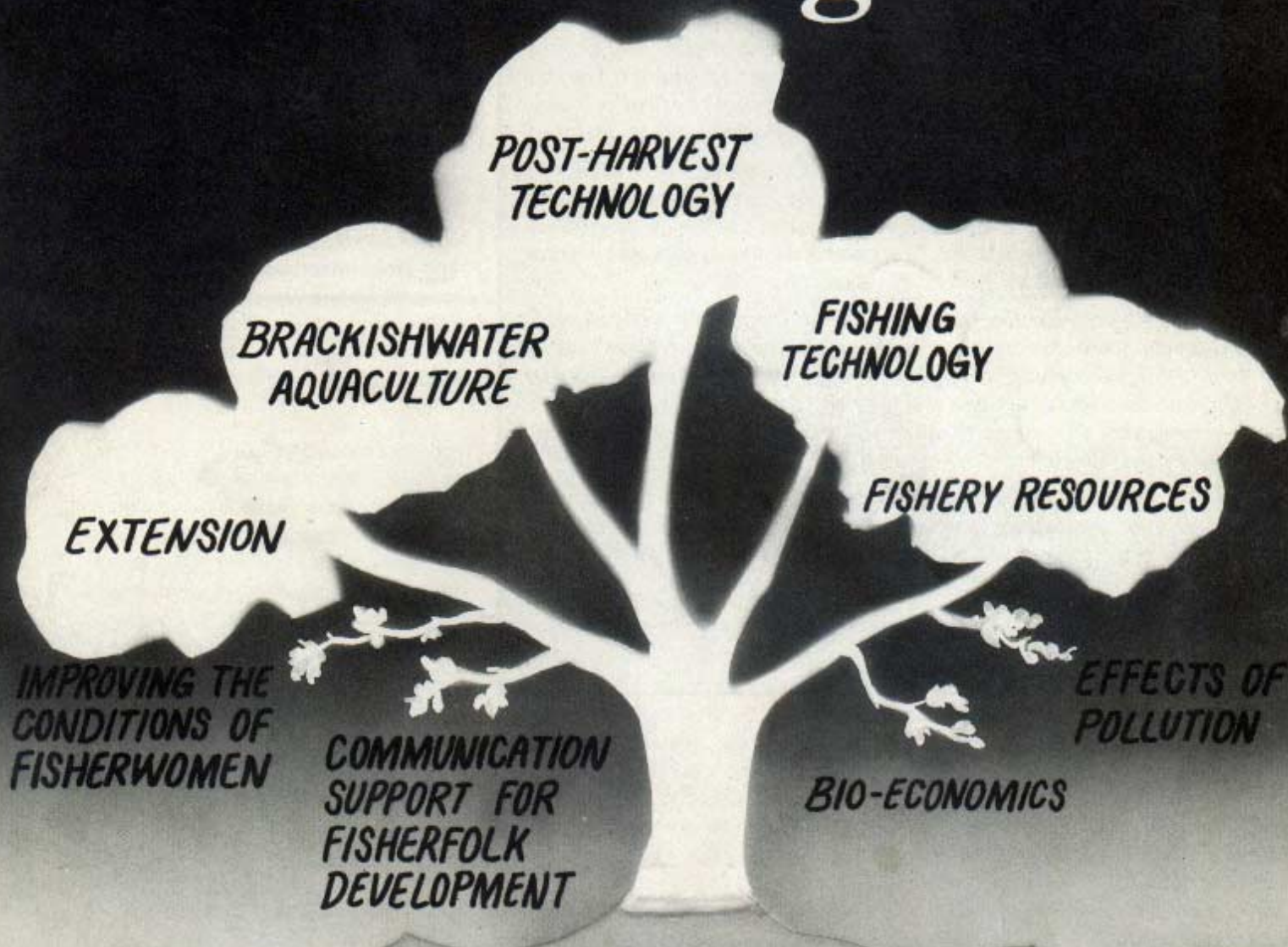
BAY OF BENGAL NEWS



Danida

AGFUND

BOBP's new challenges



BOBP's new challenges

When launched in 1979, the BOBP was primarily geared to help increase the production and productivity of small-scale capture fisheries. The Programme was conceived as early as 1974, and it became evident very early that many of the fishery resources of the region were being heavily exploited. Through the mechanism of BOBP's Advisory Committee, the Programme's efforts therefore were diverted to coastal aquaculture and people-oriented extension approaches concerned with women's activities, non-formal education, small-scale credit, etc. This trend is reinforced by a new regional BOBP project funded by the UN Population Fund (UNFPA).

In response to new needs and aspirations, the Programme is on the verge of taking up some significant new challenges. These relate to overall assessment of the bio-economics of selected fisheries; investigation into the harmful effects on fisheries of pollution and the deteriorating coastal environment; communication techniques to improve the dialogue between authorities, scientists and fisherfolk.

The new projects, and the new needs and aspirations which they address, indicate that sustainability of development and the active participation of fisherfolk in the process will be the main concerns of BOBP in the future.

Effects of Pollution on Fisheries in the Bay of Bengal

The sea is a bounteous provider — of food, of livelihood for thousands of fisherfolk, of foreign exchange through seafood exports, of countless resources known and unknown. Pollution of the marine environment imperils all these and more.

Chemicals, garbage and oil are the major known causes of marine pollution. Chemicals that pollute the sea include industrial effluents, untreated sewage, pesticides, fertilizers and wastes from refineries. Chemicals are a chronic source of pollution: So is garbage. Oil spills can damage boats and gear, clog nets, and taint fish and shrimp.

While there is evidence that pollution endangers fisheries, precise information is scanty, diffuse and hard to come by. The levels of pollution need to be known. Another problem is that investigations concerning marine pollution are scattered among a number of departments, institutions and agencies. Better co-ordinated planning and investigation will ensure more efficient use of funds, facilities and personnel, and yield better results.



The problem is recognized. Environmental activists from SAARC (South Asian Association for Regional Co-operation) countries who met January 1989 urged national institutions to generate data on the environment. They also called for a regional South Asian network, exchange of data on coastal pollution, and measures to save the mangrove eco-system.

It is in this context that a 24-month \$ 400,000 project under the BOBP umbrella has been formulated to investigate the effects of pollution on fisheries in the Bay of Bengal region. The project will be implemented through national and regional expertise. Likely activities

- Inventory of national agencies engaged in investigation and research on pollution : their facilities, personnel and experiences.
- Field investigations to identify coastal areas affected by pollution.
- The most important pollutants to be identified, and as far as possible quantified.
- Chemical and physical analysis to assess levels of pollution in various affected areas.
- Workshops to discuss, exchange and disseminate information.

The expected outcome of the project is a better qualitative and quantitative understanding of the nature of pollutants that menace fisheries and of their effects on the fishery. This is an essential first step toward concrete measures to combat and alleviate pollution.



Improving the Living Conditions of Fisherwomen and Their Families

The 1984 World Conference on Fisheries Management and Development urged better recognition and reward for the economic role of women in fishing communities. In response to this call, the FAO Population Programme fielded a mission to Asia. An outcome of this mission is a 4-year \$1 million project funded by the UNFPA (UN Fund for Population Activities), to improve the living conditions of fisherwomen and their families. It will be executed under the BOBP umbrella.

The project is based on the belief that fisherwomen with enhanced incomes, better access to health education and care, and better organization, would not only help fisherfolk communities to improve the quality of their lives but also further the cause of smaller families, an important developmental

consideration in the countries of the region.

At present, fisherwomen are a disadvantaged lot. Within their families, they have obligations, but very few privileges; duties, but very few rights. Their economic role is poorly recompensed, if at all. To make matters worse, they lack access to basic institutional credit facilities, and depend heavily on usurious money lenders. They lack knowledge and access to health care. And they often lack the organization to help them in moulding their social and economic destiny.

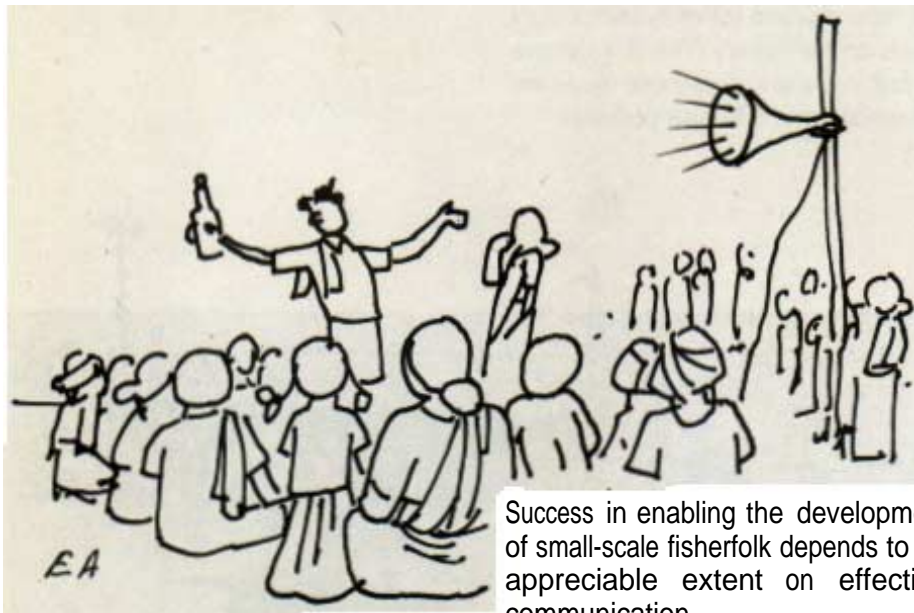
The proposed project will pursue a three-track strategy

- Encourage and enable women to organize themselves, so that they will be better able to address and resolve their social problems.

- Identify income-generating activities for women, ensure better access to credit and savings schemes, encourage entrepreneurial skills.
- Develop health education programmes for fisherwomen and strive for better access to health care.

As with most BOBP activities, the project will play a catalytic and consultative role. Its methodologies will be initially pilot-tested in about 10 villages in each of the several countries. They will be implemented by the fisheries administrations of the respective countries in co-operation with banks, NGOs and other government departments dealing with health, community development, etc. The project activities will be linked wherever possible with existing BOBP activities.

