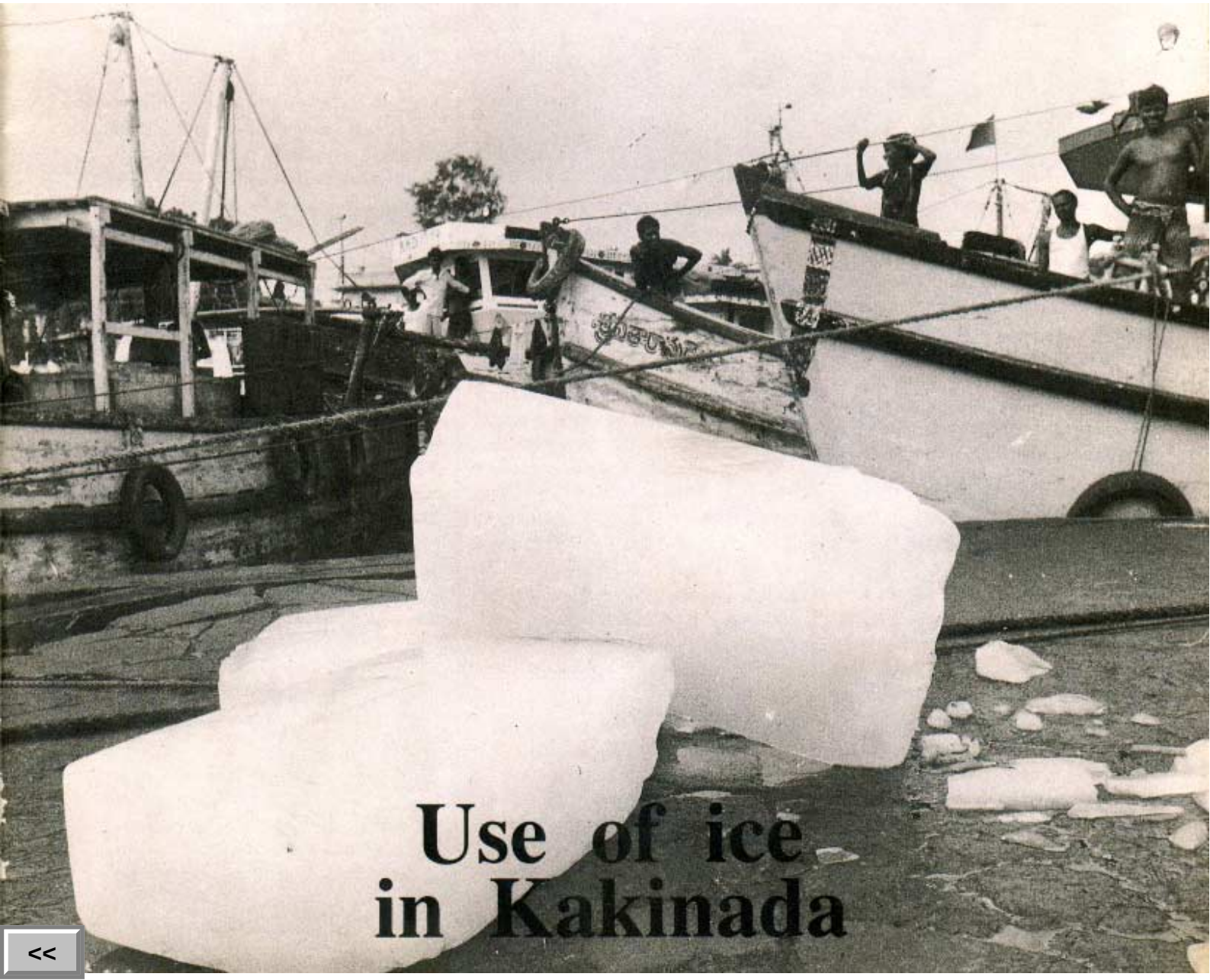
A PUBLICATION OF
BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

BAY OF BENGAL NEWS

ISSUE No. 32
DECEMBER 1988

FOCUS ON POST-HARVEST TECHNOLOGY



Use of ice in Kakinada

"Fish is Food or Cash Only After the Harvest"

by David Walker

BOBP's post-harvest fisheries adviser discusses the significance of recent activities initiated by BOBP.

Fbst-harvest fisheries technology means different things to different people. Commonly it is divided into three areas: handling, processing and marketing. But it is important to consider the post-harvest system as a whole. By adopting a holistic approach, government organisations and development programmes such as BOBP can highlight constraints and show where improvements can be made most effectively and efficiently.

In many parts of the world, including the Bay of Bengal, fishermen and state authorities are realising that capture fisheries resources are finite and unlikely to meet the needs of an ever-increasing population. This dilemma has spurred aquaculture development, but equally it should stimulate the best possible utilization of whatever fish are caught at sea.

When fish are brought aboard a boat they are usually fit for human consumption. If by the time of landing, some are suitable only for animal feed or fertiliser, it means not only a loss of value but also a loss of human food. Of course it is necessary to feed chickens and to manure coconut trees, but at the expense of feeding people? Hopefully not.

Improvements in the areas of fishing boat design, fishing gear and fishing practices are of little value if the resultant increase in catch is not fully utilised.

It is after harvest that consumers think of fish as food and fisherfolk think of it as cash. The BOBP recognises this and aims to reduce losses and improve utilisation. During the short time it has been in operation many activities have been initiated in India. In 1989 several sub-projects are scheduled for Sri Lanka, Bangladesh, and possibly the Maldives. But because fisherfolk's needs are common, much of what is done in one country can be applied in other countries as well.

Some activities of the BOBP's post-harvest project, and the questions it is raising, are featured in this issue of *Bay of Bengal News,* Icing of fish to keep the fish fresh — how can this practice be introduced in a traditional fishery in Andhra Pradesh? What are the implications of the increase in on-board icing in Sri Lanka? Two articles discuss these subjects. Smoking, as a means of preserving and adding value to fish, is a technique little used in the Bay of Bengal; its potential is demonstrated by a short account of recent work in the Maldives.

"Know your market" is good advice for any business and aquaculture is no exception. BOBP is assisting with the culture of oysters in Malaysia where they are a popular food. But to ensure that the produce finds the best market it is essential to know the likes and dislikes of the trade and the consumers. Because so little was known a market survey was carried out to gather data on prices, consumer preferences, and distribution of demand. The survey's findings are discussed in another article.

Readers aware of the boom in the farming of penaeid prawns will recognize the importance of prawn feed as an essential input for both intensive and semi-intensive culture systems. An in-depth analysis of India's resource potential for domestic manufacture of prawn feed should be of interest to all concerned.

Prawns trawled from the sea are prized highly, but the miscellaneous fish caught with them — the by-catch — are frequently just shovelled back into the sea whence they came — dead. An economist who investigated the subject for a few weeks writes about it. Complementing this article is a first-hand diary of a shrimp trawler voyage, which describes the many activities on board, including the handling of shrimp by-catch.

In this issue we are not attempting final or even first answers to post-harvest technology problems: we only hope to stimulate ideas and debate — and activities that will assist in the better use of existing resources.

Use of ice with motorized Navas in Kakinada

Icing fish at sea may cost money, but you will end up with a higher net profit – that's what the BOBP's post-harvest fisheries project is trying to demonstrate in Andhra Pradesh, India.

Ice provides an extremely simple and effective means of chilling fish. It is harmless, does not change the taste of the fish and is available at many landing sites. Chilled fish remains in good condition for several days because ice lowers its temperature, thus slowing down the rate of spoilage. As soon as a fish dies the process of spoilage begins through the actions of enzymes and bacteria. The lower the temperature the slower this process. Conversely the warmer the fish the faster it spoils, as anyone who has seen fish left out in the sun on the deck of a boat will agree.

Navas are traditional open gillnetters between 9 and 10 metres long fishing off the coast of Andhra Pradesh and Orissa. They catch quality fish such as king mackerel (seer), pomfret, snappers, jewfish, polynemus and shark which have a ready market in the large cities of India but only if they can be marketed in good condition. At present most of the fish landed have been dead for upto 10 hours and are sold in poor condition. Consequently, the fish sells for less than it would had it been kept in ice on the boat. Relatively few are fresh enough to merit traders packing them in ice for transport by train or lorry to major urban centres. Fish traders and their commission agents at distant markets are interested in receiving larger quantities of high value fish in good condition and are reportedly willing to pay higher prices for improved quality. Most urban markets are undersupplied.

