

ISSUE NO. 46

JUNE 1992

BAY OF BENGAL NEWS

A PUBLICATION OF

BOBP

For Fisheries Development

BAY OF BENGAL PROGRAMME



ODA



Danida

AGFUND

The Oysters of Ranong



Hatcheries play a significant role in tropical shellfish culture

by C A Angell
(Senior Aquaculturist)

Oyster, cockle, mussel and clam are all popular seafood in Southeast Asia and beyond. Oyster are pretty fancy food, price-wise at least, in Thailand and Malaysia, but cockle, mussel and clam are usually within reach of the average consumer. Though found throughout the Indo-Pacific region, these shellfish have really come into their own only in recent years in the Philippines, Thailand and Malaysia.

The Philippines is the leading producer of oyster, while Thailand leads in mussel. The cockle is the leading aquaculture product of Malaysia, bar none! While countries like Indonesia, India and Sri Lanka have the potential for large production increases, consumer interest is weak.

All these delicious shellfish are farmed in the ASEAN region, with the exception of clam. Farms depend upon the abundance and predictability of natural seed supplies — ‘spat’ in shellfish farming parlance. Spat availability of commercially cultured bivalves varies markedly in space and time. Its occurrence is often unpredictable.

Mussel and cockle spat are usually abundant, but oyster farming is constrained in Thailand and Malaysia by the scarcity of spat of the more popular species (*Crassostrea becheri* and *C. iredalei*). Looking at the other side of the world, Cuban oyster farms in the Caribbean Sea have faced similar problems.

The question therefore arises : Can bivalve hatchery technology be used to augment wild seed production, freeing farmers from the uncertainty and risk of dependency on the whims of nature?

A short history of bivalve hatcheries

Before venturing an answer to the question, it might be interesting to go back 30 years to the Milford, Connecticut, laboratory of Dr. Victor Loosonoff. As a biologist with the then

Bureau of Commercial Fisheries (now known as the National Marine Fisheries Service), Dr. Loosonoff and his staff developed laboratory methods for the breeding of the American oyster, *C. virginica*. The techniques he developed are still the basis for commercial hatchery operation. Other scientists, like Dr. Ravena Ukeles, contributed to the knowledge of the nutritional requirements of oyster larvae and how to mass culture the tiny phytoplankton upon which they feed.

Oyster farmers are very much aware of the costs of risk associated with dependence on wild seed supplies, so it wasn't very long before the first commercial oyster hatcheries began to appear in the United States and Europe. Improvements and modifications were made to the technology developed by Loosonoff and his colleagues. Dr. Michael Castagna of Wachapreague, Virginia, developed a simplified system of algae culture and demonstrated that it could be used for clam breeding as well as oyster.

At the same time, Japanese oyster biologists, such as Takeo Imal, were working on oyster hatchery technology in their country. Dr. David Walne of the Conway laboratory in the U.K. pioneered oyster hatchery development in Europe. Beginning with very simple methods, Dr. Walne pioneered breeding technology for the European flat oyster, *Ostrea edulis*. The Conway team led in the development of setting techniques for “cultchless” oysters.

Oyster hatcheries today are an important element in the industry in the United States and Europe. They have been instrumental in shifting the focus of production from the east coast of the United States to the west coast, particularly Washington State. Although the basic techniques of bivalve hatchery operation differ little from those developed at Milford, advances in several areas have made hatcheries much more viable.

All bivalve larvae develop in very similar ways and require very similar conditions, so advance in one species, say oyster, can readily be applied to another, the hardshell clam, for example. Thus, the evolution of reliable methods for phytoplankton culture enabled predictable production of spat. But perhaps the most significant advance has been the discovery and application of ‘remote’ setting. Why is this so?

Oyster farmers have to put out thousands of tonnes of shell, or cultch, to catch spat. Often the setting areas are quite far from the farms and it has got exceedingly expensive to transport so much shell back and forth. Before the advent of remote setting, hatcheries had to ‘set’ larvae at the hatchery. Hatchery setting entailed considerable investment in holding tanks, algal production and labour to handle the huge amounts of cultch. Remote setting eliminated all this fuss and bother.

In the late 70s, Lee Hansen and Vance Lipovsky, originally competitors in the Washington oyster hatchery business, but now working together, found that oyster larvae ready for setting could be collected on a moist screen, sent considerable distances, introduced into setting tanks with cultch and then set! The setting tanks could be located right at the farm site, eliminating the tremendous expense of transporting all that cultch. Twenty million larvae fist about fit in the palm of your hand! Remote setting has, thus, become standard practice on the U.S. west coast and has enabled hatchery production to largely replace natural spat. There are still natural sets, but it has simply become too expensive to handle the cultch.

A third major advance was the introduction of genetic manipulation to inbreed disease resistance and modify the reproductive cycle of the Pacific oyster, *C. gigas*. Pacific oyster

become very soft during the breeding season in late July and August. The major proportion of Pacific Oyster production is sold as shucked meat, but the oyster opening ('shucking') houses had to close down because the soft, 'running' oysters were easily damaged by the shucking knives. A few years ago, scientists at the University of Washington found that chemical treatment could change the chromosomal count of oysters, producing triploid, sterile animals. This is done at the egg stage, so hatcheries are essential if triploid oysters are to be produced. Being sterile, the triploids do not become soft during the warm summer months, and the shucking houses can therefore remain open. Now, it's hard to imagine the oyster industry on the American west coast without hatcheries!

Tropical bivalve hatcheries

What happened in the tropics during these years? Here and there, researchers worked with laboratory-scajie rearing of bivalve larvae to aid their investigations of zooplankton. Knowledge of the development and morphology of bivalve larvae was also useful

in predicting the dispersion and setting in nature, but commercial application of the technology was not attempted until 1984.

Cockle are very popular in Thailand and farmers wanted to increase their production. Seed supply was difficult and most had to be imported from Malaysia. The Fisheries Department took a two-pronged approach to the problem: establish brood stocks of the blood cockle, *Anadara granosa*, and look at the possibility of hatchery seed production. From 1985 to 1986, large-scale bivalve hatchery technology was introduced in Thailand. A major bivalve hatchery was set up at Prachuab Khirikhan, about 180 km south of Bangkok. Under the direction of Songchai Sahavacharin, Jintana Nagranad and Kom Silapachon adapted standard bivalve larvae rearing techniques to native Thai species. The cost of seed production proved too high for cockle, but its application to the valuable oyster industry was quickly apparent.

Today, this hatchery produces pearl oyster spat, as well as spat of the *C. beicheri* for the edible oyster

industry. Survival after outplanting in nurseries remains a problem, but the hatchery consistently produces millions of bivalve spat.

Dr. Wong Tat Meng of the Science University of Malaysia undertook bivalve hatchery work with the support of the IDRC of Canada. His chief technician, Eileen Tan, spent several months in the Pacific northwest of the United States working at the Cast Oyster Co.'s hatchery and applied the experience gained there to local Malaysian species, including *C. belcheri*, *C. iredalei* and other assorted bivalve species. Dr. Wong is now poised to construct a production-scale facility in Muka Head, Penang.

At the same time, the Fisheries Research Institute, also of Penang, was developing its skills in oyster hatchery production. In the very near future, the Department of Fisheries will build a new hatchery facility at Batu Maung on Penang Island.

Spat produced by both these hatcheries have been outplanted with varying degrees of success. The biggest problem has been getting oyster farmers to take proper care of the delicate spat.

A general view of an oyster nursery in Ranong, Thailand.



Ever since Dr. Allagarswamy, now director of the Central Institute of Brackishwater Aquaculture in India, introduced pearl culture from Japan, there has been much interest in rebuilding the pearl beds in the Gulf of Manner. An assured source of seed of *P. fucata*, the dominant species, would be required to accomplish this goal. CIBA's hatchery at Tuticorin in south Tamil Nadu developed spawning, larval rearing and setting techniques for this pearl oyster back in the mid-80's. The same hatchery is also able to produce spat of *C. madrasensis*, the local edible oyster. Commercial development of hatchery technology has not yet happened in India, but the potential of hatchery seed has been demonstrated in yet another tropical country by CIBA's work.

It may be a few years before hatcheries contribute significantly to commercial bivalve production in Southeast and South Asia, but the success of the hatcheries in Thailand and Malaysia has clearly shown that the potential is there.

In the Pacific and the Americas

Elsewhere in the tropics, remarkable success has been achieved with the extremely valuable pearl oyster at a hatchery in Australia. Rand Dybdahl and his colleagues have worked out brood stock handling methods, spawning induction and larval rearing techniques for the golden lipped pearl oyster. Spat are nursed in upwellers put out in local waters. When you consider that the pearl industry of Australia is worth more than 20 million dollars annually, the investment in hatcheries is worth the time and effort!

The Philippines is the major oyster producer in the Pacific region. Supplies of natural spat seem to be adequate for the time being. But at the rate the degradation of the coastal environment is taking place in that country, seed supply shortages may be anticipated in the not too distant future!

A very large shellcraft industry in this island nation is based on the window pane shell, *Placuna placenta*, but seed supply is uncertain. Experimental work has shown that hatchery seed production may be possible.

Increasing population pressure and over-exploitation of their coral reefs



Oysters for sale... brought to market from a Ranong farm.

have led Pacific islanders to look to mariculture to augment income and production from traditional sources. Unfortunately, there are very few organisms which can thrive in the nutrient-poor waters of the open ocean. One of these is the giant clam, *Tridacna gigas*. This animal has the amazing ability to grow its own food within its body tissues in the form of symbiotic algae! Dried adductor muscle meat of the giant clam is highly prized and this has led to the virtual extinction of the giant clam on many reefs. Islanders relish the mantle meat, as well. It is said the shell makes very high quality porcelain and is much prized by tourists. Small giant clams fetch high prices in the ornamental fish trade!

Giant clam farming projects are coming up all over the Pacific now, thanks to hatchery production. There is no natural spat collection; indeed, it is not easy to find juveniles amidst the jumble of coral reef organisms! It was not too many years ago that Gerald Heslinga of the Micronesian Mariculture Demonstration Center in Palau developed hatchery techniques for these amazing clams. Now there are projects in Samoa, Fiji and Australia, as well as Palau. Giant clams are extremely fecund, spawning tens of millions of eggs at a time. They are also hermaphrodites, so you only need a few of them to supply your hatchery with all the eggs you need.

The critical phase was found to be the ocean nursery, after the small clam are

outplanted. The juvenile clam have to be kept in covered nurseries to protect them from predators — parrotfish, octopus and lobster. Fairly efficient, low cost methods are now available for ocean nursing.