Communication Support for Fisherfolk Development



Success in enabling the development of small-scale fisherfolk depends to an appreciable extent on effective communication

- To listen to and learn from fisherfolk about their conditions, problems, needs and aspirations.

- To give fisherfolk access to ideas, information and technology which would help them to develop themselves.
- To enable fruitful dialogue and negotiation among fisherfolk; between fisherfolk and administrators/policy-makers; between fisherfolk and market forces; and between fisherfolk and the public — to discuss issues such as sustainable development, resource management, use rights, just prices etc.
- To give the public, particularly those dependent in some ways on fisherfolk, an understanding of the needs and concerns of fisherfolk.
- To give administrators and policy makers relevant information to help them in their tasks.

All this requires us to adapt communication media, both modern and traditional, to handle those larger and more complex issues concerning fisherfolk

Bio-economics of Small-Scale Fisheries

High fishing intensity, strong competition, poor incomes this sums up the grim scenario of small-scale fisheries in several areas of the Bay of Bengal. Incidents are more and more frequent of trawlers, purse-seiners and modern fishing boats raiding inshore waters, where they clash with traditional fishing craft.

It's in this context that BOBP has formulated a 3-year, \$1 million UNDP-funded project on bio-economics. Its eventual aim is to improve the catches and earnings of small-scale fisherfolk, and ensure sound management through better knowledge and understanding of the fishery resource, the economics of its capture and the socio-economics of the fisherfolk.

Under the project, case-studies will be taken up of significant problems or development opportunities in fisheries. Examples: Bio-economic assessment of the shrimp fisheries in several countries to reduce conflicts between small-scale and medium-scale fisheries and encourage management. Assessment of the clam fishery in the Malacca Straits;

Assessment of the purse-seine fisheries and their interaction with the existing gillnet and beach-seine fisheries. Investigation of the bio-economics and

the socio-economics of the set-bagnet fishery in the upper Bay of Bengal. Investigation of community uses of FADs (Fish Aggregating Devices). All of the project's work be carried out by national institutions in co-operation with fishermen at specific locations. The projects will first meet jointly with technical government representatives from all member-countries to discuss subject priorities, activity locations, executing mechanisms and institutions.

The projects main features are;

Introducing methodologies for bio-economic assessment and extending training in applying these methodologies.

Bio-economic and socio-economic assessments and approaches are becoming increasingly important for better understanding and management of fisheries. Such methodologies will be introduced, and counterpart personnel trained in their use, through selected case-studies. The training will cover, *inter alia*, the use of computer software. Project work will hopefully encourage wider application of these methodologies.

Introducing the technique of "people's participation" for data collection in fishing villages. This will facilitate accurate

stock assessment and sound management.

Says Dr. K. Sivasubramaniam, BOBP's Senior Fishery Biologist, "To assess the bio-economics of fisheries, as also to develop or manage fisheries, we need detailed data on catches by species, fishing effort, economics of the fisheries, fishing areas, seasonality and species composition. Such detailed data are just not available in most countries of the Bay of Bengal region, even at a macro-level. We intend securing the active co-operation and participation of fishermen at select locations in collecting and providing bio-economic data. We'll then analyse the data and discuss the findings with the fishermen. It's as important to communicate findings to the fisherfolk as it is to obtain data with their help. And a suitable mechanism for such communication has to be established. This will facilitate fisheries development and management."

Assessing whether the use of fish aggregating devices (FADs) can improve the productivity and the economics of small fishing units; and determining the possibilities of a community approach to fishing with FADs.

Certain pelagic species such as rainbow runners, dolphin fish, tunas, flying fish, deep-sea sharks and deep-sea demersals are under-utilized — perhaps

that involve the coming together of differing and divergent world views and perspectives. While quite some work has been done in developmental communications, particularly in the agrarian and health sectors, material is hard to come by in the fisheries sector. Further, comprehensive communication strategies to facilitate development have rarely been attempted, and may give us valuable lessons for the future, for fisheries and for other sectors.

The appropriate communications strategy should not only stimulate discussion, action and development but actually empower fisherfolk by giving them a voice.

BOBP has formulated a project to develop and pilot-test the efficacy of various types of communication media and methods, and out of the learning to propose a dynamic and knowledgeable communication policy to aid fisheries and fisherfolk development

and create the structures to convert such policy into sustainable programmes.

Sample activities would include

- Making journalists aware/familiar with small-scale fisheries/fisherfolk development issues/concerns;
- Evolving a translation service to provide features and backgrounders to the vernacular press using English feature inputs;
- Multilanguage fisheries/fisherfolk glossary development;
- Development and testing of media tools such as comic books, interactive video etc. for use in extension, development, resource management;
- Enabling inter-region, inter-country exchange amongst fisherfolk on common issues such as resource management, environmental protection and sustainable develop-

ment, in the interest of better learning and greater solidarity;

- Undertaking an inventory of available media material related to fisheries/fisherfolk management;
- Studies of indigenous knowledge and traditional media such as street theatre or *villupattu* to enable better understanding of fisherfolk;
- Consultations on the development of a communication policy and the structures necessary to implement them;
- Training of fisheries extension officers in communications and communication media.

Details of the project's workplan and approaches will be developed, once a donor is identified. It is intended 'that BOBP will play a coordinating and catalytic role and tap the talent in the region to undertake the studies, action research and pilot tests envisaged.

because they are not found in large shoals or concentrations, perhaps because the right fishing method was not deployed. Can FADs help concentrate these fish and improve catch rates and revenue? Bio-economic studies are necessary. Besides, the ownership and collective use of FADs has often posed ticklish problems. The project could investigate the possibilities of a collective community approach to the deployment and use of FADs.

Identifying un-utilized and under-utilized resources and determining whether these can be tapped by small-scale fisherfolk.

For fishing a particular resource, what's the relative performance of different fishing craft using the same fishing method? And what's the relative efficiency of different fishing methods deployed by similar craft? What do past resource surveys indicate about the status of the fishery resource?

Answers to such questions at selected locations in the Bay of Bengal region may yield clues about un-utilized and under-utilized resources. Bio-economic and socio-economic assessments may then reveal whether these resources can be tapped by small-scale fisherfolk.

The proposed bio-economics project is expected to yield the following benefits:

Better knowledge on the part of scientists, governments, and fisherfolk about

the status of selected resources and fisheries.

Sustained -incomes for fisherfolk, through the use of FADs, for example.

Better communication, between fishermen and scientists on the one hand, and fishermen and governments on the other.

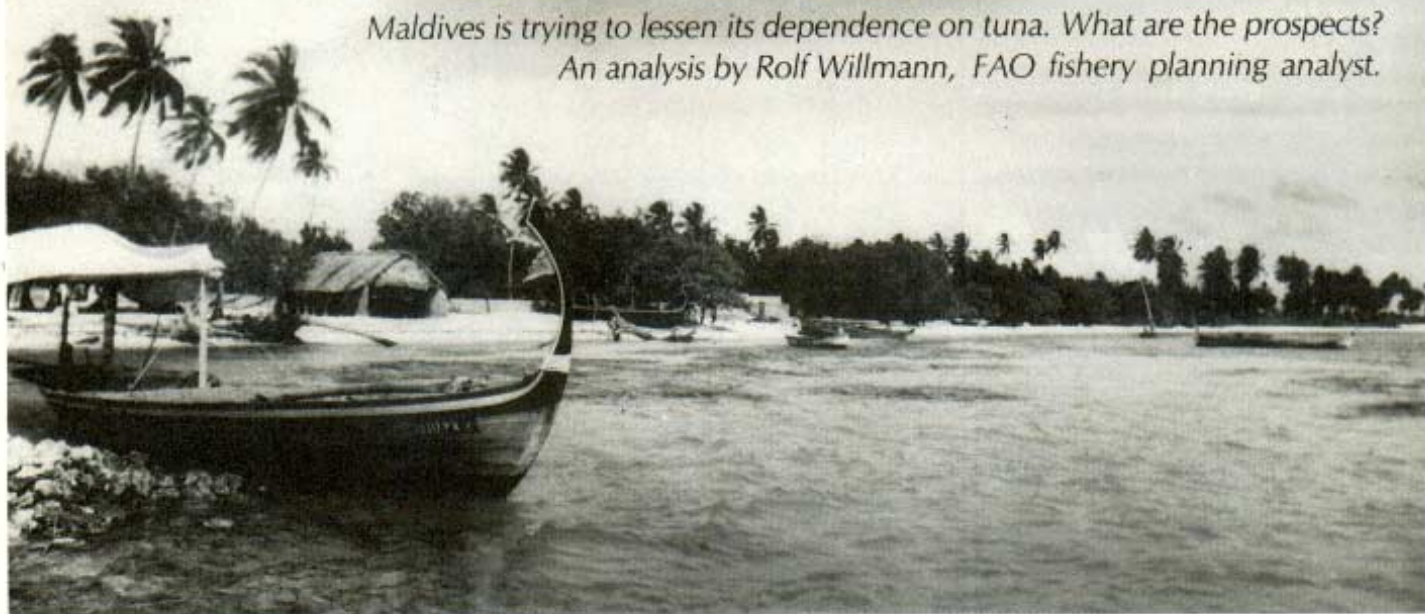
Better resource management through more systematic data collection.

Says BOBP Director Lars Engvall, "This project will strengthen governments' ability to deal with the most important fisheries management issues in the Bay of Bengal region, and strive to promote sustained benefits for fisherfolk from the available resources. Too little has been done on this subject: governments need to put in much more effort. The project's work must be seen as a very small beginning."



THERE IS MORE TO CATCH THAN TUNA

*Maldives is trying to lessen its dependence on tuna. What are the prospects?
An analysis by Rolf Willmann, FAO fishery planning analyst.*



Traditionally, Maldivian fisheries has been based almost exclusively on the catching and processing of tuna for local consumption and for export as Maldivian fish to Sri Lanka. The exploitation of other demersal and pelagic species is still very limited, in spite of potentially good markets in Asia, Europe or the Middle East for fishes such as snappers, barracuda, trevally, sail and seerfish or marlin.