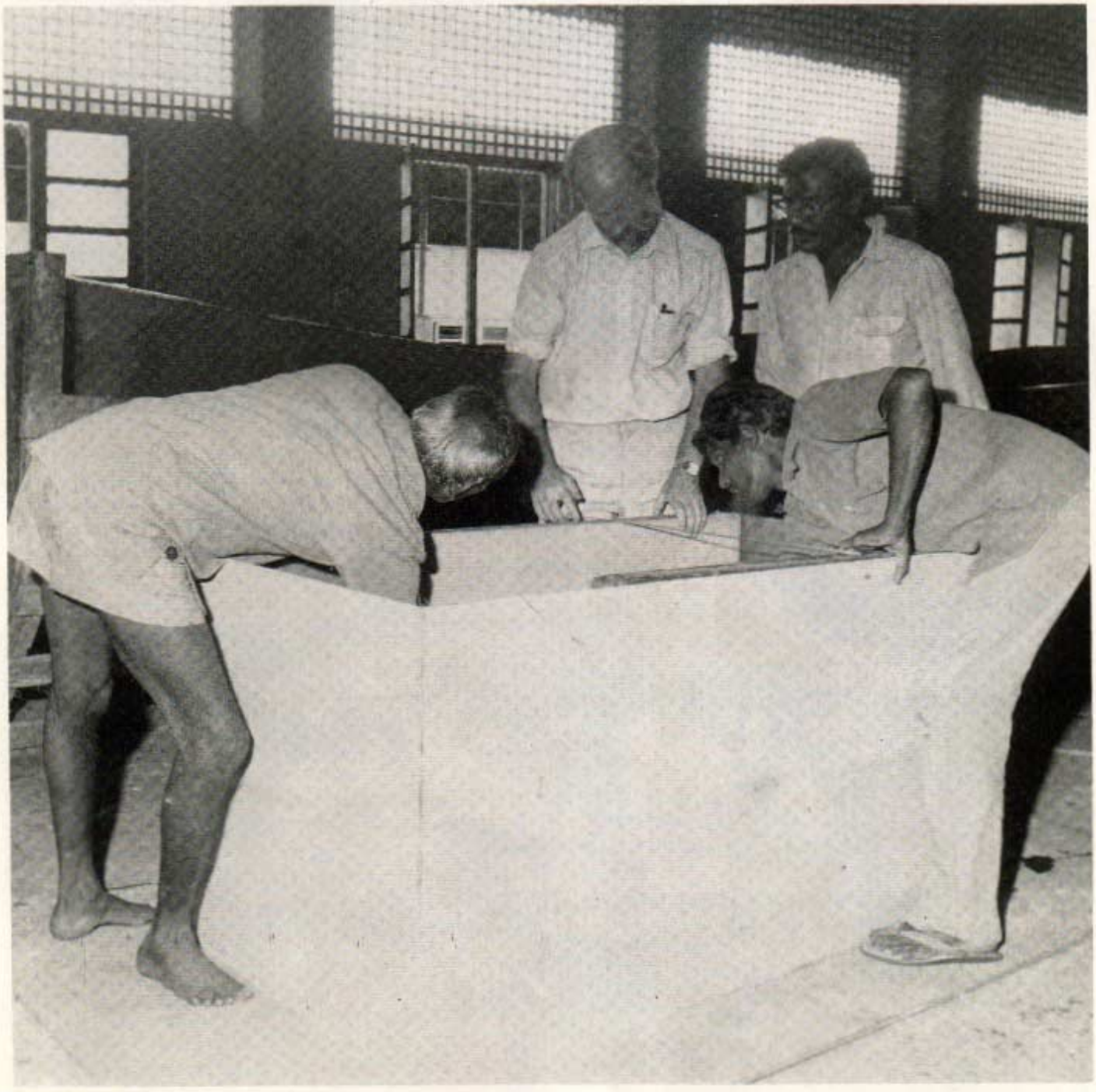
No navas ice fish at present. The crew have not been trained in the use of ice; the boats have no ice boxes, yet there is a general realisation and awareness on the east coast of India that icing on the boat should be the next step forward in the development of this fishery. Fish iced immediately it is caught will keep longer and thus can travel long distances and still fetch a good price. The ideal situation is a continuous cold chain from boat to consumer; the fishermen receiving a better price and the consumers eating better fish. To this end the BOBP's Post-Harvest Fisheries Project began a series of demonstrations and discussions about the use of ice at sea at Kakinada in September. Photographs on these pages give an idea of the demonstrations.

Mr. David Walker, ODA Post-Harvest Fisheries Adviser, visited Kakinada in August. Consultant Ivor Clucas from the ODNRI (Overseas Development Natural Resources Institute), visited Kakinada in September, talked to the nava fishermen, observed their operations at sea and demonstrated the principles and practicalities of icing fish aboard navas.

Blocks of ice being taken and crushed at the quayside in Kakinada.

<<

Above left : Trader filling a basket with alternate layers of fish and ice. Right : Fish and ice are provided in equal quantities. Below : An ice box being constructed at the Andhra Pradesh Fisheries Corporation boatyard in Kakinada.



<<

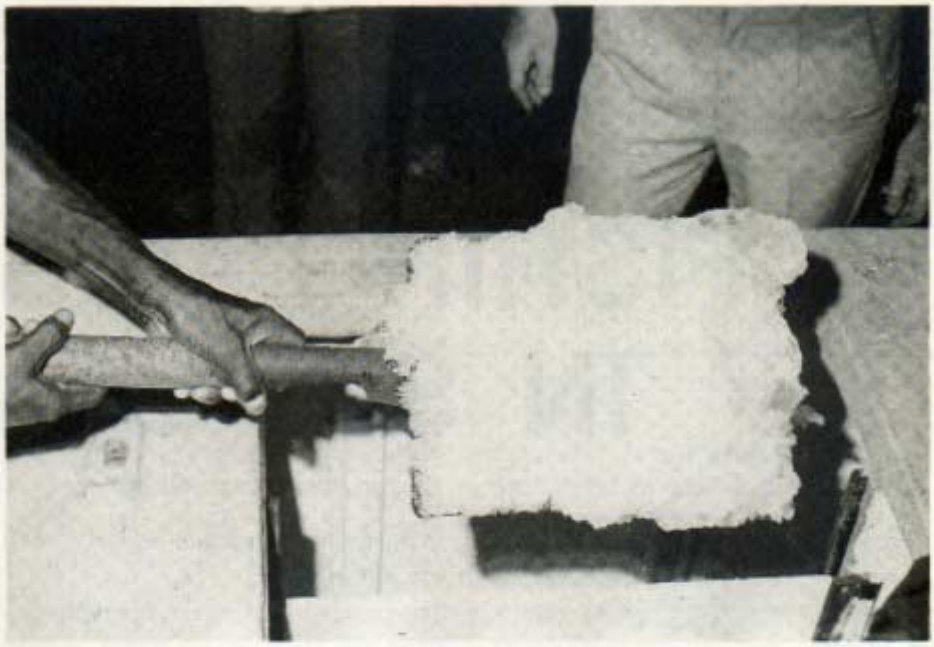
During the next few months, catch data and landing price data will be collected from four navas fitted with specially built insulated fish boxes and supplied with ice at no cost. Similar data will be collected from navas not carrying ice.

The insulated fish boxes have been constructed by APFC (Andhra Pradesh Fisheries Corporation) from a preliminary design given by BOBP. "These are trial boxes," Mr Walker emphasises. Finalising on the right type of box – the capacity and dimensions – for boats that have not previously carried ice, will need some trial and error.

Ice factories in and around Kakinada presently supply fish traders and those boats which trawl for shrimps. They have some spare capacity to supply navas with ice for much of the year although there may be very occasional shortfalls when fishing and shrimp trawling activities peak at the same time. These shortages will only last for a few days. Ice suppliers in the private sector will most likely increase their capacity if there is a significant shortage at peak times.

The use of ice will necessitate some changes in established fishing and handling practices and hence nava fishermen, quite correctly, need to be fully convinced of the merits of icing fish at sea. Those navas which do day fishing will need to lift the gill nets more frequently because there is little advantage to be gained by icing a fish which has been hanging dead in a drifting net for the previous six hours – it will already be partly spoiled. The motorised navas, which generally undertake voyage fishing for several days, acknowledge that they cannot keep the catch saleable for this length of time unless they split and salt the fish on the boat. This method of preservation can work well but salt-cured fish will never fetch such a good price as iced fish. A change from salt to ice could be very profitable.

Cash reward is the aim of most fishermen and it will only be the proven economic advantage of using ice at sea in navas which will ensure both its adoption and its continuation. It is hoped that this advantage is proven in the next few months – and that, ere long, icing of fish will be as widespread on the east coast of India as it is on the west.



Crushed ice makes better contact with fish and chills it more quickly.

An ice box being fitted on a motorized Nava at Kakinada.

Crew members, boat owners and government staff discuss the advantages of icing at sea with Mr. Ivor Clucas, consultant.

USE OF ICE ON-BOARD FISHING VESSELS IN SRI LANKA

by S. Subasinghe

The importance of ice in the post-harvest handling of fish, especially in a tropical country like Sri Lanka, cannot be over-emphasised. Ice is important both onboard and for storage on land. In Sri Lanka most of the ice is used during transportation of fish from landing sites, cold rooms and wholesale and retail outlets. However, over the last few years there has been a marked increase in the quantity of ice carried on board fishing vessels. This is due not only to the increase in the number of larger boats operating in deeper waters but also to a widespread in the fishery industry as well as among the consumers.

The source of ice for the fishery industry is the 60 or so ice plants located mostly in the coastal belt of the country. However, only about 70% of these are operational at present, producing around 60,000 metric tons of ice annually. More than half of the ice produced comes from the fishing town of Negombo on the west coast of the island, about 20 miles north of Colombo, where on board usage of ice is widely practised. The type of ice used by the fishery industry is the 50 kg block type. The bacteriological and chemical properties of this ice have been observed to be satisfactory.

As discussed earlier, most of the ice produced is used on land. Nearly 50% of the country's fishing fleet numbering about 30,000 boats, comprises non-mechanised crafts operating in near-shore areas. The mechanised fleet of some 13,500 vessels consists of about 7,500 17½'23' FRP boats with out-board engines, about 3,000 mechanised traditional crafts and around 3,000,28' (3½ton) in-board mechanised boats. Over the last few years there has

Truck delivering ice to Beruwala fish landing centre.

been an increase in the number of 32 34' boats, the present strength of the fleet being around 200. Most boats in the 28' - 34' range carry ice on-board to preserve fish, depending on the availability of ice and the duration of the fishing operation.

The larger boats of the 32' - 34' range carry out 3-6 day operations in deeper waters and are designed to carry fish on ice. The 32' boats constructed under the West Coast Fishery Development Project have a fish hold capacity of about 3.25 m^3 and carry about 1.5 tons of ice on board. The larger 34' boats issued under the North-West Coast Development project have a 7.5 m^3 capacity and take about sixty 50 kg blocks of ice on board. Due to high operational costs, especially the rise in fuel costs, the 3½ton (28') boats, originally designed for short fishing operations, have over the last few years preferred larger fishing trips sometimes lasting up to 5 days. This has made some modifications necessary. Most of the boats have been refitted with fish/ice holds for use during long fishing trips. The construction of ice holds for this purpose has become a cottage industry in some parts of the coastal fishing belt, especially on the West Coast. Many of the fishermen have benefited from a loan scheme implemented by one of the state- owned banks, the Bank of Ceylon, offering up to Rs. 20,000 to refit the 3½ton boats with ice holds. The modified version of the 31/2 ton boats constructed nowdays has a fish hold capacity of 2-3 m^3 and often carries 1 MT of ice.

A recent study carried out by the Institute of Post Harvest Technology of the National Aquatic Resources Agency (NARA) has shown that the general quality of fish landed on the southern coast of Sri Lanka is good, with 80% of fish scoring in the 'very good' quality range by organoleptic assessment. The 'quality picture' could not be much different in other parts of the island. Nearly 60% of the coastal catch is landed by non-mechanised or out-board mechanised crafts (17½' - 23') and due to the short duration of the fishery operations the general quality of fish landed could be expected to be satisfactory. It is interesting to note that over the last few years, even some of these small crafts (those fitted with OBMs) tend to take ice. The larger boats (28' - 34') account for nearly 40% of the coastal catch. The gillnetted fish from some of the larger boats is said to be of low quality; but most of the fish landed by these multi-day boats is satisfactory, thanks to the increased use of ice on-board. It is encouraging to note that quality awareness among fishermen is improving.