The only country in the Caribbean with a commercial oyster industry is Cuba. About half its annual production of several thousand tonnes comes from farms. Unpredictable fluctuations in spat supply have made expansion of the industry risky. A few years ago, hatchery spat production was introduced and is now supplying limited quantities to the industry.

The Gulf of California is subtropical and has a flourishing oyster culture industry. A large bivalve hatchery was established in the Mexican state of Sonora and is contributing to oyster production in the region. This hatchery has also been successful with one of the truly underutilized and underappreciated bivalves, — the fan shell, *Pinnq rugosa*. Its adductor muscle resembles that of the scallop. Dried adductor muscles of the fan shell are sold in the apothecary shops of Hong Kong and are popular in Taiwan and Japan. The species in Indo-Pacific waters is *P. bicolor*.

Bivalve hatcheries, it would seem from all this, are now playing a significant role in shellfish culture in the tropics where an increasing number of fisherfolk are taking advantage of this new, income-increasing technology.

WANTED: Spat supplies for oyster culture in Ranong

by

Suparp Pripanapong and Hanne Kristensen

(Project Biologist, DoF, Thailand)

(Socio-Economist, BOBP)

As the Department of Fisheries, Thailand, and Bay of Bengal Programme's extension service's project for small-scale fisheries in Ranong, Thailand, draws to a close, the six years of effort put into promoting the culture of oyster, as a new means of helping fisherfolk improve their livelihood, have demonstrated that this is an economically feasible activity with considerable potential.

The various problems with culture methods and the marketing have, by and large, all been solved. Six groups of participant fish farmers have been selling their oysters (*Crassostrea becheri*) at good prices that remain stable. And the demand exceeds production substantially. (See previous articles in *Bay of Bengal News*, No 23, 1986, No. 30, June 1988 & No. 37, March 1990.)

Unfortunately, one crucial problem remains. It has not yet, in spite of intensive trials, been possible to ensure a steady and sufficient supply of spat. This has prevented spreading the technology wider in the region. (By 'spat' is here meant young oyster up to a size of about 4 cm. Such spat are transferred for grow-out onto suitable material — in Ranong the usual material is cement tubes, mounted on wooden poles and stuck into the mudflats, or ropes hung from rafts on which oysters are attached with cement).

From the very beginning, spat have been a topic of animated discussion. How and where could the Project acquire sufficient spat to supply the 45 or so members of the groups, each with 100-500 poles for culture? The Project investigated the following possibilities: a) Luring, collecting from

the wild or making purchases in Ranong Province itself; b) Purchasing from hatcheries; c) Collecting from sites outside the Province, which have an abundant spatfall of the right species.

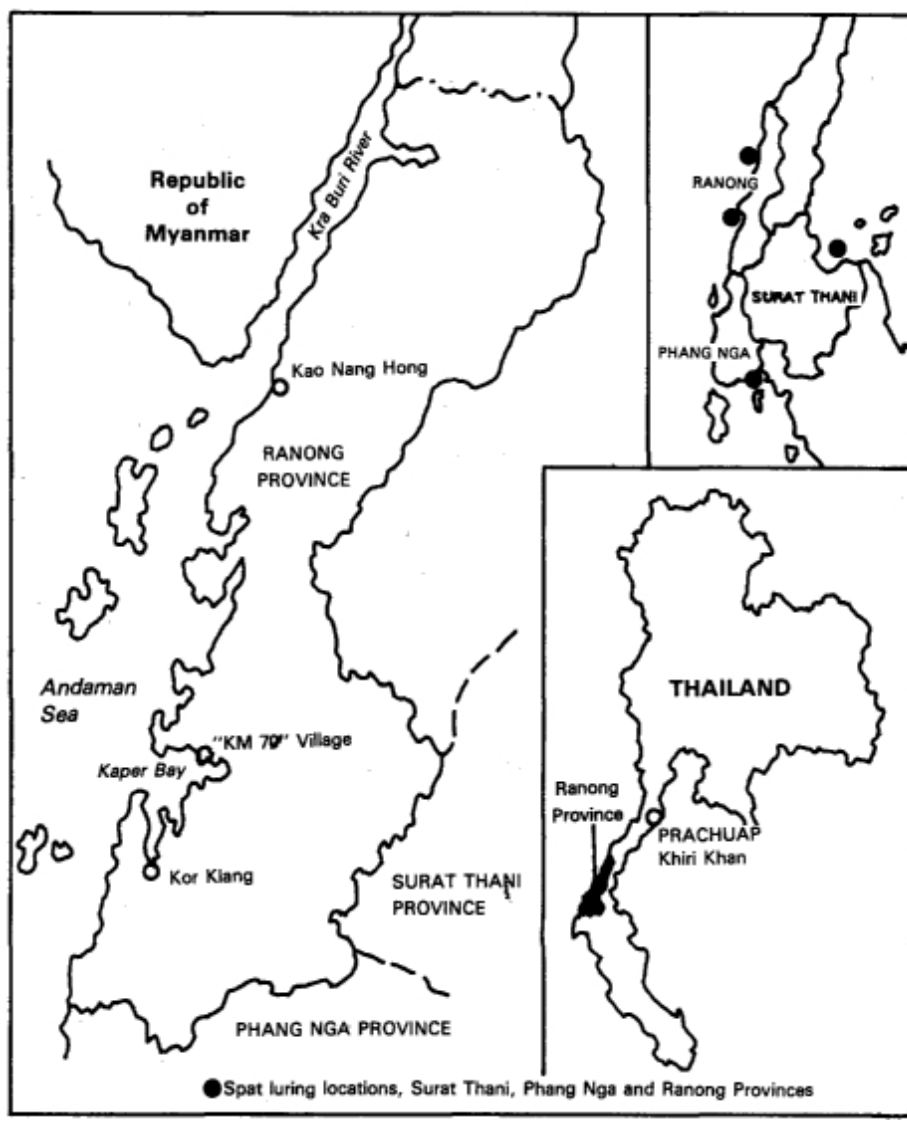
Luring wild spat in Ranong

Initially, it was planned to collect spat in Ranong Province itself, as this would be, it was assumed, the easiest and cheapest way. Accordingly, cultch (i.e. the substrate onto which young oysters attach themselves — in this case *Placuna* shell and old motorcycle tyres) was set out at five different locations

believed to be abundant in spat. At the same time, some spat were collected by the fisherfolk directly from the wild, where spat attach themselves to mangrove roots etc. This was possible in specific, protected areas with relatively calm water, such as the Kaper Bay (see map). Spat were also available for purchase in the open market (originating

Oysters from the farm are transported to the market where they fetch good prices.





from Ranong or elsewhere in Thailand), but these supplies were scarce and irregular.

After about 1½ years, the prospects did not appear very promising; only small quantities of spat had been obtained through these sources and definitely not enough to support an upcoming oyster culture project. It was wondered whether the environmental conditions in Ranong rendered spat luring there unfeasible. Greater attention was, therefore, directed towards the other sources, with which trials had been going on simultaneously.

Hatchery produced spat

Hatchery bred spat have been supplied to the project every year by the Brackishwater Fisheries Station in Prachuab Khiri Khan, on the east coast of South Thailand. These spat come in two sizes: 0.5-1 cm, which require nursing for 3-4 months before outplant, and 2-4 cm spat that could be outplanted immediately. Apart

from the fact that the hatchery is not able at present to deliver sufficient supplies to meet the greater part of the demand, the use of these spat has also been causing difficulties.

Nursing spat in the Ranong area is a problem. They cannot be nursed in open water as, even in good weather, there is a tidal difference of 4-5 m, which means very turbulent water and strong currents that virtually wash the spat away. Nursing in sheltered areas, such as lakes or ponds, has also been given up due to the very heavy rains during an 8-month long rainy season. The rains, which start in May/June (coinciding with the time the spat are delivered), cause siltation and sudden, drastic drops in water salinity during the four months necessary for nursery growth. More often than not, this has meant mortality rates up to 100 per cent.

Lunng trials outside Ranong

Trials have been carried out from 1987 in two areas, Koke Krai village in

Phang Nga Province, some 150 km further south on the west coast of Thailand, and at Ban Don Bay, Chaya District, in Surat Thani Province, opposite Ranong on the east coast (see map). The results to date are as described below:

Phang Nga

The first trials here were done using the shells of *Placuna placenta* as cultch. A lot of spat were harvested, but on transplantation at the culture site in Ranong, they were found not to be suitable, as their shells started deteriorating some 2-3 months after being attached to the cement poles. This resulted in loss of oysters. At subsequent trials, the cultch was changed to old motorcycle tyres, four or five layers tied together and hung from rafts (or under fish or shrimp cages). This has proved a much more suitable method, and a lot of spat has been obtained over the years. However, the number of spat has never been enough to meet more than a part of the needs of the oyster farming groups. The collection here was discontinued in mid-1991 as supervision was proving to be economically not viable.

Surat Thani

Three sites in Ban Don Bay were selected in November 1987 for trials, as this area was already known for its abundance of brood stock and had less tidal amplitude (the difference between high and low tide) than Ranong (about 1.5-2 m). With the assistance of three oyster farmers, cultch (in the form of asbestos roof tiles, size 15 x 55 cm) was set up. The use of asbestos tiles was, however, abandoned due to presumed health hazards arising from working with this material. Instead, split bamboo stakes of about 110 cm length were used. Only one of the sites, however, showed promising results from the point of view of settling rates.

By the end of 1989, these outside sources were able to cover only a part of the needs for spat. And to make matters worse, these spat showed very low survival and/or growth rates, mainly due to the

following factors connected with the transfer

Environmental differences: The spat transferred from Surat Thani showed high mortality rates immediately after outplant, presumably due to the considerable differences in water salinity between Surat Thani and Ranong.

Transportation: This has also been posing problems. The spat suffer considerable stress from exposure and heat during the long hours they are under way, causing high mortality rates during transport and/or immediately after transplant.

These problems have, to some extent, been overcome by ensuring that transfer of spat takes place during periods of minimum difference in water salinity between the places of collection and grow-out, and by avoiding the most critical stress factors during transport. Such safeguards are, however, only possible within limits, as purchase and transplant, to some extent, depend on the (casual) supply, which cannot always be synchronized to suit the specific conditions in Ranong. For instance, the Prachuab Khiri Khan BWFS is only able to deliver at certain times of the year.