In an attempt to broaden and diversify the tuna-and-tourism-based economy, the Government of the Maldives requested UNDP assistance to study the development potential of reef fisheries. The UNDP/FAO Reef Fish Research and Resources Survey Project commenced late 1986. This project, which is executed under BOBP's umbrella, focuses on assessing the abundance of reef fish resources in the country and on examining the suitability of various fishing gears to tap these resources (*Bay of Bengal News*, No. 25 and No. 29).

The project also aims at determining the economic feasibility of developing such a fishery. For this purpose, Mr. Rolf Willmann, FAO Fishery Planning Analyst, undertook a consultancy study in September 1988. This article summarizes his findings.

In 1987, species other than tuna contributed less than 10 per cent to the total

fish production of 57,000 tons. Most of this catch is either incidental or is caught when the weather is bad or skipjack is not available. Only a few fishermen at present aim at non-tuna species, because they yield low incomes and profits — lobsters and shark being perhaps the only exceptions. The low incomes are a result of low fish prices, which in turn are caused by small and poorly developed export markets.

Given a choice, Maldivians prefer skipjack and yellowfin tuna to all other fish. The belief is that reef fish give off an unpleasant smell and are cumbersome to cook. This attitude is, however, gradually changing, especially in the capital Male, where people are more exposed to the habits and preferences of tourists. For instance, Italian tourists have made the well-barbecued red snapper a popular dish. Their preference for this fish can be easily understood. They have to pay US \$12 for one kilogram of this fish back home in Milan! In Male it would cost only one US \$ (MRf 8.3).

With each tourist having at least one meal of fish per day — which is rarely tuna — tourism has created a small but significant market of the order of 900 tons of reef fish per year. To ensure a steady and reliable supply of fish, tourist resorts usually contract a crew

of fishermen inclusive of boat and gear. Unlike in other places, fishermen are paid on the basis of number of fish caught rather than by unit weight, with differential rates for large and small fish and premium prices of certain rare specimens such as marlin. Fish prices are fixed and negotiated for a season or year. The fisherman's remuneration includes free food and lodging and may leave him with a net monthly income of over Rf 1,000 (about US \$120).

At times, the contract fishermen do not catch enough to meet the needs of tourist resorts, in which case, they are served beef or chicken. Tourist islands in the vicinity of Male rely on the reef fish landings of a small fleet of vadhu dhonis and bokurras at the Male fresh fish market which also supplies the small amounts of reef fish consumed in Male itself. This fleet consists of no more than 20 craft, a number of them operated by part-time fishermen who supplement incomes from other sources including government jobs! Incomes achieved by this fleet are reported to be good because of the attractive prices paid by tourist resorts.

A reef fish fishery does exist in atolls other than Male. But tourism is less brisk outside Male, and producer prices are very low, ranging from Rf 0.5 to Rf 1 per kg (wet weight). In comparison, prices for skipjack range from

Rf 1.4 to Rf 1.95 and the catching efficiency/catch rate is also much higher.

At present, the only outlet for non-tuna catches in the outer atolls is the salted-dried fish market in Sri Lanka, where Maldivian products face competition from countries such as Pakistan and India. While Sri Lanka has greatly increased its imports of fish in recent years, its prices for salted-dried products are still not attractive enough for Maldivian exporters. Better prices prevail in the fresh/iced fish market, but on such imports Sri Lanka levies a duty of 60 per cent of the import price (cif). Still, with proper infrastructure facilities for fish collection and preservation, there is a distinct opportunity for Maldivians to profitably export iced and frozen fish to Sri Lanka. In general, prospects for strengthening the age-old fish trade between the two neighbouring countries are expected to increase because of the gap between demand for fish in Sri Lanka and local fish production.

Apart from Sri Lanka, a number of other countries in Asia offer rapidly growing markets for higher quality fishery products. Chief among them are Singapore, Hong Kong and Japan. These markets are, however, highly sophisticated in terms of required product forms, product quality and marketing strategies. Maldivian private industry would require considerable marketing support to tap these opportunities.

In conclusion, there are definite opportunities for diversification of the Maldivian fishing industry. Such diversification should start initially with smaller-scale operations through private entrepreneurs, and the right type of incentives and encouragement and marketing arrangements.

The main development constraint, which is unlikely to be overcome in the near or mid-term future, is the high demand for both unskilled and skilled labour in the Maldives. The present shortage of manpower imposes limits on the capacity of the Maldives for setting up and operating the necessary infrastructure and processing facilities and for efficiently discharging the organisational and managerial tasks necessary in a highly competitive international business environment.



Fishermen landing ashore at Male (above), and buyers at the Male fish market (below).



Squid Traps in Ranong province, Thailand

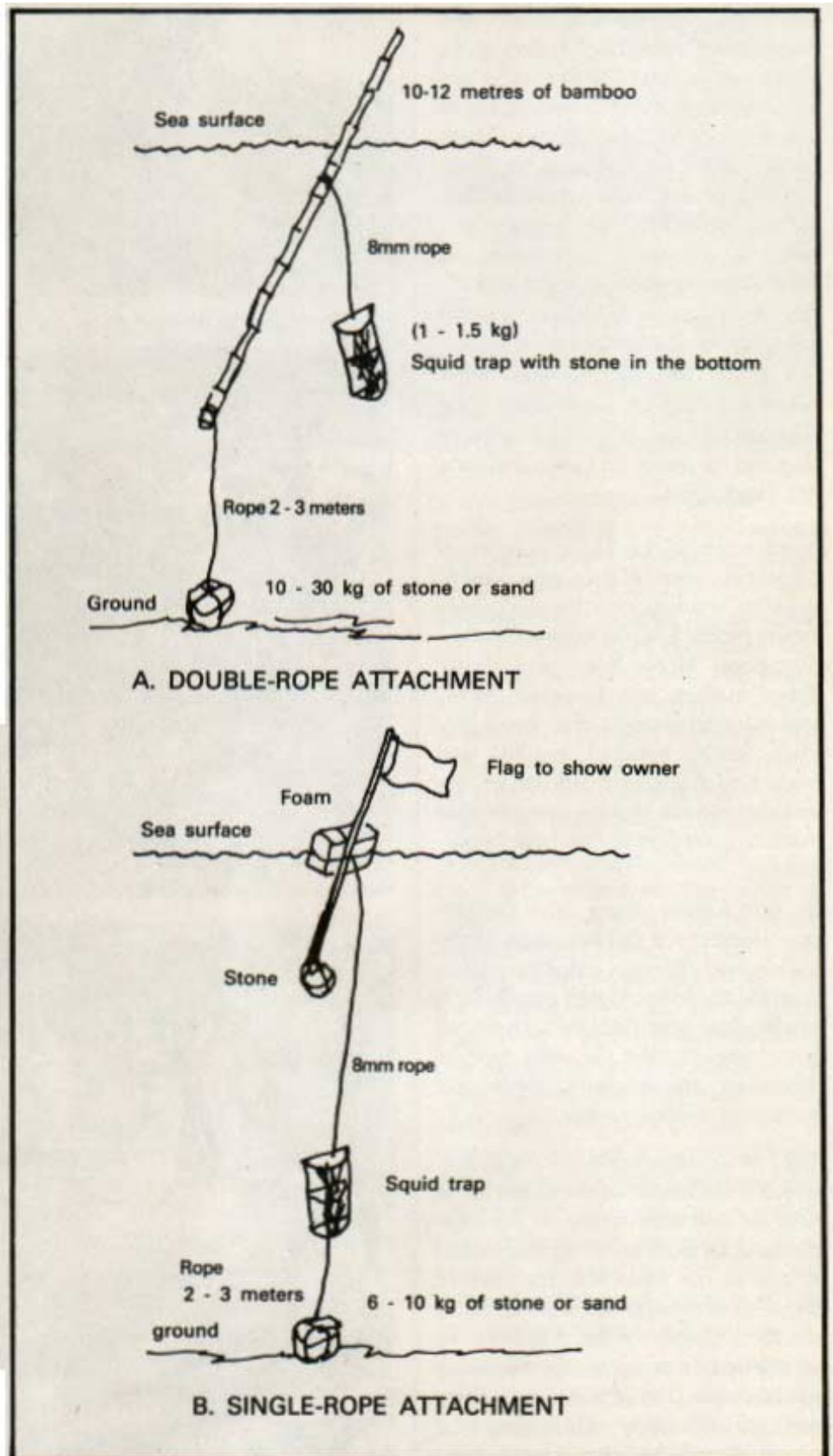
by Hanne Kristensen

Squid traps have for many years been a big success on the east coast of Southern Thailand. Therefore, BOBP's extension subproject in Ranong province in the West Coast of Thailand planned to introduce squid traps in the province. Team Leader Sanchai Tandavanitj discovered to his surprise that squid traps were already in use in the Ranong area — more than 8000 traps were being operated in Kapor district. Further investigation revealed, however, that only a few of the fishing craft employing traps belonged to the original fisherfolk of Ranong province; most others were operated by immigrants from the east coast, where squid catch during the last few years appears to have fallen sharply.

No training or extension was therefore needed to introduce the squid trap technique as such. The sub-project's emphasis has been on training the traditional residents of the area in the construction and proper use of the traps, and an organising supply of materials. It is hoped that the sub-project will enable small-scale fisherfolk of Ranong to tap the potential that the squid trap fishery offers.

Two types of traps are used. In one type, which has a single rope attachment, the trap is suspended 2-3 m above the sea bottom. In the other type, which has a double rope attachment, the trap is suspended from a bamboo stick and kept afloat at a higher level (See figure). How do the traps work? Squids and cuttle fish are lured in with natural squid eggs. For improving the efficacy of the traps, fishermen cover them with palm leaves, whose shadow is believed to help lure the squid and cuttle fish. The peak season for catching squids is from February to April.