In an attempt to improve the quality of fish landed by multi-day boats, BOBP ha introduced the 'chilled sea water' (CSW) technique to the industry. It has been observed that very often fish stored in large holds, especially the fish at the bottom of the hold, tend to get damaged. Preliminary NARA studies have shown that the CSW technique, which uses a mixture of ice and sea water, not only reduces the physical damage to fish but is also more economical (less ice needed). The Agency has planned collaborative work with BOBP to study the technical and economic feasibility of this method.

Fish Smoking in the Maldives

Maldives is well-known for skipjack and yellowfin tunas — they are exported or consumed locally. Many of the other species, caught in open waters and on reefs, are underutilised. Smoking may help to improve the utilisation of such species.

Smoking techniques for large tunas are well known in the islands, but the potential for smoking other kinds of fish had largely remained unexplored until a recent pilot study undertaken on Dhagethi Island in An Atoll. The study was commissioned by the Voluntary Fund for Women's Development. (Set up under U.N. auspices at the end of the International Women's Decade, 1975 - 1985, this fund supports women's studies and activities, particularly in developing countries).

An atoll was chosen for the fish smoking study because it has an abundance of reef fish which are underutilised: either salt-dried for export or not eaten at all. Also, Dhagethi island has been conspicuous for community initiatives.

The pilot study aimed at evaluating different types of smoking kilns, advising on suitable handling and smoking techniques, and conducting test marketing. The study was conducted by a "Women's Committee" in An atoll, with women carrying out all the fish smoking activities quite capably. Community response to the study was good.

The most successful kiln was found to be a simple fire-box made of coral rock over which fish fillets or steaks are stacked on wire trays. This is a local form of the well known Chorkor smoking kiln originally developed in

Women from Dhageti island load fish on to smoking trays for the pilot study on fish smoking techniques.

Ghana, now being used successfully in many countries. Smoking continues until the fish have a uniform medium-brown colour and are dry on the outside but still moist inside. This normally takes about six hours.

The smoke is produced by burning coconut husks which are readily available at little or no cost on most islands. The whole procedure uses local materials and simple technology, and generates little waste because heads and bones removed prior to smoking can be used for curry and fish sauce. Many types of fish can be smoked (see Table) provided they are over about 1 kilogramme in weight.

Good smoked fish can be made only from fresh fish in prime condition. Use of stale fish results in a low grade smoked product which will fetch a low price and at the same time spoil the market for top quality producers.

Test marketing from the pilot study showed that traders in the capital, Male, are eager for regular supply. More than 100,000 tourists visit the country each year; they could provide a solid domestic market,

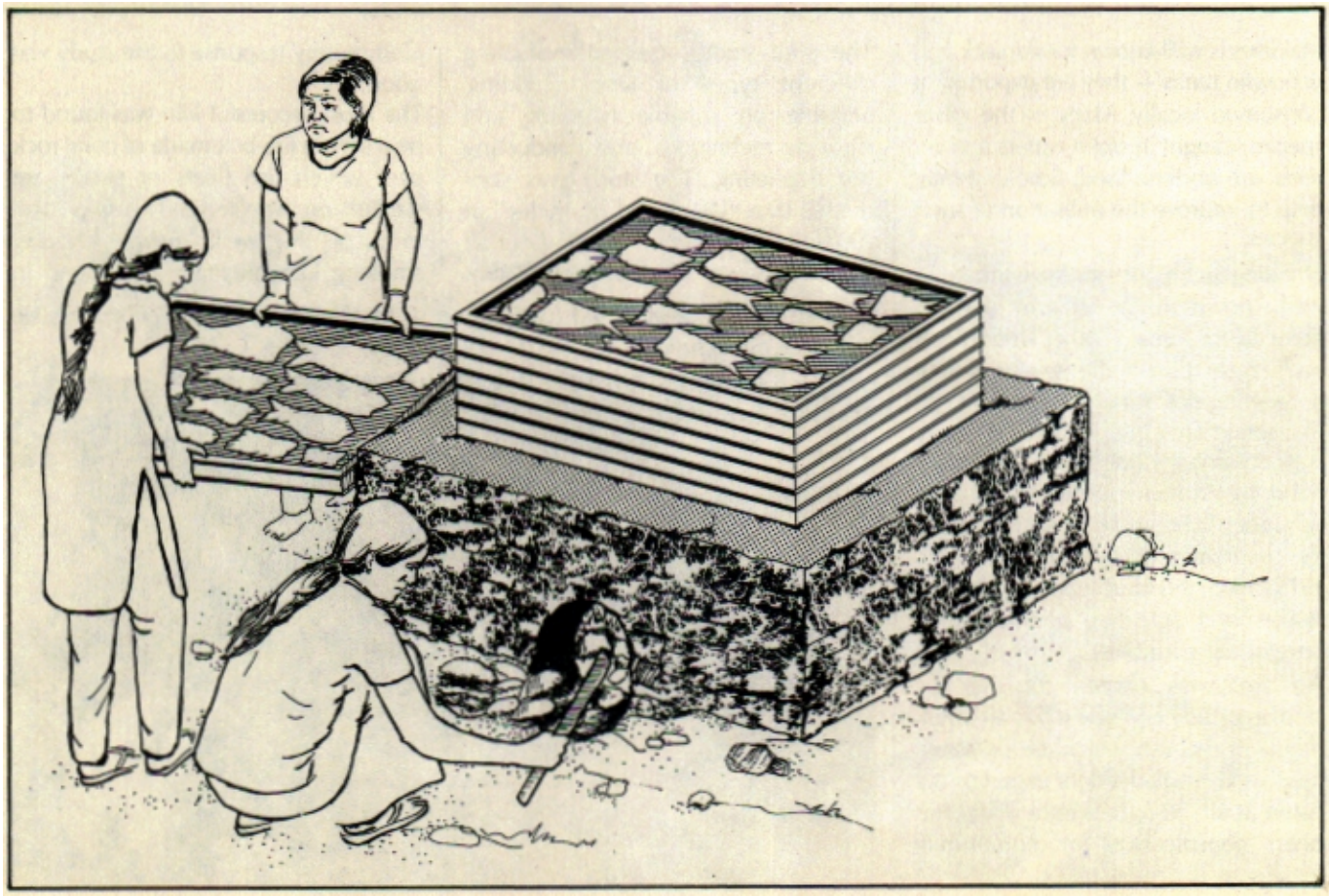
Fish smoking can be taken up and continued through the new fisheries extension service proposed for the Maldives. This will enable the main constraint identified to date, i.e. transport, to be firmly tackled. A second constraint is that the type of smoked fish produced by this method has a short shelf-life and needs to be refrigerated if it is to remain in good condition for more than a day. A third constraint is the need for better packaging.

However, the project has demonstrated the potential for improving living standards in the islands by adding to the value of an abundant natural resource.

Fish most appropriate for smoking

Type of Fish	*Means of preparation*
Snapper, Grunt, Grouper, Mullet, Hogfish	Remove scales, then prepare fillets with skin on.
Shark, Marlin, Sailfish	Make fillets, then skin them; leave belly flaps in strips, cut the nest into rectangles about 4cm thick x 8 cm x 10 cm.
Wahoo, King mackerel, Tuna	Remove all bones except from rib cage, cut up as for shark (skin can be removed on the larger firmer pieces for a higher quality product).
Rainbow runner, Pampanoo, Caranx, Jacks, Streaker	Cut as for snappers and remove skins; smoke slowly to prevent sticking (leave skins on smaller pieces and rib section).
Scads, Small mackerels	Gut, gill and cut 1cm deep along top and bottom to remove dorsal and ventral fins, smoke whole.
Needlefish	Remove head and guts. Cut 1cm deep to remove dorsal and ventral fins, cut in 10cm chunks with bone.

This is how women stack fish smoking trays on the kiln.



DISCARD OF SHRIMP BY-CATCH AT SEA

How serious is this waste of resources? What can be done about it?

by Ann Gordon

All over the world, shrimp trawling is associated with large by-catches. Where there is shrimp, there is fish too; if you haul in 20 kg of shrimp, you are likely to get also 200 kg of demersal fish. But the highly capitalised shrimp trawling industry is really interested only in high value shrimp, so everyday thousands of tonnes of fish are thrown back into the sea.

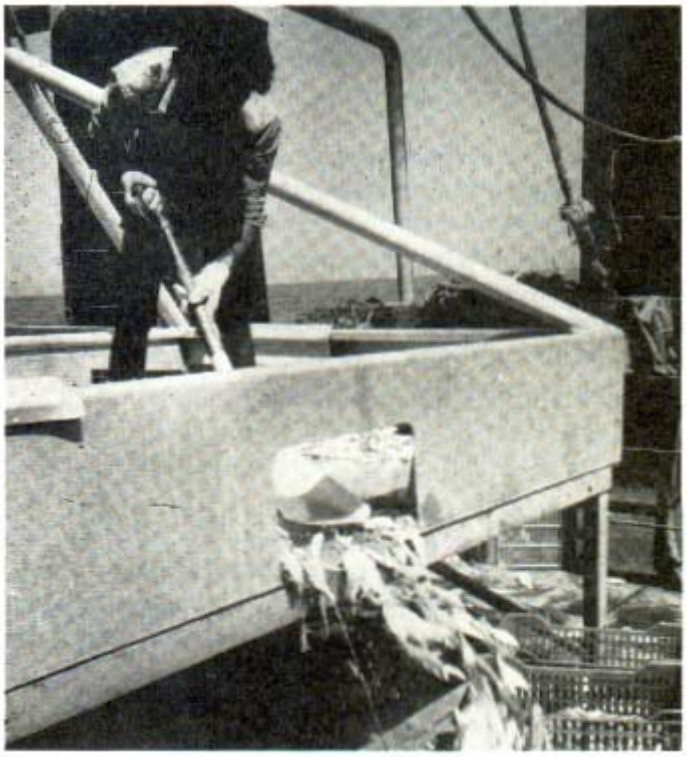
Shrimps are an important export for India, which is one of the largest suppliers of shrimp to the world market. The multi-day shrimp fishing industry is growing rapidly, and with it the quantity of dead fish which is being discarded at sea by this type of trawler. Concern over this is expressed not only in India but in other countries of the region. The need for better information led the BOBP's Post-Harvest Fisheries Project to commission a study of the problem. This work was undertaken during September and October 1988 by the ODNRI (Overseas Development Natural Resources Institute), London. The study aimed at assessing the quantity and composition of discarded fish, and investigating the options for handling and landing that fish, so as to identify both technical and economic constraints. Preliminary findings are presented in this article.