Reliance on outside sources also raises the question of costs, as the economic feasibility of oyster culture depends considerably on spat prices. These prices vary largely according to the different sources, but, whatever the source, the purchase of spat from areas outside the Province means higher expenditures, with added costs for transportation, loss of large numbers of spat due to higher mortality etc. To this must be added the practical difficulties of the fisherfolk in organizing purchases at the right time, identifying sources and managing transportation — crucial factors for the sustainability of the culture on its own, without inputs in kind and service from either the Project or the Provincial Fisheries Offices.

Thus, by the end of 1989, the extension of oyster culture was virtually at a standstill as the problems with the spat supply had started to have a negative influence on the enthusiasm (and success) of the oyster farmers. The

annual need for spat was in the range of 200-250,000, whereas the total supply was, at best, only in the range of 100-125,000. It became increasingly clear that, at least for the time being, if oyster culture was to be a really sustainable activity for the Ranong fish farmers, spat would have to be somehow produced.

Although this had not been considered necessary from the beginning, it was now decided to put more effort into identifying the optimal sites and the seasons for spatfall of *Crassostrea* in Ranong.

In anticipation of this, the project biologist, who had, since 1989, been working on spat luring in Ranong, visited Malaysia, where, apart from getting new ideas on luring material, he was also trained in the identification of eye larvae of the relevant species.

New trials were thereafter started by him at three villages in Ranong which

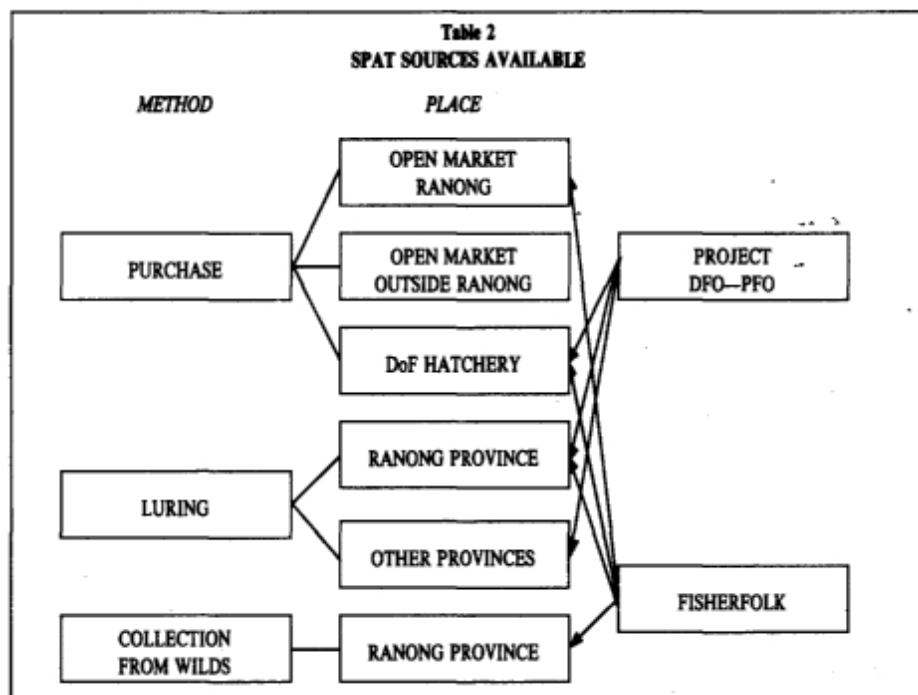
tests had shown to be the most promising. Kor Kiang and 'Km 70' village, in Kaper Bay, and Khao Nang Hong, in the estuary of the Kra Bun River, are all situated in relatively protected areas. The different types of cultch used here were: 1) poles of split bamboo, 2) small pieces of split bamboo hanging on nylon strings and 3) used motorcycle tyres. (Another material, cement-coated netlon, was tried but abandoned the cement stick to the material.)

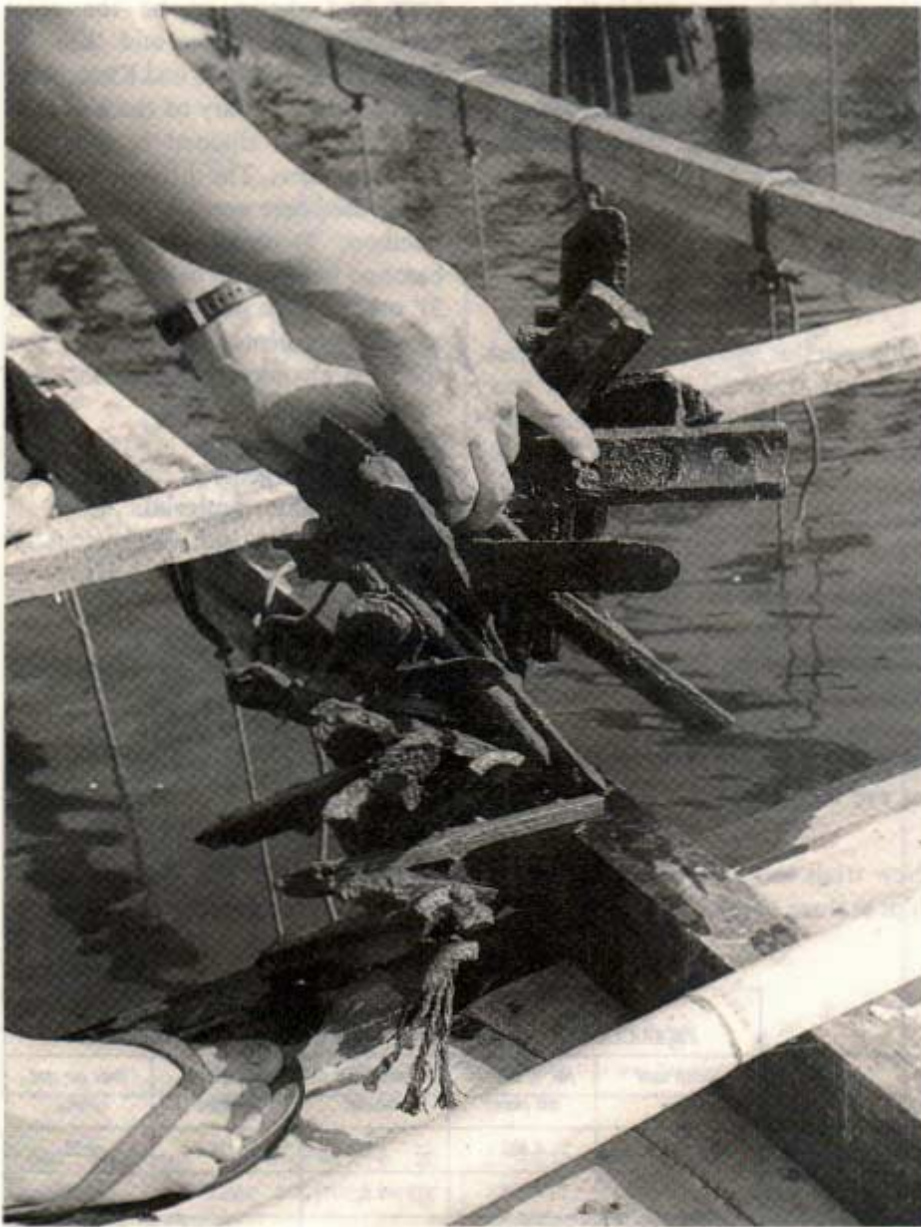
Bamboo is, in general, considered the most suitable material, as it is obtainable at low cost, the spat attach to it easily, and can, as easily, be removed for grow-out. On the other hand, bamboo only has a short life-span — that is, it cannot be left in the water for long periods, which would be preferable as then spat could be collected through the year. Further, it is becoming a scarce resource and will itself need protection in the future. Nevertheless, it was decided to go ahead with bamboo.

Table 1
PRODUCTION (1991) during spat luring trials at three locations in Ranong Province

Location	Cultch used	No. of stakes/ sets placed	Settlement/rate per stake/set	No. of spat collected	Price per spat (Baht)
Khao Nang Hong	Bamboo stakes	1,400	0.1	151	6.03
"KM 70"		4,500	0.8	3675	0.80
	Old motorcycle tyres (sets of 3)	325	2.4	779	4.83
Kor Klang		339	9.3	3166	1.19

Table 2
SPAT SOURCES AVAILABLE





Split bamboo pieces like these are hung from rafts and used as cultch in Kor Klang.

Bamboo stakes were used in Kho Nang Hong and 'Km 70'. This cultch is only applicable in shallow water and has occasionally meant loss of spat during the long hours of exposure at low tide. Also, the stakes have to be placed in an area where there is no disturbance from passing boats. To overcome the problem of bamboo's relatively short life-span in water, the Project is now setting up stakes coated with cement to see if this will enable the material to last longer in the water.

Small pieces of split bamboo have lately been used in Kor Klang. This cultch is more suitable for deeper waters. It also has the advantage of enabling easy monitoring of the setting of spat at any time (something that is more difficult with the stakes). It is necessary to construct a raft for this cultch, but it can also be

hung from fish/shrimp cages. The results with this cultch seem quite promising.

Motorcycle tyres, obtainable quite cheaply, have been tried out in Kor Klang and at 'Km 70'. The old tyres have an advantage over bamboo in that they last longer. But this cultch is only applicable in deeper waters. Also, like the split bamboo, they require a raft for hanging, which means high investment costs. These tyres can, however, be hung from already existing fish or shrimp cages, making spat collection a side occupation for those already involved with activity.

Results

The peak spawning season has been identified as May-June, at the onset of the rainy season.

No single cultch can be determined as most suitable. Its suitability is dependent on the area where it is deployed, and this is difficult to determine in advance — it must be tried out experimentally in every single case.

By end-1991, when the data from one year's trials were analyzed, the bamboo stakes showed good results at 'Km 70', with a production price per spat of under one Baht. At Khao Nang Hong, however, the method proved unfeasible. On the other hand, the old tyres proved unfeasible at 'Km 70', with costs of the spat produced as high as 4.83 Baht/piece. But at Kor Klang the results were very good, with a production price of around 1.2 Baht/spat (see table).

A monitoring of the settling rates of the same cultch in February 1992 indicated even better results.

The project biologist's view is that, the best luring material has been shown to be bamboo, in small pieces or stakes. It is cheap, and the settling rates in some areas are very good. The tyres do not attract quite as much spat.

Following the enhanced prospects for spat luring in the area, three training courses have already been given to the oyster farmers (and to others who intend to specialize in the sale of spat) on how they can lure spat themselves. One more is planned for later this year. The training has been concentrated on species identification, site selection and the various types of suitable cultch.