In Kam Phum village of Kapor district, squid catching is almost a cottage industry. Members of the household, both men and women, construct the traps themselves at a cost much lower than the market price. But it is the men



The two types of squid traps used in Ranong province, Thailand: double-rope attachment (top) and single-rope attachment (above).

who engage in the actual capture of squids. They go out in crews of 2-4 depending on the size of the boats, and the number of traps used, to the waters around Kor Kam Yai and Kor Kam Noi islands. They sell the catch either at once in the Ranong harbour or in other harbours, wherever the market price is higher. A part of the squid is sun-dried and sold to a retailer. The squid trap operators of Kam Phum have been living in the area for about four years. They hail originally from Nakhon Si Thammarat, Songkhla or other cities on the east coast.

In two villages nearby, Head Prajap and Kong Kluay (both in Kapor district), the original inhabitants (fisherfolk) have taken to squid traps, using the single rope attachment method. It is here that the Ranong subproject has concentrated its efforts. Last September, a training course was held here on squid traps, and the villagers have since continued to receive assistance and support. The traps were constructed during January and February; around mid-February, about 25 boats were setting out to lay the traps.

Those who operate squid traps face three problems. One is theft. The traps are sometimes stolen to be re-sold out-



Capture of squid by traps.

side the country at several times their Thai market value. Another problem is damage to the traps caused by the many trawlers operating in the area, often illegally. This is a constant source of conflict between small and large-scale fisheries in Thailand. The construction of artificial reefs at several places along the coasts of Thailand will, it is hoped, offer a solution by impeding trawling. Another problem is that of market fluctuations, which endanger viability.

Perhaps an even more serious issue is that of the resource base. The diminishing catches reported on the east coast are ascribed to over exploitation; although no reliable knowledge about the west coast is available, the squid trap method is itself cause for concern: the squids are caught while they are laying eggs and these eggs are used to lure other squids. Resource management is therefore a grave need, and its importance has to be conveyed to the fisherfolk.

Fishermen go out to sea to set squid traps.



A small crustacean inhabiting natural and man-made salterns from The sub-arctic to the arid tropics has long attracted the attention of zoologists. Science was fascinated by the ability of *Artemia* to thrive in the inhospitable supersaline environment of its native salt pans. This small crustacean, about 1 cm long, ensures its survival by enclosing its offspring in an amazingly resistant egg or cyst. Cysts known to be 10,000 years old have hatched into viable larvae! These cysts are scattered by the wind and carried far and wide by birds such as the beautiful flamingos that frequent salterns. But they can only survive in water so saline that no other creature, save salt-loving bacteria, algae and a few insect larvae can live there.

Now why would the BOBP be interested in *Artemia*? Well, first let's take a look at its importance to aquaculture.

Artemia

Culture in the Bay of Bengal region

by Charles Anger

Artemia, the small crustacean that lives in salt pans, forms an excellent food for shrimp larvae. What are the prospects for culturing *Artemia*? This article discusses a BOBP workshop on the subject held recently in Madras.

Decorative fish farmers, dealers and hobbyists long ago found *Artemia* to be an excellent food for aquarium fishes. Frozen adults were found to be highly nutritious and could be used to induce reproduction. The cysts could be easily stored for many years and hatched as needed. The newly hatched nauplii proved to be excellent food for larval fishes. Today, we can say that there would be no shrimp hatcheries were it not for the little *Artemia*, particularly the cyst-produced nauplius. The pioneer of the penaeid shrimp hatchery, Dr. M. Hudinaga, struggled for many years to find a food that would enable him to complete the larval development of *Penaeus japonicus*, the highly valued kuruma-ebi. He needed a food that would be both nutritious and of the proper size to allow the tiny larvae to eat. Ideally, it would be easy to produce. By accident, Dr. Hudinaga stumbled upon *Artemia*, and lo and behold... he had the perfect food for advanced larvae and early post larvae. Since Dr. Hudinaga had already found that certain single-celled algae were suitable for the early larval stages, he could now complete the larval rearing. From then on the development of commercial penaeid shrimp hatcheries was just a matter of time. These hatcheries now play a critical role in the spectacular development of shrimp farming. *Artemia* has also been found to be an excellent feed for the larvae of many marine fishes and is now widely used in commercial hatcheries producing a variety of finfish.

During the 70's, there was a shortage of *Artemia* cysts which drove up prices, particularly for the higher quality products. Today, thanks to efforts by the private sector in searching out and exploiting new supplies, cysts are obtained relatively easily. Still, they form a significant component of hatchery operating expenses. There has been a considerable effort by public and private laboratories to find a substitute in the form of micro-encapsulated feeds or modifications to larval rearing procedures, but the fact remains that good hatchery production, particularly of the highly valued *Penaeus monodon*, depends upon an adequate diet of *Artemia* nauplii.

The bill for imported *Artemia* is quite substantial in some countries where prawn and marine fish hatcheries have

developed. If the infrastructure is less developed, it sometimes may be difficult to maintain adequate inventories. Where one finds a dry season of at least six months and an indigenous salt production industry, the propagation of both cysts and adults, or "biomass", is possible.

Thus, during its 11th Advisory Committee meeting in Bangkok in 1986, BOBP was requested by its member countries to undertake activities to assess the potential of *Artemia* propagation in the region. Consequently, we planned consultancies and a regional workshop for 1988. Difficulties in obtaining a consultant resulted in a year's delay, and work began in earnest April 1989.

When we began to look into *Artemia* culture, we didn't know how our target group, the fisherfolk, would fit into the picture. Were they even involved in salt production in some way? A brief consultancy was commissioned last year to take a look at the Kovalam salt production centre, just south of Madras. Both large salt corporations and small producers operate in the area, thus we felt it would be representative of the industry. Ms. M.H. Kalavathy, BOBP consultant, looked at the social and economic aspects of salt production.

Her study brought out aspects of salt production which cast some doubt on the role BOBP might play in *Artemia* culture. First and foremost, fisherfolk were nowhere to be found! Small-scale salt producers originate from the Harijan community which normally has nothing to do with fishing. Small-scale salt production is seriously hampered in the Kovalam area by deteriorated water supply canals, which would require a considerable investment in dredging. Bureaucratic problems could also arise, in that salt production comes under various specialized bodies which normally have no relationship with the fisheries departments.

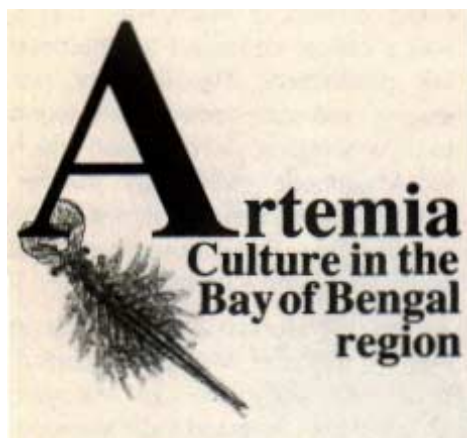
A second consultancy in April of this year was undertaken by Erwin Pador of the Philippines and involved a closer look at the technical aspects of salt production and *Artemia* culture along the eastern seaboard of India. It became clearer that BOBP's target group is not involved in salt production.

Even more, small-scale salt production needs considerable improvement and

modification before *Artemia* culture could be taken up. Again, water supply was a critical constraint to improved salt production. The illiteracy rate among small-scale operators was found to be very high, a sad condition which would impede technology transfer. While there is a definite interest on the part of large-scale salt businesses, these hardly need the support of BOBP.

A regional workshop early May in Madras followed Mr. Pador's consultancy. Representatives of Malaysia, Thailand, Sri Lanka and India attended. Mr. Ong Kah Sin of the Fisheries Research Institute in Penang, Malaysia, led off the presentation of country status reports. It seems that due to climatic conditions, there is no indigenous salt production in Malaysia. Some experiments were done with cyst production in tanks, and while technical feasibility was established, the cost of salt to maintain the required high salinity was prohibitive. But Malaysia is a good market for quality cysts and maybe biomass because of its rapidly developing private prawn industry and government seabass and prawn hatcheries. Ten tons are imported annually at a value of M\$800,000 for use by the 40 hatcheries that engage in larval prawn and seabass production.

Dr. Wit Tarnachalanukit, Dean of the Fisheries Faculty of Kasetsart University in Bangkok, described the *Artemia* production industry in his country. Thailand is one of only two countries in the BOBP region which produce *artemia* commercially, the other being Sri Lanka. Thailand has a thriving prawn hatchery industry with about 100 small hatcheries scattered around the coastal region. They supply to shrimp farms presently estimated to cover around 18,000 ha and expanding rapidly. Freshwater prawn hatcheries are also significant consumers of *Artemia* cysts and number several hundred. Thailand also has a number of seabass hatcheries and fry production centres which require lots of *Artemia* cysts. Before an indigenous *Artemia* culture industry started, cyst imports were valued at \$10,000,000 annually, but are now down to \$720,000. China, the U.S.A. and Brazil are the major suppliers. Today the total *Artemia* culture area is about 128 ha. *Artemia* may be cultured alone, mainly as biomass, or integrated with fish and



prawn, culture. The set-up depends upon local climatic conditions. Fertilization with chicken manure is widely practised and with proper water management, biomass can be harvested every 2 or 3 days. Selling at \$2.40 to \$4.00/kg, this product gives a good return to the farmer. Windmills drive wooden pumps, keeping down operating costs.

Ms. Margaret Kuruppu of the National Aquatic Resource Agency, Colombo, Sri Lanka gave a picture of the present status of the industry in her country. Sri Lanka has a well developed ornamental fish industry which is a heavy user of Artemia. Shrimp hatcheries are still few in number, but should increase in response to the developing farming industry. Artemia are now harvested from salt works in the south of the country, at Hambantota. Artemia are killed by very low salinity, so inoculation of nauplii or adults has to be done at the end of the rainy season. Local harvesters collect 250 to 300 kg each season from 83 ha of salterns. Even so, imports amounted to \$200,000 in 1986. Production is hampered by the shallow depth of the condensers and the introduction of relatively low salinity water during the salt making process. Cysts are stored in cement tanks on site, collected and marketed from time to time by NARA. The nutritional quality of Artemia nauplii hatched from these cysts was evaluated by the Artemia Reference Centre in Belgium and found to be very good due to the abundance of certain kinds of unsaturated fatty acids known to be essential for the culture of prawn and finfish larvae. Experimental work has shifted to salt works at the southern end of Puttalam lagoon, north of

Colombo. The salt corporation is constructing several ponds specifically for NARA's trials.