The development of shrimp trawling on the east coast

In India, shrimp trawling originally focussed on the west coast and even today the largest shrimp landings occur there. Trawling on the west coast, however, does not now result in significant discards. Most of the trawling there is done by small mechanised boats, going out daily, and local markets are able to absorb virtually all of the by-catch. Whilst the bulk of the shrimp landings on the east coast also come from small mechanised boats the Indian east coast fishery is characterised by large vessels which stay at sea for many weeks.

In the 1970s the important east coast shrimp grounds were along the Orissa coast, off Pun and Paradeep. As resources began to dwindle in this area, under pressure from increased fishing effort, attention was focussed on alternative shrimping grounds. The area known as Sandheads, north east of Paradeep up to the border with Bangladesh, in the outflow of the Ganges between 40 to 70 miles offshore, was found to be an extemely rich shrimp ground.

The private sector quickly recognised that this rich resource could be best exploited using modern, double-rig trawlers. Such trawlers, with refrigeration or ice, go to sea for several weeks at a time, and require comprehensive port facilities at their base. Visakhapatnam was the best equipped port, nearest to the Sandheads area, to take on such a role, and quickly became the focus of the east coast shrimp fishery. Its role in shrimp trawling and processing has expanded rapidly during the 1980s.



Fish being shoved out on trawler deck for sorting.

Why do trawlers discard fish?

Understanding the structure of the industry, and particularly its dependence in the east coast on "voyage fishing'ç is central to understanding why fish is discarded. Trawlers that can remain at sea for weeks at a time are expensive to buy and to run. Companies make the investment only because they believe that they will catch high value shrimp – for which the average landing price, head off, is currently about 117 Rs/kg (US $ 8/kg) at Visakhapatnam. Okay, you say, but if they've got extra space they can bring back some of the fish too, can't they?

Well, they can but they won't. Most companies believe that if they bring back more fish, they will have to bring back less shrimp and thus make less money. How so?

Left : Sorting bin of trawler bulges with catch and by-catch. Center : Traditional fishing craft approaches mini-trawler to collect by-catch

* Some of the trawlers carry ice, or have only a limited freezing capacity. They quite reasonably wish to reserve that for the high-value shrimp.
* Some people argue that during the peak season the crew is fully engaged in shrimping, that any additional activity might mean a reduction in the quality and volume of shrimp handled.
* Some companies fear that on vessels which use only ice the slime on fish will contaminate the shrimp.
* Many companies interviewed said that large quantities of fish are difficult and time-consuming to sell, delaying the trawler in port when it could be out mining that pink gold again. And' why bother anyway? The fish is worth so little relative to the shrimp. Even good quality "table" fish, for retailing in fresh condition, will only fetch Rs. 5-10/kg at the wharf.

How **much** fish is being discarded?

It's pretty difficult to find out how much fish is being discarded. It's a rather touchy subject which people don't really want to talk about. Accusations might fly : you're throwing away food! What's that doing to the fish resources? And anyway, no two voyages are the same, no two boats do the same thing, and no one stands by recording the many shovelfuls that go over the side. So how do you go about getting this information?

The first thing that is needed is to identify different fishing "systems". Next, to set about establishing a realistic range for the .discards from boats in each "system". The result is a cautious, but note please, conservative, preliminary estimate. It's based on numerous interviews with trawling companies, ships' crews, fishermen in West Bengal who collect some of the discards, and other people concerned with the shrimp trawling business.

We can broadly characterise the Visakhapatnam-based industry into four trawling 'systems'. There are the 10-11 metre mechanised stern trawlers, some of which make week-long trawling expeditions up as far as Paradeep. There are some 150 involved in this sort of activity. Although they land fish (some of it dried) with the shrimp . they each discard about one tonne of low value fish for each "trawling day" because of lack of drying and storage space. That adds up to about 20,000 tonnes a year.

The next biggest boat-type inolved in stern trawling is the 14 m "Sona'ç which is a bit more powerful than the smaller boats, and typically goes for 15-day trips up to the Dhamra Bay area. Like their smaller cousins, most "Sonas" only carry ice, and have limited drying and storage space. They discard about 15 tonnes of "trash" fish per voyage. There's some 70 of these boats at Visakhapatnam, and together they account for about 14,000 tonnes of discarded fish per year.

And then there are the double-rig trawlers : there are 80 medium-sized 16 m trawlers which mostly only carry ice and chilled seawater and go for three week voyages up to the Sandheads area; and 150 of the 23 m deep sea trawlers, most of which are refrigerated, which go up to the Sandheads area for 30-40 days. Both sort and retain good-sized quality fish (for example, pomfret, large croakers (Sciaenidae), eel, threadfin bream *(Nemipterus spp.),* perch, shark, and mackerel *Rastrelliger spp.).* But the smaller trawlers, which only carry ice, are unable to return with as much fish as the large trawlers (1 tonne as against 4-6 tonnes). Both of these types of trawler discard about 2-4 tonnes of fish per "trawling day", together accounting for nearly 100,000 tonnes of discarded fish each year.

All in all, then, preliminary indications are that the trawling industry on India's east coast is discarding about 130,000 tonnes of fish per year at current levels of fishing activity. This figure clearly needs confirmation.

What types **of fish** are being discarded?

Basically small fish that would fetch very low prices under current marketing arrangements. The two smaller types of trawlers use a very small mesh size (10 mm stretched mesh at the cod end, as compared with 20- 30 mm strectched mesh used by the double rig trawlers). That means that they'll be catching lots of juveniles. Sorting and retention seems mostly to reflect size rather than species; the 10 m boats discard fish less than 7 cm; the "Sonas" discard fish less than 15 cm. And the pattern of retention changes as the voyage proceeds; double rig trawlers may retain more of their fish,

discard. Right: Traditional craft proceeds ashore with fish that would normally be discarded. Roger Kullberg

catch towards the end of the voyage, when they can predict their shrimp catch (and its storage requirements) with more confidence.

So it's generally low-value fish. If landed, probably 80 per cent would be sold as raw material for fishmeal (at 1 Rs/kg) and the rest is probably not worth much more than 3 Rs/kg. Jewfish (Sciaenidae) is probably the most common species in the catch. (This is based on information obtained from enterprising fishermen in West Bengal who sail beyond the sight of land, to collect discards from trawlers, in exchange for some fresh fruit or vegetables or chicken).

A more detailed study of the composition of discards is being undertaken.

Would it be possible to land more of this fish?

What are the options? The fish can be iced or frozen, it can be salted or dried; it could be processed (perhaps minced, or made into silage) to reduce its bulk; it could be transferred to a "mother shipr' for processing, it could even be landed at ports near the shrimp grounds. That's the theoretical range of possibilities (for which there is proven technology), but what are the practical options for Indian industry?

Most trawlers have surplus refrigeration capacity and could definitely bring back more fish (barring the problem of delay at port becaue of time needed to handle large quantities of fish). There may be scope for modifying the smaller vessels so that they dry more fish, or store larger quantities of salted fish. Processing at sea, to reduce bulk, is theoretically possible but in practice may be unrealistic; additionally it would need to draw on technology new to Indian trawlers; the manufacture of fish silage for animal feed has generally not been adopted elsewhere, being apparently unpopular with the fishing and poultry -industry alike. There is potential for more of the catch to be transferred at sea and landed by collector vessels. The "mother ship" option is a popular concept, but there is no experience with it on the east coast. And it is always possible for the smaller trawlers, at least, to put in to ports near the shrimping grounds, to unload fish.

The recurring problem, in considering these options, is marketing. Currently small trawlers from Andhra Pradesh do not sell their fish in Orissa because of opposition from local fishermen. Distribution channels are not well developed and the market can be glutted rapidly. Large trawlers won't bring back large fish catches, because of the low price they fetch, but also because of the associated delay in port. All of the possibilities for landing fish discussed above would require some expansion in market distribution systems if fish markets are not to be flooded. Almost certainly the industry would find solutions to any problem if there was an enhanced economic incentive to land the fish. This goal has fuelled some public and private research — on developing "value-added products from trash fish" for example.

But the situation isn't static

What are the various trends that will affect the quantity of fish discarded? Trawling effort by the smaller trawlers is likely to increase (i.e. their numbers will grow), whilst the outrigger trawlers may seasonally divert their effort to west coast lobster fishing (which will be associated with an even larger by-catch!) So the quantity of by-catch seems likely to increase. At the same time, with growth in the livestock industry and in aquaculture, there should be a stronger market for fishmeal. The development of cold chains, still at an early stage in India, will eventually pave the way for the introduction of frozen minced fish products, and there may be changes in eating habits associated with urbanisation, education and rising incomes.

How are fish reources affected by this harvest?

It's not been possible to address this question before because the quantity and composition of the discarded fish is not known. It is important now to consider this issue, because the outcome should determine future focus. If there's no bad effect on fish resources then we can go ahead and consider how we might use this resource more effectively. But if the resource is suffering as a result of the harvest, then appropriate management measures will need to be identified. An example may be the use of "excluders" fitted to the trawl to prevent as many fish being retained with the shrimp.

Even if the resource isn't suffering, the regular discard at sea of fair quantities of usable fish is an unhappy practice. Planners, entrepreneurs and scientists should join hands in devising ways to end this practice.

Aboard a shrimp trawler: a deckhand's diary

Roger Kullberg, who has completed a 10-week "Minor Field Study" on shrimp by-catch funded by SIDA, describes happenings aboard a shrimp trawler from Visakhapatnam, including the discard of by-catch into the Bay of Bengal.

Late one Monday evening a 25m doublerigged fishing vessel leaves the fishing harbour of Visakhapatnam (Andhra Pradesh) for a 40-45 day long shrimp voyage. During the five days in port since the last voyage, the vessel's supply of water, fuel and food has been replenished.