Despite all this training and the experience gained, the results are still not impressive. The production of spat is still far from high enough and, even though the oyster farmers continue to supplement local spat with supplies from the hatchery and from Surat Thani, the total amount of spat available continues to lag behind the demand. Although the situation is definitely much better now, no final solution is expected to be found within the operative period of the Project. In time, however, the results may improve as the efforts of the Provincial and District Fisheries Offices in Ranong continue.

Some Questions and Answers on Fisheries Management

by
Barry Pollock*

Fisheries management is an important process to ensure the sustainability of a fishery. The process tends to commence with simple input controls and may become more complex over time. The lack of good scientific information (biological and economic) is often a limiting factor, but management decisions can be made on the basis of available information. Consultation is important in the process of fisheries management. Education, surveillance and enforcement are often essential to ensure compliance.

Fisheries worldwide are under increasing pressure to provide food for human populations, employment and income for fisherfolk, as well as investment opportunities for business interests. However, fisheries are finite resources and care must be taken to ensure their sustainability both in biological and economic terms. There is, therefore, growing pressure for fisheries agencies and governments to responsibly manage the fisheries resources under their control. The aim of this article is to provide a brief overview on the scope and processes, as well as the benefits, of fisheries management, through a question and answer form.

What is fisheries management?

In the broadest sense, fisheries management is concerned with conservation of fisheries resources and the allocation of rights to exploit those resources. It may consist of agreements, interventions or regulations which control or restrict fishing activities. Some examples of fisheries management arrangements, ranging from simple to complex, are

- An agreement amongst fisherfolk to only fish in certain areas.
- Custom or tradition to only take fish in a certain way or times
- Laws which specify gear, minimum sizes of fish, protection of gravid

females, or areas closed to fishing.

- Licensing of fisherfolk or fishing vessels.
- Limitations on the numbers of fishing licenses allocated to a fishery or area.
- A quota on the total annual catch from the fishery.
- Individual quotas allocated to each fisherperson.

What is the purpose of fisheries management?

Fisheries management enables communities and governments, together with their fisheries agencies,

Fisheries management can ensure the biological and economic sustainability of a fishery.



to have control over a number of important factors:

- The exploitation, conservation and sustainability of fisheries resources.
- The profitability of the fishery to fisherfolk.
- The way in which the fisheries resource is allocated amongst the community.
- The need to address wider social issues, such as unacceptable fisheries methods and by-catch issues – the dolphin issue, for instance.

The alternative to fisheries management is free access to the fisheries resource by all interested people without any limitation. In such situations, there is a proven tendency for excess fishing capacity to be directed at the fishery, with a consequential decrease in the catch of individual fishermen. As a result, the profitability of the fishery decreases and fish stocks become depleted.

What are the stages of development of a fishery?

All fisheries are based on finite resources, although in some cases the fish stocks which support a fishery may be large. As the level of fishing effort (number of fishermen, gear improvement etc.) increases, the fishery can go through a series of stages:

1. Resource to total effort ratio high: At this stage, individual catches are at their peak; incomes are generally high; the stocks are healthy.
2. Resource to total fishing effort ratio medium : At this stage, the catches of individual fish have been reduced; incomes and profitability are reduced; the stocks are relatively healthy because catch per unit effort (CPUE) is reduced by increasing effort and not by changes in stock abundance.
3. Resource to total fishing effort ratio low : At this stage, the catches of individual fish are further reduced; profits and incomes are low; stocks are reduced in abundance.

In most fisheries, the fisheries research agencies, fishermen and others closely associated with the fishery would generally be able to predict the stage of development of the fishery in terms of 1 to 3 above. It is important to note

that precise data on the fishery is not always essential to gauge the general stage of development of the fishery, and, hence, whether there is need for fisheries management.

How much scientific information is needed to manage a fishery?

It is a widely held fallacy that a great deal of scientific information and statistics are necessary before fisheries management can be implemented. Fisheries management can be introduced whenever the government/ministry/sector believes there is a need. The most important factor is to know why such management is being introduced. In other words, what are the objectives the Government is trying to achieve? Lack of detailed information should not be used as an excuse to withhold fisheries management. Fisheries management can be introduced at any given time based on the available information and consultation. As more information comes to hand, fisheries management arrangements can be altered. For example, permitted gear can be changed, the number of licenses can be increased or decreased, quotas can be altered. Experience has shown that there is never enough information to cover all the requirements for fisheries management decisions. Fisheries management is about making the best decision based on the information available.

Who decides on fisheries management?

It is normally the role of governments to determine whether fisheries management arrangements are necessary in a particular case. However, fisheries management normally involves a consultation process including government, ministry officials, researchers, fishermen and their organizations, and, in some cases, the supporting infrastructure (e.g. the marketing sector, boat-builders etc.).

It is usually the role of fisheries departments to facilitate the process of fisheries management. This often includes consultation with the various interested parties. The skills necessary for those involved in the process of fisheries management are diverse and could include backgrounds and abilities in the following areas:

- Communication and negotiating skills.

- Good understanding of the fisheries from a biological, economic and gear technology viewpoint.
- Understanding of the legal framework for a fisheries management.

What is the best way to manage a fishery?

There is no single “best way” to manage a fishery. The way that a fishery is managed depends primarily on the goals which the government sets for its fishing industry, together with the goals and needs of the whole fishing sector. Hopefully, the key issues of resource conservation and the equitable economic needs of the fisherfolk will be a primary concern.

The way that a fishery is managed usually changes over time, depending on the country goals for the fishery and the goals and needs of the sector. In cases where the sustainability of the fishery is doubtful, fisheries management is about the conservative allocation of fishing rights to certain people and the possible restriction on gear, fishing areas etc. Access to the fishery may need to be limited by licensing arrangements or by quotas.

The fisheries management plan which is finally accepted after the consultation process and endorsement by the minister/government will normally be an acceptable compromise, taking into account all viewpoints and the interests of all parties. It will contain elements which are directed at both the need to conserve/maintain the stocks at acceptable levels as well as the need to ensure reasonable catches and, hence, reasonable incomes from the fishery.

What are the legal aspects of fisheries management?

The constitutional and legal framework of the country determines the types fisheries management arrangements which may be introduced. It is not uncommon for the legality of fisheries management arrangements to be challenged. It is important, therefore, to understand the types of fisheries management arrangements that can be applied to a fishery from a legal viewpoint. The options for managing a particular fishery by way of licensing and limitation of licenses, quota allocation, closed areas or seasons etc. may be restricted by constitutional and legal requirements.



*Consultation is an important part of the fisheries management process.
Fisheries Ministers have a key-role in fisheries management.*

What are the enforcement aspects of fisheries management?

Although fisheries management arrangements are usually determined after consultation and agreements, resulting legislation will not always be observed and complied with. It is essential that the industry be continually made aware of why the fisheries are being managed. Education is a key element. It is also essential that sufficient enforcement and surveillance capacity be available (*e.g.* fishery inspectors or police) to ensure that the fisheries management legislation is complied with. In addition, the capacity for prosecution for breaches of the fisheries legislation should be available.

What are the elements of a fisheries management plan?

All fisheries should have a "fisheries management plan". Such a plan may not be consolidated into a single document, although there is a trend for fisheries agencies to publish statements of management plans.

The essential elements of a fisheries management plan are:

- The objectives of management.
- Definition of fishery in terms of area, species and gear.
- Rules for access to the fishery (licensing rules) for fishermen and/or vessels. Licensing rules normally indicate the duration of the license, renewal arrangements, transferability and fee.
- Input/output controls. Input controls cover matters such as permissible gear and areas, protection of certain portions of stocks (*e.g.* juveniles or gravid females), replacement policies for vessels. Output controls cover allocation of quotas.

Other matters which may be dealt with in a fisheries management plan include

- Reporting requirements (*e.g.* log books).
- Statement on the current knowledge (biological, economic, social) of the fishery.

- Interactions and overlaps with other fisheries.
- Methods of arriving at the management plan, including the consultation process.
- The legal framework of the management plan.
- Review arrangements for the existing plan.

It is often very useful to distribute the fisheries management plan to interested parties as a statement on the status of the fisheries and its management arrangements.

* The author is the Director, Fisheries Branch, Queensland Department of Primary Industries, Brisbane, Australia. He has been with the Fisheries Branch for 20 years and been involved with the development of fisheries management in that State. The largest and the most important fisheries in Queensland are now managed as limited entry fisheries, with strict gear and area controls. Industry consultation is highly developed. A logbook programme was introduced four years ago and covers all fisheries. Dr Pollock was recently invited to lead an FAO/UNDP Project preparation mission on fisheries management to Sri Lanka.

Extending the message of resource management in the Maldives

The Maldives is preparing for conservation of its fishery resources. It is a vital concern of this island nation whose economy is largely dependent on the income from fisheries. Even the tourist industry, which is another major source of income, depends on fishery resources, since they are a major attraction for the visitors.

National leaders and organizations generally fail to recognize the need for marine resource management before depletion sets in. Quite simply, when things look good, people have little incentive to reflect on the well-being of future generations. It is a rather exceptional step that government agencies in the Maldives have taken, addressing the issue at a time when there are few signs of serious depletion. There is, in fact, little data suggesting that overfishing is currently posing any

problems in the Maldives, but it is obvious that if the present population growth of 3.7 per cent a year and the rate of resources usage continue to increase at the present rate, the resource would, before long, become an issue of concern.

The Ministry of Fisheries and Agriculture (MOFA), with the assistance of the Bay of Bengal Programme (BOBP), has initiated an awareness building exercise towards tackling this concern. The programme aims at getting the fisherfolk to think in terms of difficulties which might occur in the future, but which are not always evident in the present.

In December 1991, thirty fisherfolk and some senior government officials met in the southern atoll of Meemu for a two-day workshop. The idea was to

encourage the fisherfolk to share their knowledge with the government authorities and articulate in the dialogue their ideas on how best to safeguard valuable reef resources. Short, formal presentations were followed by lively discussions in smaller groups. The workshop relied, to a large extent, on the fisherfolk identifying problems, needs and opportunities.

It became clear that the traditional belief of the Maldivian fisherfolk is that the reef resource will exist undiminished forever. The sea is taken for granted; it has never really been supposed that it is possible to reach a point of overutilization.

In recent years, however, the fisherfolk in some parts of the Maldives have had to face the unpleasant fact that rapid

At an evening meeting on one of the targetted islands. Charts are used to communicate with the participants.



exploitation of particular fish has threatened to lead to complete eradication of the species. The beche de mer and giant clam fisheries are cases in point.