The focus of the workshop was to be on the development of Artemia culture in India, thus it was appropriate that the dean of Artemia work in India, Dr. Joseph Royan of the National Institute of Oceanography in Goa, should enlighten the participants on the present situation in the country. Large, exploitable deposits of Artemia cysts can be found in the salterns of Gujarat and Rajasthan in the northwest. Pilot-scale production in the same region produced some 20 kg of cysts in 4 months from a 1 ha condensor. Considering the vast area of some of the salt works, the potential is impressive. For example, the Tata Chemicals salt works at Mithapur in Gujarat alone has 10,000 ha! Cysts are being collected and marketed from these sources to supply the few hatcheries in India and the aquarium fish industry in Bombay. However, improvements in quality through better processing will have to be taken up. In contrast, Artemia resources on the east coast seem rather meagre! Dr. Royan pointed out that the presence of Artemia populations on the east coast results from the mechanisms by which it is distributed in nature. It turns out this is mainly by flamingoes, whose migratory routes take them over southern Tamil Nadu on their way to Sri Lanka. Since there is no way for natural dispersion northward, Artemia is not found in Andhra Pradesh and Orissa. In spite of this there is potential for Artemia cysts and biomass production in Tamil Nadu. Russel Motha of Veppolodai Salt Corporation near Tuticorin will take it up in the near future. Dr. Royan pointed out that integrating Artemia culture into the salt production system can double income. Erwin Pador, BOBP consultant, visited Tamil Nadu, Andhra Pradesh and West Bengal to evaluate the potential for Artemia propagation in these states and how BOBP might assist its development. The salt production season in Tamil Nadu varies from 6 to 8 months. Tidal amplitude is low all along the Tamil Nadu coast, requiring the use of pumps to fill reservoirs. Artemia are found around Tuticorin and even in the Kovalam area near Madras. Several colleges and government laboratories are studying Artemia. CIFE (Central

Institute of Fisheries Education), based in Kakinada, Andhra Pradesh, has tried to introduce Artemia propagation to salt farmers, but without success. West Bengal has a sufficiently long dry season to produce Artemia and an adequate tidal range to use gravity for filling ponds.

As the workshop participants moved on to a discussion of the constraints facing the development of Artemia propagation in India, there did not appear to be any major technical problems. The introduction of exotic strains was deemed feasible, provided native varieties are preserved in some form. Such introductions might be necessary where local strains cannot meet the nutritional characteristics required for export marketing. Some of the participants, particularly Dr. Abdul Rahman, Thanjavur College, Tamil Nadu, and Dr. P. S. B. R. James, Director of CMFRI, felt that more work was needed on the natural production of microalgal feeds for Artemia.

The general experience among the participants from India was the difficulty of convincing small to medium producers of the advantages of incorporating Artemia production into their salterns. Apparently some producers believe there will be a negative effect on salt production (actually, the reverse is true), or they are simply ignorant of Artemia, its uses and income generating potential.

Cyst quality is a paramount concern where marketing is concerned. It will be essential to teach producers and harvesters how to properly clean, process and package Artemia cysts. If not, the Indian product will not find a stable niche in the export market or get attractive prices. Some of the participants felt that uniform standards should be imposed on any Artemia cysts meant for export. This could be done through existing institutions.

Dr. Royan presented an economic model of Artemia biomass culture integrated into salt production which clearly showed its profitability. It still remains an open question whether or not Artemia culture for both cysts and biomass could be profitable on its own in the Indian context.

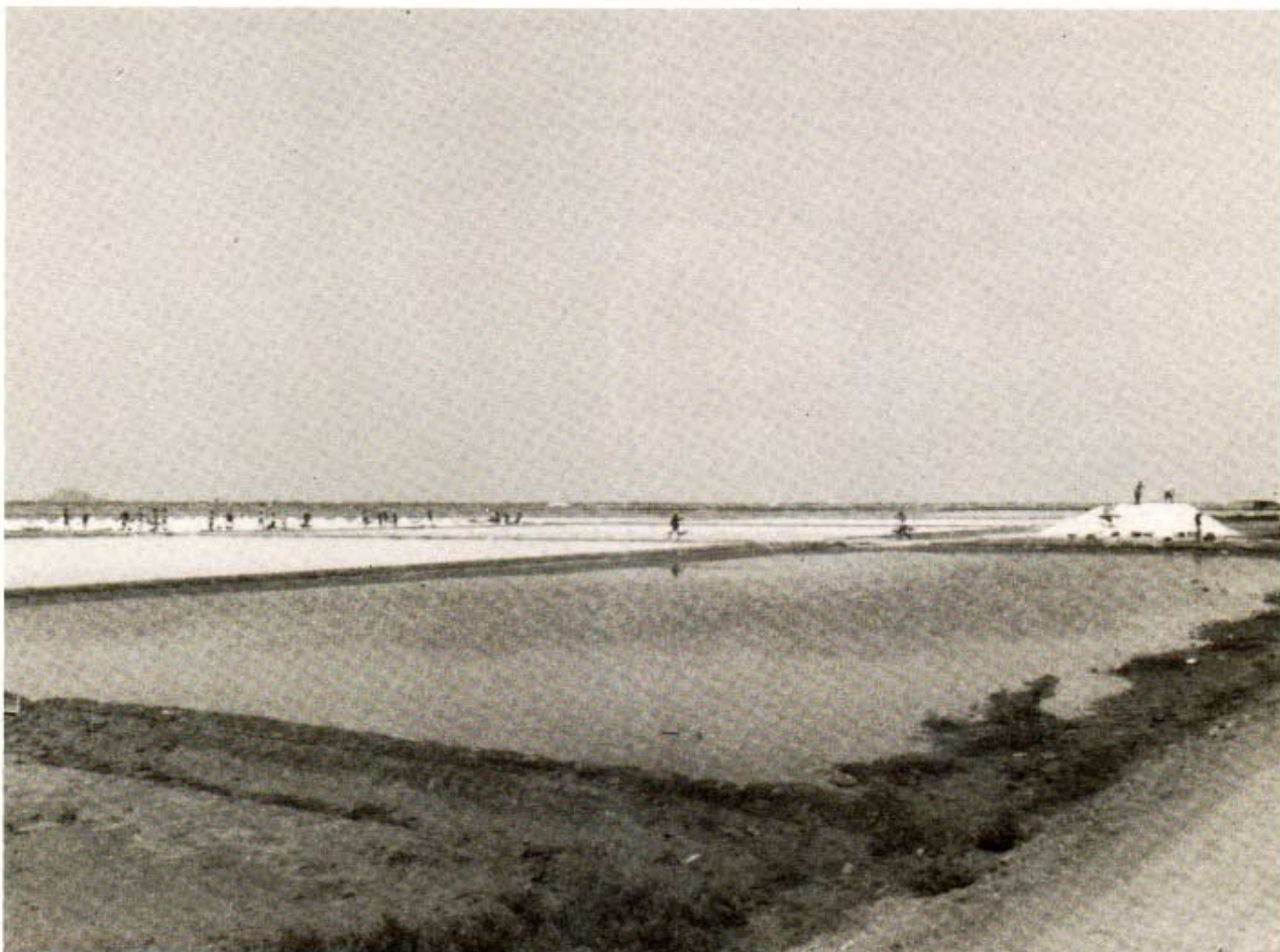
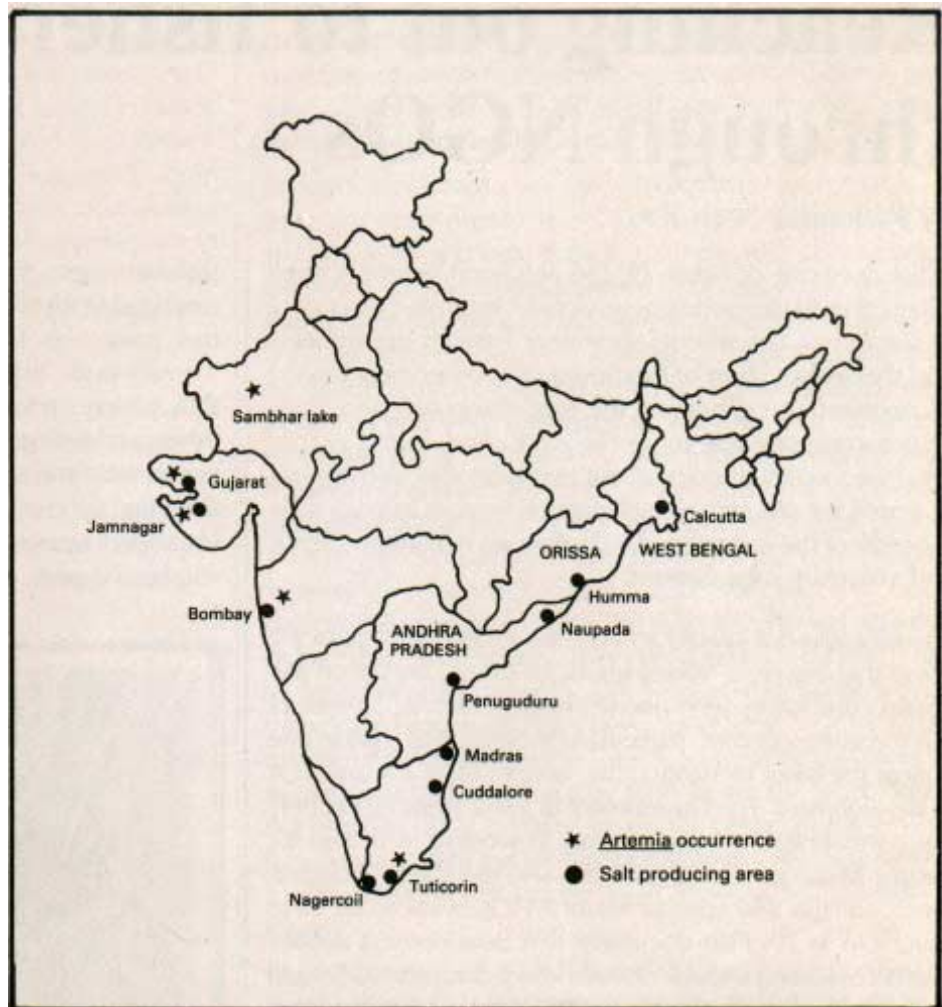
Perhaps the strongest recommendation to emerge from the workshop was for one or more demonstration farms. It

was felt that this would be the only way to convince salt producers of the economic viability of *Artemia* culture.