The course on the compass is set for the famous shrimp grounds up in the Sandheads area, south of the mouth of the Ganges: That means some 30-35 hours of steaming at a speed of 9-10 knots. The crew of this modern, well-equipped vessel consists of the captain, a bosun (captain's assistant),a chief engineer, two oilmen, a cook and seven deckhands. Some of them feel a little sad at leaving their families, but their mood will brighten up when fishing begins, they say.

After two days of steaming, we reach the first fishing ground, Dhamra. Some 60 fishing vessels are already there and one of them welcomes us on the VHF. They are not satisfied with their catch so far. Anyway we have to try our luck. The captain orders the crew to shoot the nets. This is done within 10 minutes. The colour echo sounder in the

INDIA'S EXPANDING PRAWN CULTURE INDUSTRY – WHERE WILL THE FEED MATERIALS COME FROM?

For commercial production of prawn feed in India, what raw materials are available, and how good are they? A detailed evaluation by John Wood and Jonathan Coulter.

Cultured prawn has proved to be one of the great aquaculture cash crops of the 1980's, having been the source of great prosperity in a number of developing countries. This has happened because supplies of wild-caught prawn have stagnated as catches around the world have approached or even surpassed their maximum sustainable yields. Since 1977, world landings have stabilized in the region of 1.6 million tonnes per annum.

However, demand is income-elastic, and prawn culture has continued to grow, spurred on by increasing prosperity in the major industrialized markets. Countries able to develop a prawn culture industry have found a sellers' market as they have plugged the gap between wild-caught supply and demand. Worldwide aquaculture production has soared, growing from 25,000 tonnes in 1975 to 340,000 tonnes in 1987, accounting for 16% of the total harvest in the latter year.

Like a number of traditional exporters of wild prawn, India's production of cultured prawn has expanded rapidly during the last 13 years, with output rising from about 4,000 tonnes in 1975,

cvheelhouse shows 25 m depth and a muddy bottom.

After three hours we haul in the nets again. Excitement.

The catch consists of various species, mainly of small fish. Croakers, threadfin breams, ribbonfish, catfish, pomfrets, clupeids and of course shrimps occur in the catch. Tiger prawn, white prawn and brown prawn are the most valuable species. In this first haul we got about 75 kg of white prawn and 3 kg of tiger prawn. During the season (which peaks during September-October) the average catch of whites will be 250 kg.

Within 15 minutes, the nets are emptied and back in the sea again. Immediately after, deckhands begin to sort out prawns and quality fish from the bulk. All big-sized fish will be retained and most small-sized fish pushed overboard.

During the sorting some deckhands begin to dehead the prawns. When there are lots of prawns this could take time, though the deckhands are very quick. Altogether the sorting, deheading and washing of catch could take 1-3 hours, depending on catch size. Fish and prawns get stored in the freezing room which has a temperature of -30' C. When. the prawn handling work is over, the deckhands get busy mending nets. Some of them are very skilled at this.

Occasionally, when the sea is calm and when fish, are being sorted on this big vessel, smaller boats, mostly lOm gillnetters, approach and ask for "trash fish" (fish that otherwise would be discarded) and collect it in baskets. Sometimes the small vessels pay for the trash fish in kind - fruit, chicken, cigarettes. Sometimes they get it free. Trawler owners, I hear, are not happy about such deals.

Likewise, it is said, trash fish from small trawlers sometimes gets transferred to traditional boats. These deals occur nearer the shore than the big trawler-gillnetter transfers.

After some hours of work dinner is served — fishcurry with rice, chapathi and an orange for dessert. The cook serves three meals a day. In between, coffee, tea and Horlicks.

Meal over, the bell sounds: it indicates hauling time. Hydraulic winches pull in the wire rope, and the crew get ready to handle a new catch before dark sets in. There are 4-5 hauls per day. Sometimes, if a good catch is predicted, nightfishing is done' for brown prawn. White prawn is not caught during the dark hours. If there is no fishing activity during the night, the anchor will be dropped and the crew could rest until sunrise. The main 500 hp engine will also get some rest, and fuel is saved thereby. All the machinery on the vessel (main engine, help engine, pumps, winches, referigeration system, etc) is serviced and checked by the engineer and the two oilmen. The work on a double rigged vessel can be really hard. Very little sleep, rough weather, many days away from the family.

Do the crew make much money? Depends completely upon the catch. A good voyage means Rs.5,000 to Rs.7,000 for a deckhand.

After three weeks of fishing, the freezing hold is loaded up with 2.5 tonnes and that's not considered good enough after so many days of fishing. If the catch is poor, the vessel will probably go to Cochin and fish for deep sea lobster, and stay there until the shrimp season begins again in June.

---

to 17,000 tonnes in 1985 and at least 24,000 tonnes in 1988/89. (Yield per hectare however is low, averaging 400 kg per hectare per annum). Notwithstanding this remarkable achievement, India's rate of growth has been slower than in a number of other Asian countries which have moved faster to fill market requirements.

In 1975 India was Asia's (indeed the world's) second highest producer of cultured prawn, but by '1985 her position had fallen to sixth in Asia and seventh in the world.

A number of reasons have been advanced to explain the apparent slow rate of prawn culture development in India. These include: the effect of land allocation policies; greater environmental concern than in some competing countries (where mangrove swamps have been severely affected); fragmentation of the efforts of.Government and State institutions concerned with development of the industry; relatively unattractive conditions for foreign capital; scarcity of seed, especially *Penaeus monodon;* and lack of commercially available feed commanding the confidence of the prawn farmers. It is the last of these aspects which we wish to address in the context of the overall prawn farming system.

For any farming operation there must be control of all the major inputs if profitability is to be maintained. For aquaculture these may be summarised as:
(1) a market for product off-take (2) stock of the desired species and in the required quantity. (3) a controlled growing environment (4) a diet to support rapid, healthy growth.

Criterion (1) has been met since Indian prawns of good quality find a ready market in Japan, USA orturope. Thus far requirements of post larvae have been met only partlyfrom wild sources, and new hatcheries are being constructed by Government or private organisations. These meet criterion 2. However, control of the growing environment (criterion 3) and availability of suitable diets (criterion 4) to support the slowly expanding monoculture of *p. monodon* in particular, require con-

siderable development before real success can be foreseen. The inter-relationship between environment and feed availability and quality are in many ways far more critical in aquaculture than in terrestrial farming, and thus if animals fail to survive or grow the blame is often, and perhaps unjustifiably, laid on the quality of the feed rather than on lack of control of water quality or the bottom soil.

On the assumption that water quality can be improved, what will be the requirements for prawn feed production in India, and what raw material resources are available?

Taiwan is frequently referred to in India as a model for Indian aquaculture, but experience in other Asian countries suggests that India will progressively move from extensive to semi-intensive methods using supplementary feed and that the Taiwanese intensive model will be adopted by only a small number of farms with sufficient capital and technological expertise. Moreover, under conditions of potentially depressed prices likely to obtain in the 1990s due to an oversupply of prawns on the world market, there may be sound economic reasons for preferring semi-intensive as opposed to intensive production systems. It would be most logical to aim principally for semi-intensive systems with annual yields per ha per annum (two crops) in the range 1 to 3 tonnes, where the feed required would be supplementary to nutrients coming from the natural productivity of the ponds. Data from the practical culture of prawns under extensive conditions indicates that natural pond productivity can support initial stocking densities of approximately 20,000 animals/ha, higher stocking rates depending on some form of supplementary feeds.

In India, **9O%** of cultured prawn production comes from farms using traditional or extensive systems, located principally in West Bengal and Kerala. Paradoxically, semi-intensive farming is most developed in states which are minor producers, especially Andhra Pradesh and Orissa. Farmers use mixtures of oilcake, rice bran, powdered dried fish, locally available snail, clam or mussel meat and buffalo meat etc., these ingredients being pre-cooked where necessary, mixed and ground up into a paste and often mixed with cooked tapioca as an adhesive binder. Moulded paste balls are placed in pottery bowls at marked pond sites, (approximately 30 per hectare) and feed loss is examined at 2-3 hourly intervals. There is often no attempt to nutritionally balance these feeds, and typical mixtures are shown below:

Mix1	Mix2	Mix3
Groundnut meal 10%	**Cooked buffalo meat 40%**	**Rice bran 50%**
Soyabean meal 20%	**Rice bran 60%**	**Groundnut cake 20%**
Rice bran 60%	—	**Clam meat 20%**
Tapioca *bob*	—	**Dried prawn head waste 10%**

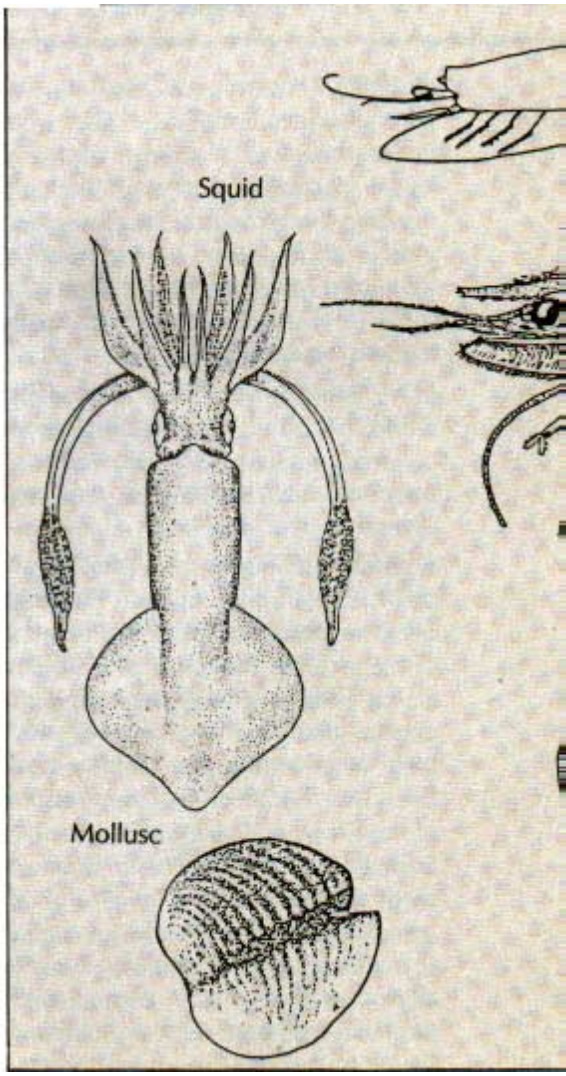
How mych of the feed presented to the prawns is consumed as feed or is broken down as fertiliser for use by pond organisms is a matter for more detailed study, but over-feeding is well recognised as a route for water pollution and stock losses.