The workshop participants showed apprehension over such localized over-exploitation which threatened their natural environment. But how were they to care for these valuable assets that needed both preservation and conservation?

The opinion expressed by MOFA and BOBP was that reef resource management could only be successfully implemented by fisherfolk and the authorities teaming together. This raised the question: How were the islanders to be persuaded to act in the common interest?

The answer lies more in education and less in law enforcement. Only by providing them accurate information, based on sound scientific analysis, can the fisherfolk be persuaded to play an active role in ensuring a sustainable utilization of the available reef resources. Keeping this in mind, the MOFA extension unit has planned

a sustained awareness building and information programme for 1992. This programme takes a dual approach: the generalist, or multi-disciplinary, approach takes an overview of reef resource management, while the more specialized in-depth approach aims at specific species under threat.

Implementation is taking place on fishing islands in the Vaavu and Meemu Atolls in the south. Illustrative and explanatory posters have been prepared, taking into account that constructive discourse depends to a large extent, on the recognition of the thinking, knowledge and perceived constraints of the receivers. Hence, the planning process entails the translation of what has been learnt from past and current activities in the field. A series of short radio programmes has been broadcast, with MOFA staff involved in the production. Through these means it is intended to extend the reach of information to fisherfolk on islands other than the ones targeted for the project.

In May 1992, the MOFA-BOBP team set out on its first visit to the selected

islands. The beche de mer fishery was the focus of its attention. The rapid depletion of the sea cucumber in several atolls in the Maldives in a very short time served as a powerful illustration on how a particular resource can be depleted quickly through uncontrolled fishing and short-sighted financial interest.

The team met both the men's and women's development committees on each island. At these meetings the topics were introduced in a fashion aimed at provoking discussion and reflection rather than at providing readymade answers.

The topics of legislation and implementation of the laws aroused much debate among the islanders. It was felt that in order to make legislation effective, awareness building was essential. As one committee member pointed out:

"We cannot rely on the government to do everything. We also have to contribute our share by accepting responsibility to learn to manage the reefs and its resources."

A.M.H.

Charts also find a prominent place at an open air meeting with members of the Development Committee.



A SHARK-RUSH IN PURI

And the BOBP-developed beachianding craft are sought after again

by Thomas Dahigren

Photographs by S. Jayaraj and Thomas Dahigren



Pentakota fishing village, near Pun in Orissa, is one of the biggest and most dynamic fishing societies in the Bay of Bengal. Its fleet of around 1200 traditional *teppa* and a hundred or so beachlanding craft (BLC), strengthened seasonally by visiting *nava* from Andhra Pradesh, has been supplying fresh seafood not only to Pun, Bhubaneshwar and Cuttack but also, to a great extent, to Calcutta and Delhi. It has, however, never enjoyed such prosperity as in the past year or so, when a shark-rush has been turning into a virtual gold-rush. And that's making the BLC a much sought after craft once again.

The main reason for this shark-rush is the increasing demand and rising prices for dried sharkfins, much in demand in the Singapore market. Around 2000 Rs/kg is paid for dried fins in Pun. There is also a growing market for shark meat in various parts of India and this too contributes to the good prices.

Estimating landings in Pentakota is tricky, as the fishermen and dealers in shark products are secretive about their earnings. But a realistic estimate is that until the end of March 1992, more

than 500 tonnes were landed in the past year, valued at more than ten million Indian rupees! Earnings from a single trip are often as high as IRs 30,000, and average catches are around IRs 10,000. With figures like these bandied about, there's a Klondike feeling to Pentakota. And just as in those gold-rush days, this Orissa village is not much more than a camp with little

=IRs.29appx.

The beachlanding craft of Pentakota, Orissa.





investment in permanent fixtures. Most of the earnings have, so far, been put into properties in Andhra Pradesh, from where Pentakota's hardy fisherfolk originally hail.

Fishing with the fleet

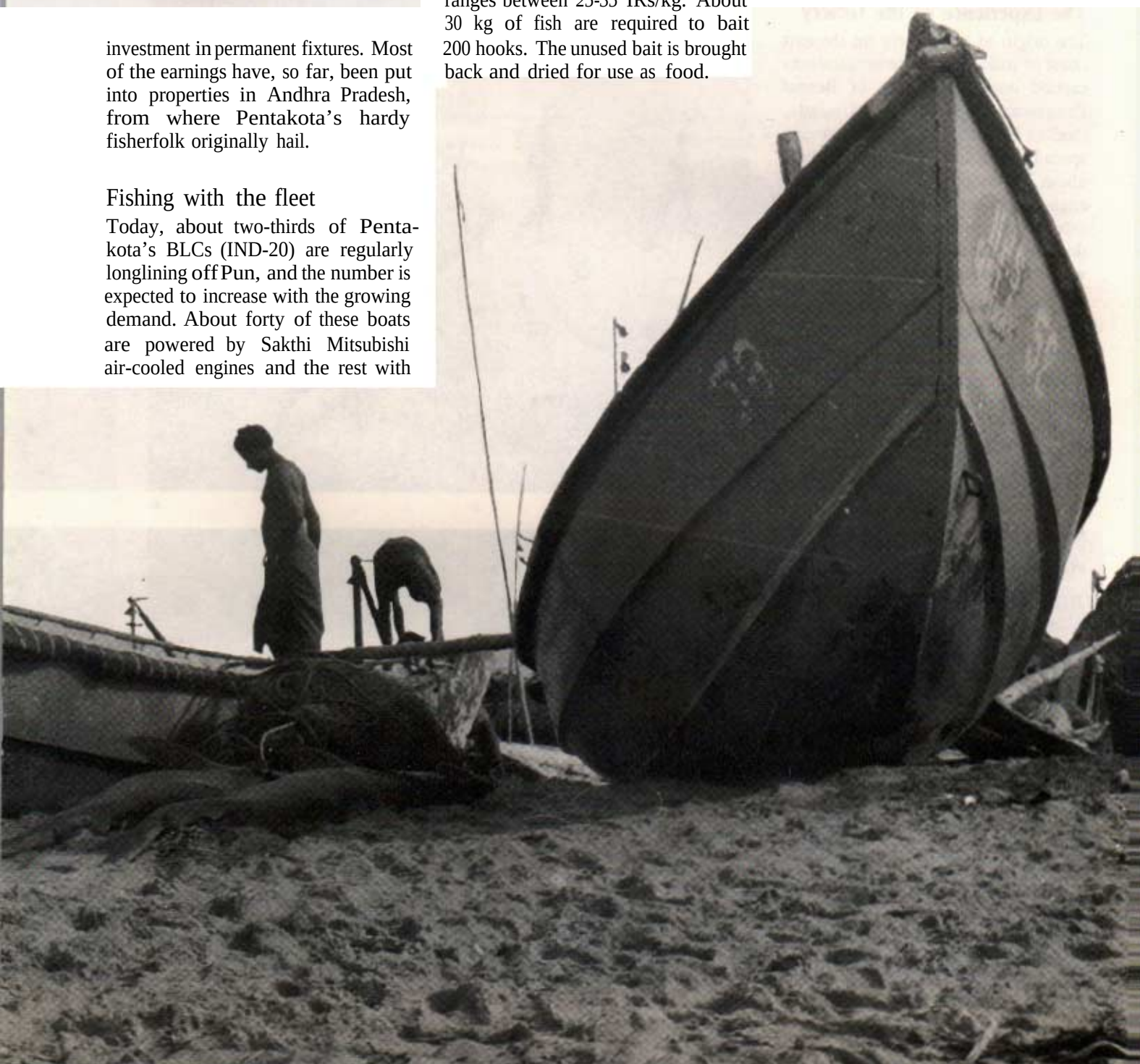
Today, about two-thirds of Pentakota's BLCs (IND-20) are regularly longlining off Pun, and the number is expected to increase with the growing demand. About forty of these boats are powered by Sakthi Mitsubishi air-cooled engines and the rest with

Sakthi Mitsubishi water-cooled engines. Sails are used without exception — to increase speed, save fuel and in cases of emergency, such as engine breakdowns. Because of overheating, the air-cooled engines are run at low RPM, resulting in a speed of about 4 to 5 knots.

The BLCs put out to sea during the day and the drift longlines are shot at sunset in deep sea areas 25-50 n miles from shore. Small mullet (20-30 cms) is the preferred bait. To keep the bait fresh, it is often stored with ice in palmyrah baskets on the way out. It is cut in half before being put on the hooks. The price of the bait depends on the availability and demand, and ranges between 25-35 IRs/kg. About 30 kg of fish are required to bait 200 hooks. The unused bait is brought back and dried for use as food.

The lines are hauled in at dawn after a soaking time of about 11 hours. Before each shark is taken aboard, it is secured with a sling round the head and stunned with a blow on the head delivered with a heavy wooden club.

The minimum duration of a trip is about 36 hours. Sometimes more than one night's fishing is carried out and some trips even last three or four days. This depends on the first night's catch. Strong currents and poor positioning of the boats very often result in boats reaching the shore far from Pun. It often happens that as many as ten hours are wasted getting back to Pun.



The catch ranges from no shark to about fifteen shark a trip. The catch is usually kept in the nethold or, because of lack of space, on deck. Ice is never used in the BLCs to preserve the catch. The quality of shark landed is, nevertheless, acceptable.

As soon as the shark are auctioned, they are slaughtered and the fins cut off. The guts and heads are left on the beach. The liver is rarely retrieved. The fins are dried and sold to middlemen in Calcutta and Madras who deal with the Singapore market. There are sometimes as many as ten buyers seeking shark products in Puri. The meat is salted, partly dried and transported, mainly to Kerala.

The experience of the fishery

The origin of this fishery on the east coast of India was the demonstrations carried out by the Bay of Bengal Programme (BOBP) in Uppada, Andhra Pradesh, in 1986. The learning spread to nearby Kakinada, where about 150 motorized *nava* have been engaged in the fishery since then. The extension work in Puri was, however, done by some of the *nava* fishermen, who migrate to Onissa seasonally.

The Puri season starts in December and ends in May/June, with January to April considered the best months, mainly because of good weather conditions. But as the fishery is still developing, these are not yet established timeframes.