Research into the identification and selection of strains should be supported. An *Artemia* cyst "bank" could act as a repository of selected strains and preserve indigenous ones as well.

Salt production technology needs to be improved, particularly for the smaller operations, even before *Artemia* can be introduced. This is obviously quite beyond the capabilities or interests of BOBP. In any event, there exist resources of *Artemia* cysts and even biomass in India that could be exploited right away, without even considering to expand them beyond the northwestern region. Given the total absence of our target group, the small-scale fisherfolk, from the salt industry, it is doubtful that BOBP will have a role to play in the future development of any *Artemia* industry.

Right: Salt-producing areas along the coastline of India — and places where Artemia occurs. Below: A 'typical salt-water lake, where Artemia cysts could occur.



Reaching out to fisherfolk through NGOs

by Rathindra Nath Roy

What does one do when on the one hand fisherfolk need extension and development services to improve their quality of life and on the other Government fisheries departments find themselves short of funds and of appropriately trained manpower? You either find the right manpower and funds or get somebody else to do the work. And, that is exactly what we thought of doing about two years ago. We thought of amplifying and expanding extension services to small-scale fisherfolk of the east coast of India through non-governmental and voluntary organisations.

The idea was not exactly a new one, except perhaps in the sense that we were talking about an unusual and often forgotten community who needed help- fisherfolk. Several of our member countries, particularly in South Asia, had in one way or the other recognised the services of NGOs and VOs in development. The Government of India, realising not only the constraints of its departments in working with and for people at the grassroots level but also the special commitment, abilities and approaches of NGOs, went so far as to specify in its 7th Plan document that development departments could (and should) channel efforts through NGOs and to do so could channel as much 10% of developmental funds through NGOs. So when BOBP proposed to "strengthen and amplify extension efforts to fisherfolk communities through training of, technology transfer to, and support for pilot extension schemes of non-governmental organisations working with and for fisherfolk" we received strong support not only from our member governments but also from our donor agencies.

Our concept was quite simple. We would find NGOs working with and for fisherfolk. We would give them what BOBP can give — technical know how, technology transfer, training and even some funds for pilot extension activities (though we are not a funding agency). The NGOs in turn with improved and expanded capabilities would extend services to fisherfolk. Our counterparts, the government fisheries departments, would assist us in the process, take on some of the tasks, learn from the process, particularly the intricacies of working with NGOs, and in good time even take over the responsibility from BOBP and channel funds to NGOs — as suggested for example in India by the Seventh Plan. Therefore in 1988 we set up a sub-project, entitled Extension Support through NGOs, to be implemented in the four east coast states of India.

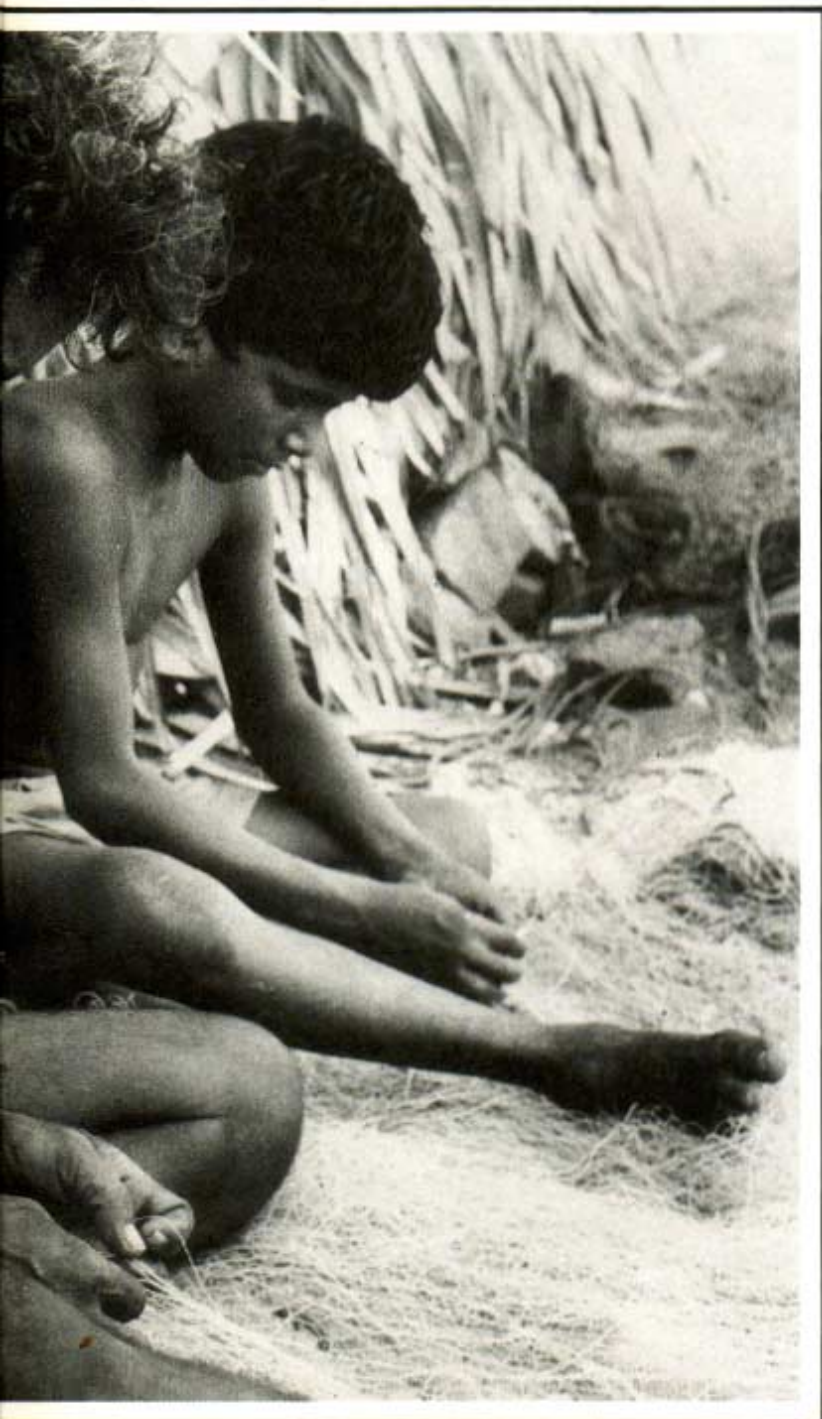
We set about by first undertaking an inventory of NGOs working with and for fisherfolk. This involved not only searching NGO data bases, but meeting known NGOs and agencies which fund NGOs, and often just travelling down the coast meeting fisherfolk communities and NGOs working with them. The inventory was our first surprise. Relatively speaking, compared to the numbers of NGOs working in the agrarian and social welfare sectors, those working with and for fisherfolk were very few. Even in absolute terms the

numbers were small - often in a whole state we barely managed to identify 20-30 NGOs. What further complicated this issue was that several of the NGOs did not see themselves as "fisherfolk NGOs"; in the process of their work they happened to be dealing with some fisherfolk amongst others and the type of services and activities, except in a few cases, were the same for their various target communities. Wanting to start small and learn as we go along, we shortlisted our inventories in two states, Tamil Nadu and Andhra Pradesh, and invited a few NGOs from each state,



who we thought were committed and capable and organised enough to benefit from the effort we were planning, for discussion in Madras. The NGOs were enthusiastic and articulate about their efforts and needs. Our staffers in fishing technology, brackishwater aquaculture and post-harvest fisheries had discussions with each group, and some preliminary and tentative ideas for possible cooperation emerged. BOBP then mounted multi-disciplinary missions to visit the NGOs and the fisherfolk communities they worked with, to better appraise needs and to further specify and concretize our possible cooperation.'

This closer interaction led us to our second surprise. We found there were different types of NGOs with varying styles of work and different levels of capability. This in and of itself should not come as a surprise. There are literally thousands of NGOs and one should expect a great deal of variety in them. What surprised us was that not only would the



differences require from BOBP differing approaches to help the NGOs; but more importantly, the real objective of the exercise, extension to fisherfolk, would occur differently and after different lead times of assimilation 'by the NGOs. An example or two would perhaps clarify our dilemma.

In south Tamil Nadu we are working with three NGOs — let us for convenience refer to them as A, B and C. NGO A works in three coastal districts, primarily with poor agrarian folk; but along the fringes of their activity they encounter large numbers of fisherfolk. Their main activities are awareness-building and mobilization through various training and education approaches. The group is very committed, well organised and very interested in working with fisherfolk. However, the group has very little knowledge of fisheries or fisherfolk and of their predicament, concerns, needs and problems. BOBP felt and they agreed that the best way to involve them would be to train the NGO staff over time on fisheries and fisherfolk matters, and assist them to build rapport with and get to know the fisherfolk. Armed with this knowledge and solidarity, they could extend and reach out to fisherfolk with our help. We were talking about a long drawn-out process of first "developing" the NGO who in turn would "develop" the fisherfolk. In principle there is nothing wrong about building tools to get the work done, but with BOBP's primary objective being working with fisherfolk and with the limited time span of a regional project it was a dilemma whether we could afford such an alternative route.

On the other hand, NGOs B and C were a totally different proposition. NGO B represented really the beginnings of a reasonably self-reliant people's movement. Fisherfolk who had been initially mobilised by a service NGO had over the last 17 years of struggle organised themselves into marketing credit, savings and welfare associations at the village level with a federation at the district level. The group over the years of struggle have managed to become self-reliant in their leadership and in their economy (though less so) and are less and less dependent on the initial organisers who play more of a reflective liaison role. The groups have not only wrested control of the first sale of their fish but established their credibility with local banks as safe credit risks. Thus NGO B is really an organization of fisherfolk and by fisherfolk, who being entrepreneurial, are eager to develop and who through experience and reflection are very clear about what could help them. We at BOBP found that not only could we work with them, directly answering their needs, but the time gap between us helping the NGO and the NGO helping the fisherfolk was zero because one was the other.