A particular problem with formulations based on molluscs is that they are not sustainable in the long term; they depend on scarce proteinaceous ingredients, whose availability cannot sustain a major increase in demand. To meet the growing demand for feed, several companies have attempted to introduce pelletted feed for use in semi-intensive operations. Unfortunately, the feeds were rejected by farmers who complained of poor water stability. However, there were probably other problems contributing to this failure, especially poor farm management and husbandry (e.g. in water exchange systems) and the lack of advice on such aspects. The products were often tried for short periods, e.g. a week. This did not allow the shrimps to get accustomed to the change of diet, and the failure to consume may have been incorrectly attributed to the feed. On the one hand there is a need for a programme of on-farm testing prior to launching the product on to the market, as this could have demonstrated at least to the feed manufacturer the product's advantages over accepted feeding practices, and on the other hand, the approach to marketing should perhaps have laid more emphasis on technical selling and extension and less on subsidy. Indeed there would appear to be a danger in accustoming farmers to subsidies if they are extended over a long period. Subsidised farmers were often unwilling to pay Rs. 7-8 per kg of feed although they were aware that imported feed could cost more than Rs.25 per kg.

One company launched a new grower feed in April/May 1988, and though it has not yet been proved commercially by feeding trials, it appears to have high water stability.

Intensive farming has been practised at only one location, i.e. on the Hindustan Lever research farm in West Bengal. A high measure of success has already been reported, with yields of at least 5.5 tonnes per ha per crop using locally manufactured grower feed under controlled water quality and aeration. Unlike the pastes used in semi-intensive operations, fish meal (both locally available and imported from Norway) and prawn head meal have been used in formulating this feed. It is not known whether the company intends to sell feed in the open market to the mass of semi-intensive farms, and in competition with other manufacturers, but the cost effectiveness of using such a high

Possible raw materials for indigenou



<<

quality diet for semi-intensive pond culture has yet to be proven.

MPEDA has been at the forefront of official efforts to encourage the manufacture and use of supplementary feeds and has subsidized for a limited period the sale of new commerical feeds. At the same time MPEDA has recently persuaded the Government of India to reduce the duty on imported shrimp feed from 105% to 35% ad valorem. The aim of this measure is to get Indian farmers accustomed to using supplementary feed, until such a time as proven domestic feeds are available.

Despite these efforts, MPEDA has not wished to manufacture shrimp feed on its own account, and believes that this should be done by the private sector.

Projeded feed requirements

Early estimates of land area suitable for development of shrimp culture have ranged as high as 2 million ha. but these figures have since been revised down dramatically. MPEDA estimated the total brackishwater area under culture at 55,500 ha. in 1987, with an additional 122,000 ha. having potential for farming. Of the 55,000 ha. two thirds are concentrated in West Bengal, with Kerala and Goa being the other main producing States. Most of this area is farmed by traditional rice-cum-prawn (Bheri and Pokali) culture or other extensive systems. National annual production of cultured prawns for 1987/88 was estimated at 22,000 tonnes and is projected to rise to 24,000 tonnes in 1988/89.

There are 3,287 shrimp farmers registered with MPEDA, covering a total farm area of 16,178 ha. These are generally the most technically advanced farmers, and give some indications of the numbers likely to be interested in increasing their productivity. Supplementary feeding on a regular basis is reported to be most practised in Andhra Pradesh and Orissa, not in West Bengal and Kerala which have the largest areas under extensive shrimp culture. The area of semi-intensive culture is not known, but is believed to be approximately 2,500 ha. with an annual productivity of up to 1 tonne prawns per hectare. A few farms are obtaining 2 tonnes per hectare from two harvests.

Forecasting the demand for supplementary feed is difficult, but if Indian manufacturers were to supply a feed of proven quality and at a reasonable price, it could probably be adopted by the year 1991 for regular use with 8000 ha. This area is about **15%** of the total area currently under culture or about half of the area belonging to farmers registered with MPEDA. If one were to assume that annual yields per ha. were to commence at 800 kg and rise at **5%** per annum throughout the 1990's; that the apparent feed conversion rate was 2.5:1; that the total area under prawns was increasing by 5% per annum and that the proportion of farmers using supplementary feed was rising by **bob** per annum, (i.e., there is a 20% compound annual growth in demand from 1990 to 2000 AD) then, under these assumptions the area using supplementary feed would be expected to rise to about 14,000 ha. by 1995 and 28,000 ha by the year 2000. The annual feed demand would therefore rise to about 33,000 tonnes in 1995 and 82,500 tonnes in the year 2000. Of course, given the number of imponderables, there is a considerable margin of error in such estimates,but it should be noted that even if demand for shrimp feed were to increase to 80,000 tonnes it would still be only about 2.5% of the current demand for poultry feed.

The implication of these calculations is that prawn culture is unlikely to greatly affect the supply and demand situation for feed ingredients which are used in large quantities for poultry and other livestock. We therefore need only, be concerned with those potential requirements for prawn culture which are significant in relation to that supply.

Prawn feed ingredients

The range of raw materials typically included in prawn feeds are given in Table 1. They have been grouped broadly in terms of nutrient source and as potential attractants; but since prawn feeds must be water stable for a minimum of 2 hours, raw materials must also be selected in terms of their ability to, induce water stability. Water stability depends also on the methods of feed manufacture which enable the functional properties of raw materials to be developed.

Prawn feed manufacture has become a specific technology engineered by successful manufacturers and must be addressed as a separate issue.

In terms of raw material requirements, the most critical ingredients are the marine proteins, the major sources in India being fish meal, prawn heads, small non-penaeid shrimp, meat from bivalve molluscs and snails, squid processing waste and squilla (stomatopods). Unfortunately these materials – particularly fishmeal – are of limited availability in India for prawn feed manufacture, because they are an essential source of protein in other animal feeds. In contrast, oilseed meals and cereals are in abundant supply, though there will be competition for the least available (i.e. soya and sesame meals as plant sources of lysine and methionine/cystine respectively) between the poultry industry and the expanding prawn feed industry.

Ingredients essential for prawn diets but needed in small amounts – such as fish oils, phospholipids and sterols, vitamin/mineral mixtures and polymer binders – may need to be imported. However,the effectiveness of their use for supplemental feeds rather than for intensive culture will need to be clarified by practical trials to enable imports to be minimised.

manufacture of shrimp feed in India.

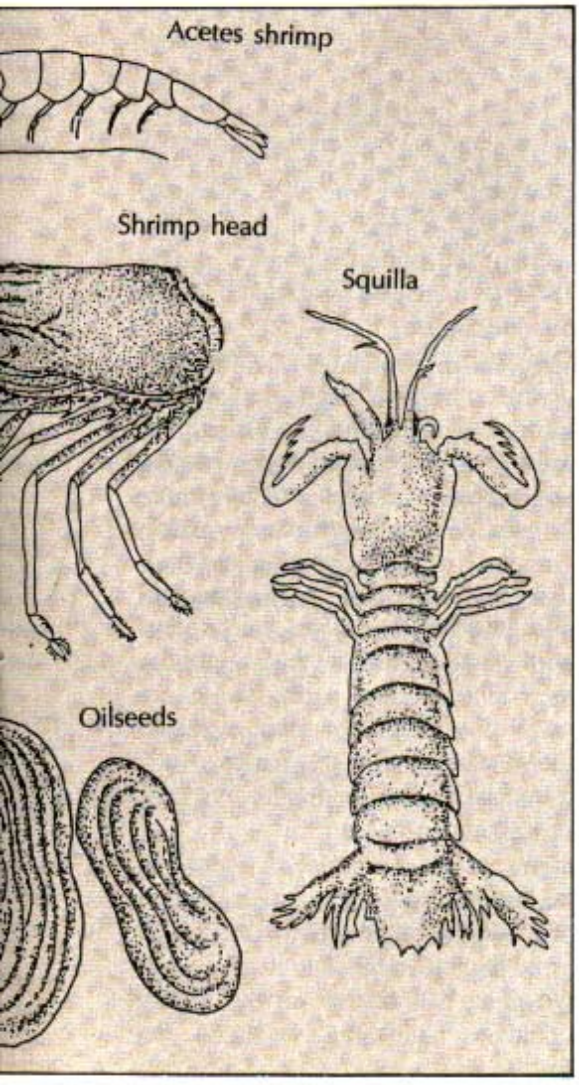


Table 1: Sources of Major Nutrients for Prawn Feeds in India

Type	Inclusion Level (%)	Sources	Major Nutrients Supplied: Protein	Carbo-hydrate	Essential Fatty Acids	Phospho-lipids	Sterols	Attractant Properties	Water stability Properties
Marine Proteins	30-50	Fishmeal	X		X	X	X	X	
		Prawn meal	X		X	X	X	X	
		Prawn Head meal	X		X	X	X	X	
		Squidmeal	X		X	X	X	X	
		Clammeat	X		X	X	X	X	
		Mussel meat	X		X	X	X	X	
		Snailmeat	X		X	X	X	X	
		Squilla meal	X		X				
Non marine animal proteins	1-5	Meat meal	X						
		Blood meal	X						
Vegetable Proteins	15-30	Groundnut cake	X		X				
		Soyabean seed cake	X		X				
		Sesame seed cake	X		X				
		Copra cake	X						
		Dried yeast	X						
Cereals	15-30	Wheat flour	X	X	X				X
		Wheat gluten	X	X					X
		Wheat bran	X	X					
		Rice bran	X	X					
Starches	1-20	Tapioca (pre-cooked)		X					X
Phospholipids	0.5-2	Lecithin			X	X•			
Oils	1-5	Fish Oil			X				
Polymer binders	0.5-4	Guar/gum							X
		Celluloses							X
		Alginates							X
		Synthetics							X

Details of potential raw material availablility in India are given in Table 2 and in the following paragraphs.

Fish meal.

Fish meal is made mostly from small demersal fish and shellfish brought in as by-catch and not used for direct human consumption, as well as some processing waste and some small pelagic fish caught in periods of glut. The small demersal fish and shellfish used are almost entirely shrimp by- catch, or rather that part of the, by-catch which remains after the larger and more valuable pieces have been separated out for direct human consumption.