With the increasing confidence of fishermen in the BLC, because of its more reliable engine and better

PICTURES ON RIGHT:

1. *Fishermen of Pentakota prepare their longlines.*
2. *A beachlanding crafti (IND-20) puts out to sea on a fishing trip.*
3. *A handsome haul of shark is auctioned on the Pentakota beach.*
4. *The shark are shed of their fins on the beach itself. In the background, a BLC is hauled ashore.*
5. *After its fins are removed, the shark is cut into chunks.*
6. *The shark meat is then taken for proce&cing.*
7. *The meat is soaked in brine*
- 8 *and then sun-dried*
- 9 *like the fins.*



1.



4.



7.



2.



3.



5.



6.



8.



9.

performance, they will most probably stretch operations beyond these months.

The crew of a boat usually consists of five or six fishermen, but rarely includes the owner. This leads to negative repercussions on the boat and poor engine maintenance by careless or non-motivated fishermen who are paid on a share basis (50 per cent for the owner, 50 per cent for the crew) after deduction of the total running costs.

Drift longlines are often lost due to ships and large shark. Sometimes the fishermen connect their fishing gear and tie the longline between boats at each end to reduce the risk of loss. This is also done for safety reasons, especially when the boats belong to the same owner.

Not much of interference with other fisheries has been reported.

The preferred craft

A BLC when it puts out to sea carries, besides crew and their necessities for three days, 6 km of mainline and 200 hooks. On its return, an 8.5 m IND-20 could be bringing back as many as 15 shark, each of about two metres length and around 50 kg weight. That's quite a load — and the IND-20 is the smallest possible craft capable of coping with this kind of operation. With its greater beachlanding ability an additional positive factor, it is not hard to see why it is the preferred craft of the Pun fishermen.

This had led to a revival of interest in BLCs after a decline due to technical problems and decreasing catches of demersal species. What we see now is the BLC being used as it was meant to be used — for offshore (deep sea) fishing. This has brought not only new investment in BLCs but also fresh inputs to improvement of the craft.

Demonstrations in March 1992 of a new liftable propulsion system using rubber bellows, instead of an engine box, gave better speed. This system, together with an improved water-cooled engine, also resulted in fewer overheating problems. Before long, this led to new orders for BLCs at boatyards in Pun. These demonstrations also generated interest in improved hooks of better construction and quality (Mustad Tuna Hooks

No 10/0). These were later imported in quantity from Singapore with the assistance of BOBP.

But there's concern, too

The success of the shark fishery, however, is tinged with concern over questions of sustainability. Elasmobranchs populations are known to be sensitive and there are already examples of overused resources. The bulk of shark caught by Puri fishermen comprise of silky shark (*Carcharhinus falciformis*) and some scalloped hammerheads (*Sphyrna lewini*). Swordfish and sailfish are also occasionally caught, but are considered of low value.

These shark, being viviparus, give birth to comparatively few young ones — only 2-14 in the case of the silky shark. This is the main difference compared to most bony fish. And this is what makes firmer and better management

and monitoring necessary for an offshore pelagic shark fishery.

During this initial period of drift longlining in Pun, there has been no monitoring of either landings or fishing efforts. But this is necessary if a sustainable shark fishery is to continue to thrive in this area. Management measures also need to be introduced.

Below: The dried shark meat is packed and loaded in lorries for the long journey to Kerala.

At bottom of page:

The overseas market for sharkfins and the Kerala market for shark meat have created a shark-fishing boom in Pentakota. And to meet the shark demand more BLCs are needed. The boatyards in Pun are busy once again building BLCs — which are now being used as they are meant to be.



Ramnagar Block I is in the extreme south of West Bengal, about 200 km from Calcutta. The Indian Institute of Management, Calcutta, did a survey of the area in late '88 and early '89 and estimated the population of the block to be around 120,000. No river flows within, or by the side of, the block, but there are some big canals connected with the sea, with sluice gates at their mouths. These canals are mainly used for drainage purposes. The water in the canals remains saline except during the rainy season and fry catchers eke out a living from these waters. The cultivable land is mostly mono-cropped, irrigation systems are few and far between. The economically weaker section and the landless people of the lower and scheduled castes are mainly involved in the shrimp fry catching. There has been an increasing number of such households involved with this activity over the last ten years. Most of the catchers have work for eight months, during a November to June season, with a peak period from January to May.

There are no local middlemen to buy the catch. Most of the middlemen come from North 24 Parganas, where shrimp culture is concentrated. These middlemen, use local agents to buy fry from the catchers. Due to the non-existence of shrimp culture in the local area, there is no local demand for shrimp fry. On the other hand, the

outside middlemen are so well organized that they leave no scope for the catchers to bargain or to supply their catch directly to the *bheri* owners or sub-agents. The catchers of Ramnagar have, therefore, long been at the mercy of the middlemen. One of the objects of our Project was to find a way out of this.

To catch, sort and preserve the catch, the fry catchers of Ramnagar have customarily used traditional household goods. Their nets are made from pieces of nylon cloth used as mosquito nets. They use aluminium pots, bamboo, dishes, spoons and shells for collection, preservation and counting.

Their activity was also becoming a real threat to the survival of a number of other species. The fry of mullet, sea bass, other varieties of shrimp, and so on were being caught in the nets as by-catch. The catchers, however, wanted only the fry of the Tiger Shrimp, *Penaeus monodon*, and did not always return the other species to the water. The wastage was very high compared to the catch of shrimp fry. Hence, another of our objectives was to spread ecological consciousness among the fry catchers and save the other species.

The beginning

SANLAAP got involved with the Project in late 1989. Our initial task was to organize an Awareness Camp to discuss the overall status of fry

catchers, facilitate the process of mobilization and organization building and select the beneficiaries from the villages of Ramnagar and Barsolemanpur. The Fisheries Department Brackishwater Division at Ramnagar introduced us to some villagers and after several rounds of home visits, we identified 14 couples for the first phase of the cage culture project, all fry catchers and most of them landless. A cage was assigned to each couple. Although the priority of SANLAAP lies with women, we opted for this arrangement because it best suited the culture of the people involved: Women do the feeding and cleaning better, whereas men provide the night watch. The work was thus divided. Moreover, we thought the Project would, through this means, gain wider acceptance among the men, who would not feel left out.

We first met with those selected in a camp in December 1989. The Fisheries Department allowed us to use their Training Centre at Ramnagar for a week. We talked about cage culture, collective economic enterprises and various community development activities. Puppetry, skits and songs broke the monotony of long sessions and made the camp a lively one. Meanwhile, out on the lawn of the Training Centre, Henrik Nielson, the BOBP aquaculturist, busied himself with nets, bamboos and iron frames. Under his guidance, the participants were taught to prepare their own cages. BOBP made the materials available to them free of cost, but the emphasis was on simple materials that would be easily available locally at any time in the future, such as plastic drums, nylon nets, iron frames, bamboo and ropes. Making a cage with such materials was a bit of a surprise to all of us. Some of the participants later told us that they even thought it was all a bit of a joke.

Participants were then taught how to measure the salinity of water, clean the cages, feed the fry and do the sorting. They were also advised to put a portion of their catch in the cages, raise them to the juvenile stage and then sell them at a higher price.

Learning by trial

All of us watched the lowering of the first cage in the canal with excitement and pride. Several hundred *P. monodon* fry were stocked on a trial basis to study the survival and growth

Rinara (below left and on page 24) paddles her way to a canal near Ramnagar to catch fry. She is accompanied by Kabita.



rates in the canal at Ramnagar. After a couple of trials, the beneficiaries were encouraged to stock fry in their individual cages.

As the fry catchers live on the earnings from their catch, BOBP provided loans to stock the cages. SANLAAP also gave them loans to buy new nets. The beneficiaries agreed to pay back the loans in instalments whenever the juveniles were sold.

We were soon faced with a number of very human problems and, of course, learned something new each time.

- Crabs damaged the nets in a very short time and we had to replace them with different ones of better quality.
- Natural calamities, in the shape of sudden heavy rain, killed the fry a couple of times. “
- The total procedure was not taken very seriously by some of the participants; several of them either did not clean the cages properly or failed to provide feed regularly.
- We were most upset by a series of thefts that took place in the absence of a proper night watch. Some floats were found missing. And fry had also disappeared from cages.
- Being used to misuse of public funds, some of the participants did not take the repayment of loans seriously.

The expenses mounted as a result of all this and so did our tensions.

Additional problems were caused by the local agents who collect the fry for the middlemen. These agents also act as money-lenders and the fry catchers take loans from them before and during the season on condition that they sell their catch to the particular agent, who deducts the loan with interest from the price paid for the daily catch. The agents did not appreciate the idea that the fry catchers were stocking their cages with a part of the catch, instead of seffing it to them. They attempted to discourage the participants and so we had to try and convince these agents that they could buy the juveniles and get a better price and profit for them.

All these problems caused the majority of the participants to lose interest in the Project, but three couples lasted the

course and not only raised juveniles successfully but also made a good profit. They have now done so several times and have proved, to a great extent, the economic viability of the Project.

Nielsen's video on similar activities at Magnamapara in Bangladesh revived the interest of the participants. They were also lured by the 'lure line' system he introduced. This simple method to catch fry during the tides suits women and children well. Hitherto they had to stand in the deep water of the canal for hours to make the catch with hand-held scoopnets. But the new method has not only reduced their long working hours but also ensured a better catch.

In search of markets

The participants have till now been, for the most part, trying to sell the juveniles to the local agents and the government. But a bigger market is essential if the project is to thrive. Their profits will not improve unless they can sell the juveniles directly to the *bheni* owners through their collective effort. But for this, there has to be regular production.

SANLAAP's eventual objective is to set up a fry catcher's co-operative and

ensure that the profit stays in the hands of the villagers by eliminating middlemen. SANLAAP would also like a portion of the profit to get channeled into different community development programmes, such as education and health services.

For the collective good

Even as we drew up plans for the future, we began taking some action in the present to improve the social lot of these fry catchers. We had met several young girls who were not attending school and were loitering in the village when they did not have work in the house or the canals. We found that they were interested in going to school, but classes were held at a time when they had to collect fry or cook for the family.

Several of them used to cling to us at the Awareness Programme. And we, in turn, fell in love with these little girls who slogged all day long, day after day, and felt that we had to do something for them.

The turmoil of initiating something new began all over again. To start a school, get teachers, find some space in the village, bring mothers to the

Rinara and Kabita on their way to net tiger shrimp fry in a Ramnagar canal.





When work is done, Rinara and Kabita discover the joys of reading at a SANLAAP-run centre.

centre, and encourage them to send their girls to the school — none of this was easy, but it all happened.