NGO C, a spin off from NGO B, is an organization of fisherwomen vendors and not only displays the same characteristics but offers an equally interesting challenge for us — to enable their efforts at self development.

BOBP's subsequent efforts at working with NGOs have reinforced the analysis above. Unfortunately the number of NGOs who would belong to B or C as a category would perhaps be less than 5 per cent of the fisherfolk NGOs. The remaining 95 per cent are more or less in league with NGO A — lots of potential but unfortunately demanding lots of effort over long times. This requires us at BOBP to diversify our strategy in working through NGOs into two main streams:



- (i) Stream 1, aimed at the "Ready Group" NGOs like NGO B and C, whom we can work with immediately, who have a good understanding of fisherfolk, who know what the problems are, know their needs and have the capability and the organization to absorb help and pass it on to fisherfolk;
- (ii) Stream 2, aimed at the "potential group" NGOs like NGO A, who need to be first developed for the task before they can offer extension services to fisherfolk.

Our experience in Tamil Nadu and Andhra Pradesh also raised other important questions. Time and again we found initial enthusiasm and interest dying out. Groups in Andhra Pradesh who we thought could do things for fisherfolk did not respond to our invitation after agreeing to work with us during discussion. Some questions from NGOs, questions we are hearing more and more, have led us to understand such reluctance.

First, a group working with and for people, which is capable of absorbing inputs like training, information, know how and even funds, in order to translate these into development-enabling action, needs good management. NGOs, we found lack good management. And this is not just lack of a particular ability but rather reflects the organisational cultures and leadership styles prevalent. Barring a few NGOs we have heard and read about and some like NGO B and C, our encounters have been with NGOs who are not gatherings and groupings of people concerned and committed to collective action for their improvement, but rather a few persons, and often just one person with considerable leadership/public relations capability, who brings together a group under him/her as an NGO. This style of leadership and management has a potential for conflict and instability, and this is particularly evident in the number of NGOs who are spin offs of other NGOs.

Secondly, we at BOBP get the feeling that perhaps we have made a mistake by going directly to the NGOs in the hope of convincing them about the needs of fisherfolk. In most

cases the NGOs are convinced of the needs of fisherfolk and are interested in working for them. Their concern is who is going to pay for such efforts. BOBP is a technical assistance agency, not a funding agency. We infer that a considerable responsibility in deciding on what an NGO does and how it does so seems to be with the funding agencies since very very few NGOs are self-reliant in the manner of NGO B, which has its own savings through its market activity. A major thrust by NGOs into the fisheries and fisherfolk development sector would be impossible if BOBP or any other agency limits its inputs to only training, information, technology and know how—which are tools 'but not the capital. So, perhaps BOBP should first convince funding agencies about the needs of fisherfolk and the appropriateness of NGO action and then perhaps facilitate the funding agency's commitment through inputs to NGOs.

In retrospect, BOBP did overestimate the capability of NGOs to amplify extension to fisherfolk; and also its own capability to give NGOs this ability. The current year will be a year of search and learning, through which BOBP would have to decide on this particular modality of helping fisherfolk.

Some pointers are clear. BOBP is going to look for Stream 1 NGOs to work with them. Perhaps not in a special sub-project, but rather as we already do to an extent, by incorporating NGOs into existing and potential sub-projects. We are also going to explore the needs of Stream 2 NGOs to find out how, if at all, we can help them enable fisherfolk development. And we will hold discussions with select groups of funding agencies to appraise them of the fisheries/fisherfolk sector and its needs, to urge their involvement in promoting NGO action in this sector and to discuss what role BOBP could and should play in such moves.

Our views and perceptions should be seen in the context of our limited experience with coastal NGOs on the east coast of India. We invite debate and discussion, which we hope would lead us into the kinds of activities that in the future may enable more NGOs to take up extension among small-scale fisherfolk communities.

Shrimp fry culture in West Bengal

by Henrik Nielsen

On Kakdwip tidal flat in West Bengal, the monotony of the landscape is striking. Since it is subject to regular high tide flooding, the only vegetation consists of prickly bushes and grass, sturdy enough to withstand the swings between saline tide water and drought. Yet, opposite the village of Moyanapara across a small channel, some high dikes are visible. This is BOBP's nursery pond project.

As described in the March 1989 *Bay of Bengal News*, several thousand poor people living along river banks in the Sunderbans of West Bengal make a subsistence living from shrimp fry catching. A BOBP-supported activity aims at helping these fry catchers by constructing nursery ponds for growing the fry to juvenile size. The fry will grow in 40-60 days to juveniles – to a size of 40-50 mm. The catchers can obtain attractive prices for these juvenile shrimp from shrimp farmers. BOBP is also training the shrimp fry catchers in better catching techniques; and training programmes are being organized for women to help them manage the pond complex.

At present the project consists of a 1.1 ha shrimp nursery pond complex of 20 ponds, each covering an area of 200

sq metres. Between February and May of this year, Mr. Modesto Chavez, BOBP shrimp consultant from the Philippines, helped survey the area, design the outlay of the ponds and supervise labourers excavating soil to build the dikes. The area is subject to enormous tidal amplitude, reaching more than 5 metres in September. Further, heavy monsoon rains and occasional cyclones move water further upstream. So precautions had to be taken to ensure the integrity of dikes subjected to such stresses. Until now 9000 man days of work have been expended on the project, mostly towards soil excavation. On some days, upto 260 people, men and women, have crossed the channel to work on ponds, dikes and connecting sluice gates. All the labourers come from Moyanapara village, and though not accustomed to this kind of work, they have quickly picked up the routine. More important, as they work they develop a sense of responsibility; these nursery ponds are meant for them and will benefit them.

From time to time progress is delayed by high tide water, and as happened recently, by thunder showers which make the clay soil soft and slippery and impossible for the labourers to work in.

Construction of shrimp nursery ponds in Kakdwip district, West Bengal.



The same conditions exist when one has to cross the channel in order to reach the nursery ponds on the tidal flat. With muddy river banks on each side, you have to make your way to and from the project site gingerly, carefully.

The high tidal amplitude is one of the reasons for constructing nursery ponds on this particular tidal flat. During high tide, water can freely pass into the ponds to renew and refresh the water; during low tide, it can drain out. One main sluice gate at the feeding channel and one for each pond facilitates the passage of water. Water passing through these two, sluice gates can be screened to exclude predators.

Ten out of 20 ponds are now ready for operation. During the monsoon, salinity drops to values below 10 ppt, too low to grow tiger prawn fry (*Peneaus monodon*). The possibility of rearing fresh water shrimp or carp at this time will be investigated. This will give fry catchers an opportunity to get familiar with pond management techniques before the "real" stocking with tiger prawn fry starts in October-November, when these fry will reach brackishwater channels and rivers in greater numbers.

Success in this project does not depend merely on the availability of water and shrimp fry and on management techniques. Reaching the target group, securing their understanding and ensuring smooth implementation of activities is often difficult. On behalf of BOBP, Adithi, an NGO, will train women in Moyanapara village, and form women's groups to manage the pond complex. The aim is to build confidence and develop leadership qualities among the women and show how government schemes can be tapped. Adithi will also focus on problem-solving and on resolving conflicts.

A woman motivator has been engaged to be in the village, almost full time. She is selecting other women trainers and studying how effective leadership can be developed in the women's group.

"We hope that by encouraging local organizations and by providing technical training, we'll enable fisherfolk to demonstrate the viability of nursery ponds as a means to improve their economic and social status", says BOBP Senior Aquaculturist, Charles Angell.

GETTING FISHERIES CO-OPERATIVE SOCIETIES TO REPAY LOANS

by P.M.K. de Gunasekara

It is possible to get fisheries co-operative societies to repay loans, says the author, who is chairman of the loan recovery committee in Sri Lanka's Ministry of Fisheries.

Towards the end of 1978, the activities of most fisheries co-operatives in Sri Lanka had come to a standstill. The reason: most of them were overburdened with debts and were in no position to borrow fresh amounts without discharging their existing loans. Many societies faced the prospect of having their registration cancelled. Collectively, they owed SLR 65.7 million to the Ministry of Fisheries and most of this had been due for over 15 years. The highest annual recovery was around SLR 0.6 million (0.9%).

The Minister of Fisheries saw clearly that the only way out of this emasse was to initiate action to speed up loan recovery. With this end in view, a loan recovery committee with the present writer as chairman and three field officers as members was constituted.

Why loans were not being recovered

The committee analysed the reasons for the non-recovery of loans.

The major reasons were

— The absence of a formal programme of work aimed at loan recovery;

— Though loans had been outstanding for several years, debtors had not been notified of this fact;

— Loan instalments repaid by debtors were used not to settle their loans but for activities of the fisheries co-operative societies not related to the loan programmes. This discouraged debtors from repaying their instalments regularly.

— Debtors did not receive accurate accounts of the amounts due from them; consequently, they did not trust the loan accounts received.

— Officers of the Co-operatives Department and the Ministry of Fisheries were not made responsible for the development and administration of fisheries co-operative societies

— Boats of loan defaulters had not been seized for the purpose of loan recovery.

Formulating and implementing schemes to encourage loan repayment

These shortcomings had to be eliminated. The first step was to finalize a scheme which would make skippers of boats the owners once the loan due on a boat had been repaid. This scheme was implemented in 1979. Under this scheme, once a society member repaid his loan full, he — rather than the society — became the owner of the boat for which the loan was taken. This scheme encouraged skippers to repay loans through the incentive of ownership.

The next step was to get loans repaid through banks rather than through the societies. (Most debtors lacked confidence about the society passing on the money they repaid to the ministry.) Each debtor opened a separate savings account in the bank in which his society had its account. Amounts deposited in this account were transferred directly to the Secretary, Ministry of Fisheries, till the loan was paid off in full. Once the loan had been paid off, the debtor could operate his account on his own. This scheme solved the problem of debtor suspicion to a large extent.