Sources within the Indian fishmeal manufacturing industry (principally grinding of sundried fish) estimate the annual national production to be around 1 10,000 tonnes. This figure agrees with estimates of by-catch from prawn landings, and is probably the best estimate of fish meal production levels. Expansion of fishmeal production by present means, at least in the short term, does not seem feasible, since unpublished data from Government fisheries institutes indicate that overall fish landings have fallen in 1987 and 1988. The fall in landings is evident in the supply of fish meal which in 1988 is estimated to be 45% below the normal level of 110,000 tonnes, i.e. about 60,000 tonnes. It should be added that shortage of marine fish is a problem affecting many parts of the world, but the Indian sub-continent in particular.

Most of the fishmeal plants using reduction technology (rather than sundrying and grinding) which were established in India during the 1960s and 1970s, are out of business while a few plants in Karnataka operate only during the peak catch season. At the same time the proportion of shrimp by-catch available for making fishmeal is slowly diminishing, as more and more of it is marketed fresh or dried for human consumption.

The primary consumer of fishmeal is the poultry feed industry where an average inclusion rate of 5-7%, typically recommended, means that the poultry industry currently requires about 200,000 tonnes to satisfy its needs. However, this, is twice the estimated availability in 1988. As a result of this scarcity the price of fishmeal during 1988 has increased by about 60% over previous levels.

Most Indian fishmeal is made by sun-drying on the beach and grinding. Due to poor handling and processing, fishmeal is of low quality, and material with a protein content of 45% or more is now considered the best quality, compared to 65% or more in international markets. Most Indian fishmeals also have high microbiological counts and contain considerable impurities including salt and sand. These are major headaches for feed manufacturers, affecting both the quality of their formulations and the useful life of their processing equipment.

Some companies making developmental shrimp feeds have succeeded in procuring meal of satisfactory quality from Gujarat, but at a premium. However it is doubtful if the quality could be maintained for large and regular orders.

With the poultry feed industry growing by 10-12% per annum, and fishmeal supplies probably declining in the long term, there is a prospect of increasing scarcity and rising real prices.If prawn feed manufacturers are obliged to buy domestically produced fishmeal, which is of poor quality and in chronically short supply, then the rate of development of shrimp culture in India maybe severely hampered.There is therefore a case for permitting the importation of quality fishmeal into India at non-prohibitive rates of duty. (At present, import is extremely difficult.)

Prawn heads

The main unutilized source of marine protein is the heads of prawns from the prawn packing industry. Heads are usually removed in peeling plants near the landings or at packing plants, except for prawns landed by the large trawlers operating from Visakhapatnam, as these are deheaded at sea. India's total annual availability of heads, based on the quantity of prawns exported, is stated to be 30,000 tonnes, on the basis of average tail exports of 55,000 tonnes per annum, and a weight ratio of tails:heads of 65:35. Most of this quantity is currently treated as waste but a small amount is hot air dried for export to Taiwan where it is believed to be used in the manufacture of prawn feed. Since prawns are deheaded at many small landing sites there are logistical difficulties in collecting much of this material. We estimate that one third of all shrimp heads landed could be used for making meal,hence 10,000 tonnes of wet heads would yield approximately 2,200 tonnes of shrimp head meal or about 3% of our projected prawn feed requirements in the year 2000.

If prawn head meal of high quality is to be obtained, the wet heads must be dried quickly after deheading to avoid deterioration due to enzyme activity. Hot water blanching to denature enzymes before sundrying, or rapid hot air drying are recommended methods of treatment.

A further possible development which merits investigation is the extraction of head-meat by use of a meat-bone separator before drying. The protein content of the whole shrimp head meal produced by hot air drying is believed to be around 30%, but by extracting the meat, an ingredient with higher nutrient density and upwards of 60% protein could be made. It might also be possible to produce chitin and chitosan as useful by-products of the process. However, in many of the smaller landing sites, the quantity of product available on a daily basis would not justify the investment in machinery for upgrading of prawn heads.

Acetes **shrimp**

Landings of acetes shrimp *(Acetes indicus),* caught mainly in Maharashtra, averaged 15,000 tonnes in 1985 and 1986. The potential use of this small shrimp in animal feeding is limited by the fact that it is already mainly used for human consumption in India, as well as being exported to Japan (for human consumption) and small quantities to Spain and Portugal as bird feed. In view of this trend, acetes should not be relied upon as a source of protein for prawn feeding.

Meat from **bivalve** molluscs **and snails**

Meat from cooked claims, mussels and snails is already being used in shrimp feeding in localities where they can easily be collected, but it is evident that the supply, based on known and accessible resources, is limited and will not sustain a major increase in offtake. For example, in Andhra Pradesh, clam meat is already costing Rs.4.50 per kg to the farmer, which on a dry-weight basis is three to four times the wholesale prices for fishmeal, and prices are reported to have doubled in the last two years. Similar constraints were reported with the use of snails in the Chilka Lake area of Orissa.

One company currently dries grey clam *(Villorita cyprinoides)* and mussel meat for export to Taiwan, where they are presumably used as attractants in the manufacture of prawn feed. At a price of around US$1,500 and $2,200 per tonne respectively, they are clearly not suitable as major sources of marine protein, though they may find similar uses in India to those in Taiwan.

Table 2: Availability of Major Raw Materials for Prawn Feed in **India.**

Raw Materials	Estimated Potential Availability per Annum (tonnes)	Estimated off take by other users (tonnes)	Other Users
Fish meal	110,000	110,000	Poultry feed
Prawn-Head meal	2,200	100	Export, resource to be developed
Acetes shrimp	15,000	15,000	Human food – export
Squilla meal	10,000	10,000	Poultry feed/fishmeal, fertiliser
Clam meal	500+	500	Export – Taiwan
Mussel meat	N.A.	N.A.	Used wet in local prawn feeds
Rice bran[1]	2.2 million	N.A.	Human food. Poultry and cattle feed
Groundnut cake[2]	1.4 million	300,000	Export-animal feed
Sesame cake[3]	270,000	1.1. million	Animal feed
Soyabean cake[4]	560,000	560,000	Animal feed
Tapioca	5.6 million	N.A.	Human food, Starch/animal feed

Notes:

55.5 million t. paddy per annum x 4% rice bran fraction.

2 6.7 million t. shell on nuts per annum x 50% crushed x 43% cake.

3 0.5 million t. seed per annum x 90% crushed x 60% as cake.

0.7 million t. seed per annum x 80% as cake.

Squid waste

Where not discarded overboard most of the squid waste is dried for use as fishmeal, and for this reason it cannot be treated as a separate resource in addition to those already discussed. Small quantities of squid waste are dried for export to Taiwan. Private sources estimated that sufficient waste was easily available for export of up to 600 tonnes per annum, but logistical problems, the export of squid in whole form, and excessive salting prevent larger quantities from being collected. Whether there is a potential for the establishment of a squid fishery remains to be seen.

Squilla

Landings of stomatopods, consisting mainly of squilla *(Ovallosquilla nepa)* were estimated to be 40,000 tonnes in 1985 and 1986, being largely concentrated in the Karnataka coast. This resource is being dried for use as fertilizer and low grade fishmeal, but like the squid waste it should not be counted as an additional resource. The main point of interest is that it might lend itself to processing by the meat-bone separator as suggested for prawn heads. The techno-economic feasibility of this proposition perhaps merits its further investigation.

Oilseeds

India is a major producer of oilseed meals which could be utilised in prawn feeds, particularly soya, sesame and groundnut, though the latter will require screening for aflatoxin contamination. Consistency of quality is essential for maintaining formulation quality and the development of close working relationships between the oil cake producer and feed manufacturer to ensure product consistency should be strongly encouraged.

Miscellaneous ingredients

As indicated in earlier paragraphs, some of the minor but essential ingredients will require importation, the cost of which, including any duty, must inevitably be passed on the feed purchaser. The market demand for these materials may encourage the establishment of local industries, but in the short term, importation would appear to be necessary.

Conclusions

From the foregoing examination of raw material availability and the criteria for establishment of successful prawn farming and feed manufacturing enterprises, it is clear that there is a major deficiency in marine protein for prawn feed manufacture in India. Since this is a major limiting nutritional requirement for formulation and thus manufacturing capability, the establishment of mechanisms for improving the supply of quality fish meal to the industry requires urgent attention. The expansion of prawn feed manufacturing in India may otherwise be seriously hindered.

glimpses into BOBP projects

Wooden Orus in Sri Lanka

Two wooden *Orus* (outrigger canoes) built by BOBP, more fuel efficient than tarditional dugout Orus, are engaged in commercial test fishing in Doddanduwa, a beach-based fishing village in southern Sri Lanka.

The purpose is to demonstrate ways of building planked canoes to replace the traditional dugouts. This will reduce the amount of wood needed and at the same time these vessels will be more fuel efficient than the traditional canoes.

One of these canoes is round-bottomed. It uses Jack wood strip planks glued with epoxy. The second canoe, with hard chines, uses short planks of pressure-treated mango wood. The material is cheap and the building method easy for fishing village based boat building.

The boats were built in Negombo. Four carpenters did the job, under the supervision of Consultant Naval Architect Oyvind Gulbrandsen and Marine Engineer (Associate Professional Officer) Roger Karlsson between November 1987 and February 1988. The outrigger float is in fibreglass.

Technical trials were carried out with a 8 hp kerosene OBM and a sailing rig. Under a load of 400 kg, both canoes reached a speed of 7.8 knots, as compared to the 6.3 knots speed of 18 ft FRP boats. Under sails, a maximum speed of 5 -6 knots was obtained when the wind speed was 8-10 knots.

After technical trials the canoes were taken to Doddanduwa for commercial fishing. Traditional fishermen there appreciated the large working space and high speed of the boat. (With a 8 hp OBM the BOBP Oru was as fast as traditional Orus with 15 hp OBM). They also appreciated the fact that the boat is so fuel-economic. To further reduce the canoe's fuel cost a long-tail diesel engine will be tested.

One of the wooden Orus doing test fishing in Doddanduwa.

OYSTER MARKETING IN PENINSULAR MALAYSIA PROSPECTS AND PROBLEMS

by Charles Angell

In the first detailed study of oyster marketing in peninsular Malaysia, BOBP investigators talk to oyster collectors, brokers, retailers and consumers in several centres. The study's findings are summarized in this article.