Once the school started, and the children began playing, drawing and reading, we did not need to persuade them or their families any more. They all became interested. Now the teachers needed training and we arranged for that. It wasn't long before the Panchayat and Block Development Officer began to appreciate our efforts. Now we are planning new schools in adjoining villages.

We also started an adult education centre in the last quarter of 1990. We initiated an informal education process to develop awareness and allow people to gain confidence in themselves. We had constantly been trying to make people understand what was going on, had encouraged their involvement

and helped them to assume responsibility. They now selected a local graduate to teach them on alternate evenings. The women were quick to learn to read and write. A lot of emphasis was put on functional literacy. Soon the Adult Education Centre became a sort of a forum for the fry catchers, who sat together at regular intervals to discuss the progress of cage culture.

We have also been able to organize the beneficiaries and a number of other fry catchers into a Mahila Samiti. Through a series of one-day camps, we have tried to raise their consciousness about the overall status of women in our society. We are now planning a lot of alternative economic activities around inland fish culture, such as net-making and mending, handicrafts from sea shells and so on. This year we are also trying to raise carp in a small pond taken on lease.

Interaction with the Panchayat

Although the Panchayat approved the selection of the beneficiaries and allowed us to use the premises of the primary school for the Adult Education Centre, our relations with it were formal and distant for some time. But the activities of BOBP and SANLAAP, and especially of the adult and pre-school education centres, gradually caught their attention. The Panchayat Sabhapati, along with the Block Development Officer, visited our centres on their own and that broke the ice.

Now the Panchayat has helped us with the selection of beneficiaries in Joshipur and Quliatta (both in the Ramnagar area) for the second phase of the cage culture project. It has also taken an interest in the economic activities planned for the Mahila Samiti (Women's Committee) members at the Panchayat and Block level. The support of the Panchayat has made our efforts easier.

Looking back, looking forward

The first months were undoubtedly difficult. The teething problems of selection of participants, the non-cooperation of some villagers, disturbances caused by some participants, all these caused us heartache. But continuous visits and close contact with the villagers have removed many of the barriers and brought us closer together. We may have squabbled at times, but we soon forgot each other's faults and tried to do things better the next time around. The result has been an established cage culture Project, an adult education centre and a pre-school programme.

Now the old group is getting ready with their cages to do better this season and a new group is getting acquainted with a new skill. At last, we and the villagers have learned to have faith in each other, and the local gdn\inistration and the Fisheries Directorate have begun to have faith in both.

Endeavours like ours, assisted by programmes like the BOBP, may be small, but we have seen how they can bring some improvement in the economic conditions and self-respect of the poor and provide them with some education and enlightenment so that they get a little more knowledge and a little more income. With these they can stand on a little firmer foundation and look forward to a better life.

Sharing Learning

A study tour to Bangladesh

The Bay of Bengal Programme (BOBP) recently helped us organize a trip to neighbouring Bangladesh to visit with UBINIG, a local NGO, and study a shrimp fry cage culture project it is helping with. It was intended that SANLAAP and UBINIG could share experiences and learn from each other.

At Magnamapara, in southern Bangladesh, where BOBP and UBINIG have been working on the project, we first met with ten fry catchers. The group was well organized and its members had a good understanding among themselves. They were ready to experiment together, without seeking immediate benefits. The group had selected a watchperson from among its members and pays him well. Last year's cyclone had swept away their cages midway during the season, but, undaunted, they have now started all over again.

This group's experience was a little different from ours. They had constructed and structured the cages as a team, whereas, in West Bengal, we had allocated the cages to individual couples. We are now thinking of experimenting with the Bangladesh method, whereby fry are put in the cages jointly and the daily cleaning and feeding is done according to a roster drawn up by the group.

The work is neither full-time nor does it meet all their needs. Hence, most of the group also catch fish for sale in the local market. A few of them work as agricultural labour. Most of the men also make dry fish.

UBINIG has been successful in getting the wives too involved in the cage culture work. They now prepare the feed for the shrimp and mend the nets as and when needed. UBINIG is trying to organize these women into groups to undertake other activities, UBINIG's women members have attempted to interest these women in education and awareness, but most discussions at present lead to the consequences of the last cyclone. The women appear interested only in economic relief programmes.

Magnamapara now has a local school, restored and run by UBINIG. It is well supported by the local people and it was good to see a large number of girls attending classes. There is also an active Mahila Samiti (women's committee) here.

Meeting with UBINIG staff, we discussed their approach to development in the area. We had heard of other groups coming into the area to work and felt they could affect the work already done, or the work planned, by UBINIG. A UBINIG member explained how UBINIG's emphasis is on Action Research: if any other organization wants to pick up the threads thereafter, UBINIG has no problems with that. But they would not wish anyone to spoil the ongoing research.

From Magnamapara we returned to Cox's Bazar by way of Maheshkhali, where UBINIG works with the Rakhain community from Myanmar. We were very impressed with the beautiful handicrafts done by these women.

In Chittagong, we visited with the Community Center for Development (CODEC) and were taken to a village of the

'Jaladas' community, who are traditionally fishermen. CODEC has educational as well as economic programmes for this group underway in three or four villages by the sea.

We visited a non-formal and a primary level school being run by CODEC. We then talked with the women of the villages and found a strong sense of community among them. There were fewer Muslim and more Hindu women in this group. Their men catch fish while the women mend nets or sell fish. Some of the women have been given loans for petty businesses and are involved with poultry, duck and goat rearing and vegetable vending. The women have a 'savings' scheme, to whose common kitty all contribute and from which they take loans when needed. This is much appreciated by all the women.

CODEC also has a Health Advisory Programme, but the need is a proper health programme. We saw cases of vitamin deficiency and skin diseases. CODEC is trying to get a doctor to visit the villages regularly, but without success so far.

CODEC showed us the work they've been doing with an ice box developed by BOBP's Post-Harvest Project to store fish. We also discussed the Post-Harvest Project's fish container programme with the village women involved in fish vending.

Back in Dhaka there was a workshop where we discussed our experiences with UBINIG. Their work experience was important to SANLAAP. We shared our experiences of working with individual couples (in cage culture) and discussed the advantages of working with a group.

UBINIG suggested that we get into some simple research on cage culture, as the findings in the two countries would make an interesting comparison. We requested UBINIG to frame a questionnaire based on:

- the present involvement of BOBP and SANLAAP/UBINIG;
- its effect on women and men as an economic programme;
- how the middlemen could be eliminated;
- the necessary economic support;
- the time and involvement of BOBP/Groups to make it successful;
- direct and indirect benefits;
- parallel programmes on education/income-generation! women's issues/savings etc; and
- the involvement of Governments, NGOs, banks, umons/panchayats etc.

Out of this learning, we hope, much benefit will emerge, especially for women.

I.S.

The Hope that Extension Offers the Fisheries of Bangladesh

by Rathin Roy

Summer in Bangladesh is, in the best of circumstances, a time of despair, yet, strangely, it is a time of hope as well. The winter crops are being harvested and there is work to do, but the oppressive heat and sudden storms bring despair and destruction. It is the time of water shortages and diarrhoea, but the darkening clouds bring hope. Preparation for planting begins in the hope that the monsoons will come. It seemed, therefore, an appropriate time to gather around to reflect on what fisheries development (or, to be more precise, the role of fisheries extension in development) should have been and was not and what it could be and how.

A destructive tornado and a mini-diarrhoea epidemic notwithstanding, the Bangladesh Department of Fisheries (DOF) brought together at a 3-day Consultation, late in April, about sixty people from every agency and level of fisheries development to discuss fisheries extension. The meeting, supported by the Danish International Development Assistance (DANIDA) and the Bay of Bengal Programme (BOBP), was, as such meetings go, unusual in many respects. First, not only was every government, donor and non-governmental agency concerned with fisheries development involved, but so were various levels within them — the meeting included the whole range from the Secretary of the Ministry of Fisheries and Livestock to Fishery Assistants and women's group supervisors. Secondly, there were no papers presented. Except for a few briefings and a short field visit, the whole time was spent in group discussions. Thirdly, there was none of the pomp and ceremony that has come to be accepted as a norm for such deliberations. Lastly, there was no pressure to come up with a consensus or a model of fisheries extension — a dream, given the variety and



Field visit by participants to meet fish farmers running a village scale fish hatchery.

complexity that exists in fisheries and among fisherfolk.

Why Consultation?

Why was the Consultation called in the first place? Fish is central to life in Bangladesh, more so than in most countries. A meal without fish is considered incomplete. Fish production has lagged behind population growth, resulting in lower availability per capita of the main source of animal protein. Fish exports earn a sizeable chunk of foreign exchange for the country. And most Bengalis in the rural area, some time or the other, either fish or make their living from fish. Most importantly, there is, in government, dissatisfaction with the way things are. As Ataur Rahman, the Director of Fisheries, put it and as A.Z.M. Nasiruddin, Secretary of Fisheries and Livestock, reinforced, all is not well with the efforts for fisheries development. They were not just talking about shortages of manpower or training or even of

funds, but of organization of, and approaches to, fisheries extension and development that could have, but had not, paralleled the green revolution in agriculture with a bluer variety. They charged the Consultation with the responsibility of learning from the past to give direction to the future.

The discussions

Given the plans and aspirations of government with regard to fisheries development on the one hand and the needs and aspirations of fisherfolk and fish farmers on the other, what needs to be done and how? This was the central objective. The background to this was elaborated in six briefings. The first from the DOF put the fisheries development plan of the Fourth Five-Year Plan in perspective. It was followed by four briefings from DOF projects in inland fisheries and aquaculture that are being supported by DANIDA, ODA, ICLARM and UNDP-FAO. The sixth briefing

covered marine fisherfolk and extension in a DOF project that is supported by BOBP. The briefings focussed on the status and needs of fish farmers and fisherfolk, the various approaches taken by the project to address these and, most importantly, the learnings from the efforts.

It was against this background that the participants, in small groups, discussed three aspects:

- What should the objectives of fisheries extension efforts be when addressing the aspirations and needs of both government and fisherfolk and fish farmers?
- Given the objectives, how should you go about achieving them? In other words, what strategies and approaches should be adopted and, more importantly, who should and could do this?
- What factors, in existing systems, either aid such processes or constrain them?

The groups, after discussing each issue, presented their findings in plenary sessions. Given the vastness and complexity of the issues and the sector, and the short time for discussion, the intention was not to reach a consensus but, rather, to create a cafeteria of ideas from which an extension team could choose menus to suit needs and conditions.