A major problem in loan recovery was the multiplicity of loans each debtor had availed of. For instance, loans for purchase of craft which carried a subsidy component of 50% were separate from loans for purchase of fishing gear, loans to compensate for a sudden increase in the prices of hulls

Performance of the loan recovery committee

Total loans to be recovered	Total loans outstanding on 1st July 1988	
Old loans (issued before 1979)	SLR 65.7m	SLR 22.6m
New loans (issued after 1979)	SLR 73.2m	SLR 138.9m

Break-up of loans outstanding

Amount due from the northern and eastern provisions	SLR 7.6m
Amounts due from societies where loans recovery has already commenced	SLR 10.6m
Amounts due from various societies for a period of more than 5 years	SLR 4.4m
Amounts due from societies whose registrations have been cancelled	SLR 0.4m

and engines, etc. Once the first loan had been recovered, the boats were released from hypothecation, thus leaving the other loans unsecured. Also, debtors had no clear idea of the amount they owed under various loan schemes. The loan recovery committee, as one of its first activities, consolidated all these various loans into a single statement; this statement served to not only increase debtor confidence but also to facilitate the committee's basic task of loan recovery.

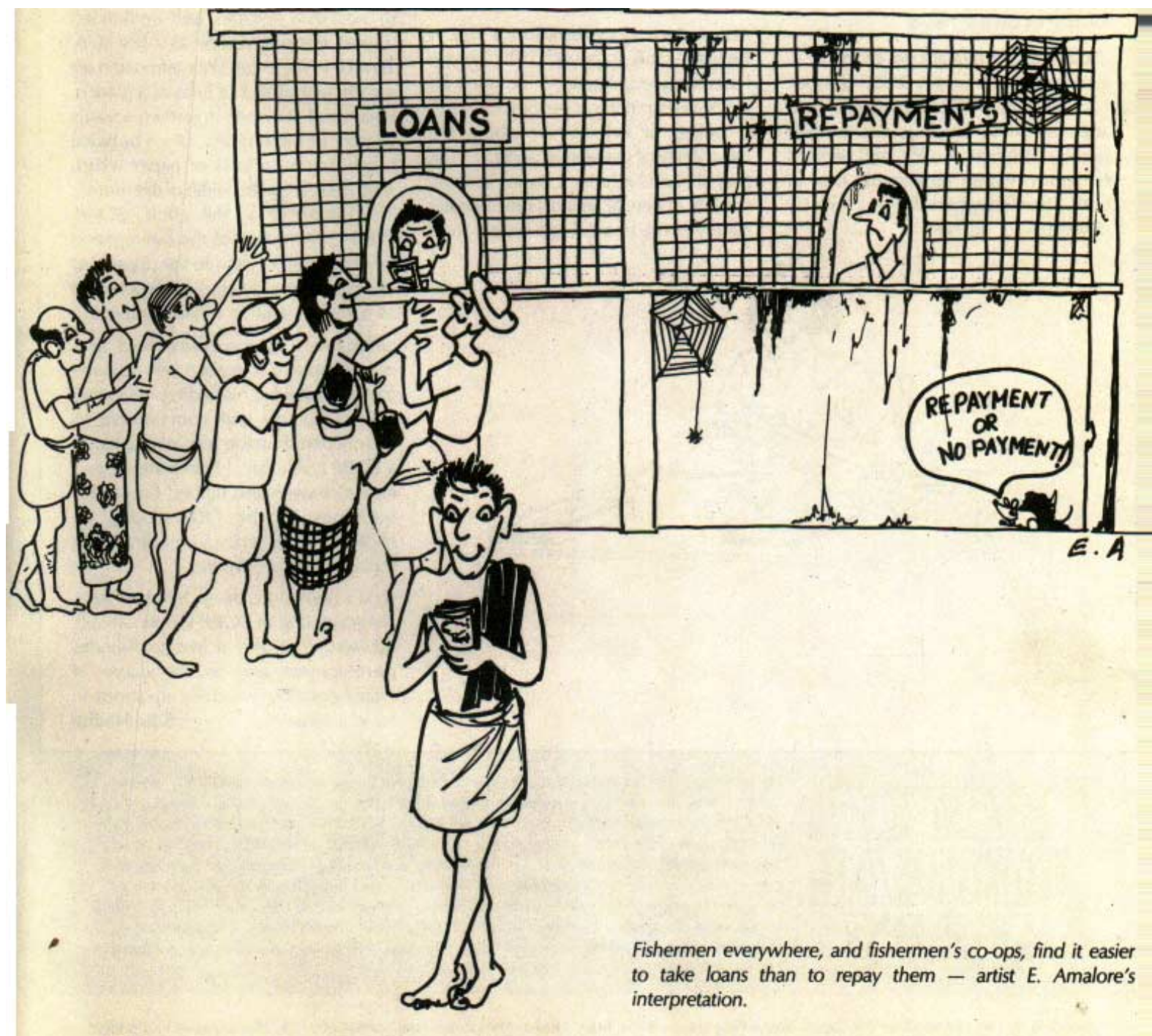
In addition to all these measures, it was also necessary to gain the confidence **of debtors and to impress on them the need for timely repayment of loans.**

The first objective can be achieved by an attitude of understanding and 'sympathy'; by, for example, discussing loan recovery problems with individual debtors rather than in groups. As regards the second objective, this writer has found that if the debtor is told clearly of the grave consequences that will follow upon default, he tries his best to get his repayment schedule in order. In this context, showing the debtor the warrant for the seizure of his boat, coupled with assurances that the warrant will not be executed if the loan is repaid, is very effective!

Finally, the committee found that setting targets for its own performance,

both monthly and annual, helped focus its efforts better. Before the committee was formed, the annual loan recovery was of the order of SLR 0.6 million. The committee set for itself an annual target of SLR 5.0 million. This target was exceeded for the first time in 1985.

The first two amounts in the "break-up of loans outstanding" (see table) are recoverable once peace returns to Sri Lanka. The third amount, SLR 4.4m, can be recovered after the registration of defaulting societies is cancelled and their assets liquidated. The last item, SLR 0.4m, represents money still recoverable after the societies' assets are liquidated.



Antony Raja

On May 5, 1989, B.T. Antony Raja, 55, was taken ill in Pun, Onissa, where he was explaining BOBP activities to a two-member Swedish study team. He passed away two days later, leaving colleagues and fellow fisheries scientists shell-shocked.

Raja was one of BOBP's first consultants, also One of the best. His all-round knowledge of fisheries, his experience as scientist and administrator, and his thoroughness and objectivity were evident in the many studies he carried out for BOBP, the dozen-odd reports he drafted or edited, his articles for *Bay of Bengal News*.

"Scientists' and bureaucrats often live in separate worlds", says BOBP director Lars Engvall. "Their concerns and attitudes differ. Dr. Raja was equally familiar with both worlds, and perhaps embodied within himself the best of both. Therein lay his value as a fisheries development adviser."

Raja's first major assignment for BOBP concerned the 1980 international consultation on stock assessment in Chittagong, Bangladesh. At that time information on fishery resources in the Bay of Bengal region was scattered, uncoordinated and ambiguous. The consultation helped clarify the picture. Particularly useful were two reports put together by Raja after the consultation, plus a state-of-the-art paper (BOBP/WP/8, "Current knowledge of fisheries resources in the shelf area of the Bay of Bengal"), which generated so much demand that even after a reprint, we have no copies left.

About stock assessment in the Bay of Bengal region, Raja said: "On the one hand people understand the need for stock assessment; on the other, there's a feeling of helplessness about the inevitability of over-exploitation... The task ahead is gigantic: to understand the Bay of Bengal region's multi-species fishery in the tropical eco-system in its

totality." Raja's own work over the years helped such an 'understanding.

Raja's forte was fishery biology (his Ph.D. from Tokyo University related to work on Indo-Pacific sardines), but few fisheries subjects remained untouched by him. In fact, late 1988, Raja prepared a scholarly paper on women in fisheries development for a seminar in Delhi, and colleagues at BOBP gently twitted him about his new speciality.

Raja's flair for organizing, classifying, analysing and simplifying masses of technical fisheries information made him a technical editor of rare competence. Dr. K. Sivasubramaniam, Senior Fishery Biologist, recalls Raja's work on the hilsa. "The hilsa is an important fishery. Plenty of work had been done in India over decades, and we needed a solid literature review as a first step. To take in the entire documentation on a particular aspect of hilsa at a glance, Raja used to paste together various sources of information. Once or twice I saw Raja with rolls of paper which stretched across the width of the room". The output of all this effort (BOBP/WP/37, "A review of the biology and fisheries of Hilsa ilisha in the upper Bay of Bengal") is a classic — indispensable as a review and as a bibliography.

Soft-spoken as a person, Raja was outspoken as a scientist: he was quite frank about what his findings revealed. This objectivity and commitment to scientific truth made him invaluable as a BOBP consultant. His experience and expertise **were also** tapped on various occasions by the ODA (U.K.), by NORAD, by fisheries administrators in India, by private bodies.

Raja's premature death removes from the scene one of BOBP's most capable advisers; it is also a loss to fisheries development and to the cause of documentation, which he advanced so **handsomely**.

— S.R. Madhu



Bay of Bengal News is a quarterly publication of the Bay of Bengal Programme (BOBP), a regional fisheries programme which covers seven countries bordering the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka, Thailand. The BOBP's main project is "Small-scale fisherfolk communities in the Bay of Bengal" (GCP/RAS/18/MUL). Executed by the FAO (Food and Agriculture Organization of the United Nations) and funded by Denmark and Sweden, the project develops techniques, technologies and methodologies through pilot activities to improve the conditions of small-scale fisherfolk in the seven member-countries. The project began in 1987 for a duration of five years. It succeeds an earlier BOBP project, 'Development of small-scale fisheries in the Bay of Bengal', which terminated 1986. A five-year post-harvest fisheries project, executed and funded by ODA (U.K.), is also part of the BOBP.