Summary

If the Consultation can be summarized — and the writer runs the risk of being blamed for trying with this to force a consensus out of the diversity — this would perhaps emerge:

- The Consultation defined the role of extension services as enabling communication, organization, motivation, training and the establishment of support services.
- It identified extension as the central role of the Department of Fisheries.
- The Consultation, identifying strategies in order to achieve the aspirations of the Government of Bangladesh and to better address the needs of fisherfolk and fish farmers, felt that the DOF needed

to undertake a two-pronged approach. So:

FIRSTLY, by strengthening the DOF through Human Resource Development and Reorganization, Improved Planning and Management at all levels, and Increased Operational and Maintenance Fund Allocations, in order to improve the mobility and motivation of staff, the knowledge base and technological support and backstopping.

SECONDLY, given the DOF's limitations of manpower and financial constraints, by facilitating the involvement of other government organizations, non-governmental organizations, donors and the private sector through contractual agreements.

- The Consultation placed special emphasis on the need to establish institutional arrangements to make 'available viable credit to fisherfolk and fish farmers in order to fuel development.



Crystallizing thoughts for presentation. A group discussion in progress.



Connecting reflection to reality: dialogue with the fish farming community.

Brief and obvious, until you stop to reflect and read between the lines. Then you will find, bulit into this summary, some radical departures.

The recommendations

The meeting, while recognizing the importance of integrated development, hoped to restrict fisheries extension to enabling fish production and management. By doing this, the Consultation did not set aside vital needs like health, water supply or, for that matter, education; it proposed that these are best done by other agencies, in and out of government, and which are better trained and equipped to do so. Fisheries extension should play a facilitating rather than direct role in this, it felt.

Moving away from scientific research and regulation, Consultation felt that the central role, and perhaps the only role, of the DOF was extension.

Governments, sometimes for political reasons, and often merely to protect territorial rights, usually want to do everything by themselves, irrespective of ability. The meeting strongly recommended that the DOF should facilitate the involvement of others, going so far as to suggest that the DOF contract out components of fisheries extension and development (for instance the Highways Department could be contracted to build a road bridge). This was particularly significant because both the Secretary, Fisheries and Livestock, and Peter Myers, the FAO Representative, said at the meeting that this would be a way to explore if for no other reason than that government did not have the resources to do everything (assuming it had the ability) nor did donors feel that governments should do what others in the private sector could do, and more viably at that.

Looking back

So what did we get out of it all, barring a well printed 'Proceedings', with detailed checklists, for some to read and others to neatly file away? For participants harried by day-to-day deadlines and work, it was an opportunity to sit together without distractions of files and telephones and to reflect on and think through fisheries development and extension. An opportunity, possibly the first of its kind, for senior



So this is how extension translates to action! Village scale finfish hatchery.

and junior staff to sit together and get a feel of each other's perspectives, concerns and dilemmas — a vital input, given the rigid hierarchies of organizations. An opportunity' for participants to learn from each other's work in order to learn from mistakes and avoid trying to reinvent the wheel. And, finally, a frankness in the discussion, resulting from a lack of pressure to arrive at a consensus, that allowed people to often say what they wanted to but normally don't.

The meeting was a beginning, a setting of direction and tone. And there is reason to believe that something may come out of it. The Secretary and the

Director committed themselves to that which they had been party to. Further, the Director of Fisheries, the Secretary and the Donor Representatives wanted the proceedings to be elaborated into a working paper that would concretise the options and recommendations and act as a foundation for project development.

To end with a return to the metaphor of summer. The rains will eventually come, perhaps a little late, perhaps even early, it may rain too little to nurture the growth or too much 'and wash it away. It is too early to say. But come it will, and in that there is hope for the fisheries of Bangladesh.

When doing it again...

The very uniqueness of this Consultation makes it worthwhile asking ourselves how we would do it had we the chance of doing it again.'

The meeting was conducted simultaneously in English and Bangla, which proved problematic to those who knew only one of them. More efforts should have been made to ensure translations.

'The central methodological approach, of bringing together staff of various levels, ran into problems because, naturally, the more senior staff had their say while the junior staff often underlined their lack of voice by their silence. Mediators in the groups, whose role was to facilitate discussion and to ensure a certain equity in participation, could not wholly overcome this cultural hurdle. A lot more needs to be done to give people a voice.

And time was short. Even if the three days were reasonably well used.

NEW BOBP PUBLICATIONS

The Bay of Bengal Programme throughout the year prints reports and working papers on its various subprojects, thus providing much information about the fisheries and the fisherfolk of the Bay of Bengal region. These publications are nominally priced to cover the cost of production and mailing and may be obtained from the BOBP Information Service, Post Bag 1054, Madras 600 018, India. The following publications were released in the recent past.

BOBP/REP/49 — Introduction of New Small-Fishing Craft in Kerala, India.

Attempts to introduce modified and new types of small fishing craft in the state of Kerala, India, are described in this report. Three new types were constructed and tested, and underwent commercial fishing trials.

BOBP/REP/50 — Report of Sixteenth Meeting of the Advisory Committee, 20-23 January 1992, Phuket, Thailand.

This document records the recommendations of the 16th meeting of the Advisory Committee of the Bay of Bengal Programme for Fisheries Development (BOBP), held 20-23 January 1992, in Phuket, Thailand. It also contains the annual reports (or status reports) of the projects in the Programme. These reports describe briefly the work and achievements during 1991, assess the progress and status and indicate the work plan for 1992. The reports were prepared at the end of 1991 and presented to the 16th Advisory Committee.

BOBP/INF/12 — The Fisherfolk of Puttalam, Chilaw, Galle and Matara, Sri Lanka. A study of the socio-economic status of the fisherfolk of four fisheries districts in Sri Lanka.

The findings of a socio-economic survey conducted by the Ministry of Fisheries and Aquatic Resources (MFAR), Sri Lanka, and the Bay of Bengal Programme are presented in this document. The twin objectives of the survey were to obtain socio-economic information that would help in the formulation of a new credit scheme for fisherfolk and also to supplement the existing socio-economic information base of MFAR relating to the fisherfolk communities. The survey was conducted in the coastal villages of four fishing districts in Sri Lanka.

BOBP/WP/68 — The By-catch from Indian Shrimp Trawlers in the Bay of Bengal: The potential for its improved utilization.

Shrimp are a major foreign exchange earner for India. But in the race for valuable shrimp, the

considerable by-catch hauled up with it is, by and large, ignored in parts of the country. This by-catch is almost 90 per cent of the shrimp caught and was estimated at approximately 100,000 t/year in 1988. This working paper documents work on assessing the volume and composition of shrimp by-catch discarded by trawlers on India's east coast and identifies the constraints to its improved utilization.

BOBP/WP/70 — Kattumaram Fisheries and Fisherfolk: A study in Kothapatnam- Pallipalem, Andhra Pradesh, India.

This working paper describes the attempt made to conduct an integrated study of the biological, economic and sociological aspects of the fisheries and fisherfolk that use one of the most traditional and lar fishing craft of the east coast of India — kattumaram. The benefits of the results from such an approach are also presented. The paper discusses the significance of using one or more types of fishing gear with such a traditional craft, correlation between income from fishing and income from other sources, relative performance by other types of craft.

interactive Fishing problems, exploitation of resources underutilized resources, motorization of traditional craft, marketing practices and opportunities for traditional/ alternative income generation.

BOBP/WP/72 — Giant Clams in the Maldives: A stock assessment study of their potential for culture.

Tuna fishing is the major fisheries activity in the Maldives. However, fishing for non-traditional organisms is becoming popular, as it provides fishermen with new areas of employment or alternatives when tuna fishing is poor. One such non-traditional fishery in the Maldives is that for giant clam. Within a year of the establishment of this fishery, so considerably had the resource been exploited that different non-fishery professionals — tourist resort owners, divers and environmentalists — showed great concern about its long-term effects. This led to the Ministry of Fisheries and Agriculture undertaking an assessment of the status of giant clams in the Maldives. The paper, based on the report submitted by the consultant to the Government of Maldives in April 1991, describes the findings of the assessment and discusses the possibility of developing a viable mariculture project to ensure the continued existence of the giant clam.

BOBP/WP/73 — Small-Scale Culture (lithe Flat Oyster (*Osirea folium*) in Pulau Langkawi, Kedah, Malaysia.

A part of a programme aimed at developing small-scale culture of oyster along the west coast of Peninsular Malaysia is described in this paper. It deals with the methods of culture and harvesting of the flat oyster (*Osirea folium*), discusses the marketing of the product and analyzes the economic implications.

BOBP/WP/78 — The Fisheries and Fisherfolk of Nias Island, Indonesia.

This background document for the planning and programming of a fishing technology subproject is in two parts. Part I is a brief and factual presentation of data and information on the main features of the small-scale fisheries of Nias Island, Sumatera, Indonesia, and is based on field visits to the fishing villages and on information provided by the District Fisheries Service of Gunung Sitoli in Nias Island. Part II presents data on the socio-economic situation of the fisherfolk of Nias, obtained during a socio-economic appraisal in eleven villages in 1989-1990.

BOBP/WP/79 — Review of the Beche de Mer (sea cucumber) Fishery in the Maldives.

A review of the beche de mer (sea cucumber) fishery in the Maldives. This review was undertaken in view of the potential of the fishery for further development as well as the vulnerability of the resource to uncontrolled exploitation, which had already commenced.

BOBP/WP/85 — Cleaner Fishery Harbours in the Bay of Bengal, Madras, India.

Besides summarizing the proceedings of a regional consultation on Cleaner Fishery Harbours in the Bay of Bengal, held in Penang, Malaysia, in December 1991, this report also includes summaries of reports on the status of selected fishery harbours in India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand.

BOBP/MAG/IO — 'Our Fish, Our Wealth' (A comic book, in English/Tamil/Telugu).

This colourful book tells in pictures and relates in simple words a story that could help fisherfolk realize what they should do to protect and conserve their wealth, their fish stocks, and ensure there is enough for all. Fishing methods, gear and craft are discussed and the hero, Raghu (a Fisheries Institute graduate), explains how all these could be best used for the benefit of the different types of fisherfolk who make up a typical fishing community on India's east coast.



Bay of Bengal News is a quarterly publication of the Bay of Bengal Programme (BOBP), a regional fisheries programme which covers seven countries around the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka, Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new techniques, technologies or ideas to help improve the conditions of small-scale fisherfolk communities in member-countries. The BOBP is sponsored by the governments of Denmark, Sweden and the United Kingdom, by member-governments in the Bay of Bengal region, and also AGFUND (Arab Gulf Fund for United Nations Development Organizations) and UNDP (United Nations Development Programme). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).