An earlier issue of *Bay of Bengal* News (September, 1986) looked at the potential for oyster culture in BOBP member countries. BOBP has since been assisting the Fisheries Research Institute at Glugor, Penang, Malaysia in its oyster culture development study. The work until now has concentrated on technical aspects of oyster culture, but we wanted to learn more about how oysters are actually sold and consumed in Malaysia. Delicious as they are, oysters are only a very minor part of total Malaysian fisheries production and barely rate a place in official statistics. So, we had to go to the "primary" data source – the collectors, traders, hawkers, restaurants and last, but certainly not the least, the consumers.

The study was approached in two phases. BOBP commissioned INFOFISH. an FAO project based in Kuala Lumpur, to do a preliminary survey of the market, defining its outstanding features. For the follow-up phase, Nicholas Luginbuhl of the BOBP travelled to Malaysia to take a more detailed look at the market chains through which oysters are sold, and in particular at the street food hawker business, known to be an important retail outlet for oysters.

Acknowledgements

The author expresses his thanks to Mr. Ong Kah Sin, Director of Research, Fisheries Research Institute, Glugor, Ng Fong Oon, Project Manager; Ms Devaki Nair, Fisheries Biologist; Kamal Zamen, Fisheries Officer; and to all the collectors, brokers and retailers who so generously shared their knowledge.

Why a market study now?

The project doesn't have any product to sell yet, so why bother with a study at this early stage? There was a general feeling that oysters should sell well with Malaysian seafood consumers. Moreover, the import of fresh oysters from Thailand, and the steady rise in imports of dried oysters from South Korea, indicated demand for oysters. But one couldn't be absolutely sure in the absence of a study. If we could get data on prices and product preferences and on how demand is distributed in the country, we would be better able to judge if the culture technologies being tested by BOBP were appropriate and profitable.

How was the study implemented?

Although some scanty statistics were available on oyster production, imports and exports, our study rested on interviews with oyster collectors, brokers, retailers and consumers. The investigators visited many oyster production, marketing and consumption centres on the west coast of peninsular Malaysia. Government fisheries officials at the state level were consulted on culture technology and on statistical data.

We wanted a snapshot view of oyster marketing in the country to highlight its most important features and to guide us in our choice of growout systems. It would have been impractical to visit every hamlet and town where oysters might be traded or consumed. But we hoped to get the information we wanted by focusing attention on major production, trading and consumption centres. After consultation with FRI staff and state fisheries officials, the following locations were selected : Langkawi, Penang, Lumut and Pulau Pangkor, Kuala Lumpur including Port Klang, Petaling Jaya and Kuala Selangor, Melaka, Muar and Johor Baharu.

How are oysters produced in Malaysia, by whom and how much?

The bulk of production originates from intertidal stocks of *Saccostrea cucullata.* Muar and Pulau Pangkorare exceptions, where *Crassostrea belcheri* is harvested by divers. Collectors use hammer-like oyster picks to open the upper shell of the oyster and remove the meat, which enters the market chain as a shucked product. Once it enters the market chain in shucked form, there is no species differentiation.

One noteworthy outcome of the marketing study was the picture that emerged of oyster collectors. Both major ethnic groups in Malaysia participate in oyster harvesting. The collectors are predominantly women, who occasionally act as brokers. Many of the approximately 100 collectors, of Penang are women in their fifties or older, and told our interviewer that young people are not interested, preferring easier and more lucrative jobs in the many factories on the island.

Collectors are active in Pulau Pangkor, but oyster harvesting is a part-time activity, fetching only about M$ 60 per month for the women who harvest intertidal oysters and the men diving for *C. beicheri.* Melaka is one of the major

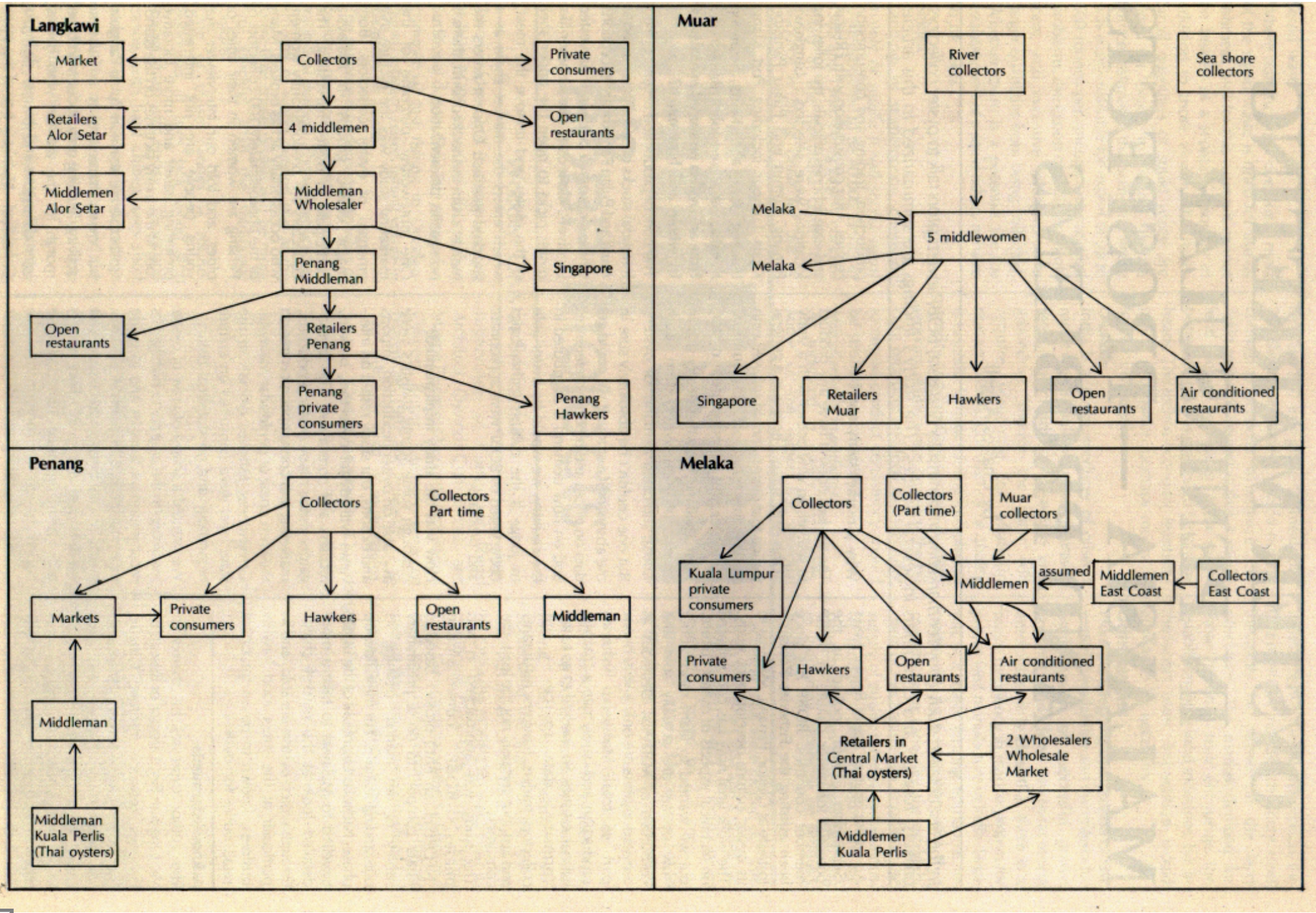


Fig. 1: OYSTER MARKETING CHAINS IN SOME MAJOR **CENTRES**

<<

BOBP is assisting the Fisheries Research Institute, Glugor, Penang, in oyster culture.

consumption centers in peninsular Malaysia and about 20 women harvest stocks from the surrounding coastal area. Collectors working the beds south of Melaka can bring in about M$ 200 a month working part-time. Some of the ladies working full time at oyster harvesting travel considerable distances by bus, often as far south as Johor Baharu. A few of them also act as brokers.

Harvesting sites are obviously widely dispersed. Most transactions are direct between the collector and his or her customer, be it broker or retailer. And considering the relatively minor position of oyster landings in the context of total Malaysian fishery production, it's no wonder that statistical data are scarce. The 1984 FAO statistics cite a figure of 2 tons, undoubtedly an underestimate.

On the basis of interviews with individual collectors, and estimates of the number of collectors, we worked out annual production figures for five west coast centers (Table 1). Annual exports of fresh, chilled and frozen oysters, mostly to Singapore, averaged 57 MT between 1984 and 1987. Since Singapore imposed stringent sanitary standards on bivalve imports, these exports declined to an estimated 27.7 MT in 1987. We do not know if the difference has been diverted to Malaysian markets. If so, the results of our interviews with collectors, brokers and retailers do not point to' any depressing effect on prices. We have no production estimates for the east coast of penisular Malaya.

Distribution of fresh oysters.

The striking feature of Malaysian markets for oysters on the West Coast is the variety of marketing distribution systems. Production and marketing centres are often far away from each other. Both buyers' and sellers' markets can be found.

Langkawi is a buyer's market, as is Pulau Pangkor and the surrounding areas, where collectors have no power to influence prices unless they avoid normal channels. Local demand is limited compared to local production, depressing prices. Geographical remoteness and broker monopsony are the two main factors that keep prices low despite high demand outside the collectors' locality. Brokers have all the connections required to ensure an effective disposal of oysters. In their present situation, this could never be done by collectors themselves who are not organised and lack the necessary skill and connections to get good prices.

Table 1

Center	Annual Production (MT) of shucked meats
Langkawi	52.8
Penang	18.0
Pangkor	7.2
Melaka	31.2
Muar	18.0
Total	127.2

Oyster supply patterns

Shucked oysters are packed by collectors or middlemen in plastic bags of 300 gm each filled with water. This makes oysters gain weight through osmosis. Fresh shucked oysters are imported from Thailand and partly supply the markets of Penang, Melaka and Kuala Lumpur. Apparently, tax is levied on fresh oyster imports. Oyster production from the Malaysian west coast is not subject to high seasonal variations. The exception is the Muar River mouth, where production drops dramatically during the monsoon. According to fishermen, the situation is caused by two factors: high mortality rate due to change in salinity and their reluctance to dive when the water is deep and cold. Variation in production also occurs during high and low spring tides.

Price sensitivity to gluts makes collectors reduce their production immediately. As the supply of imported oysters does not fluctuate much, market prices seem stable. But during the monsoon oyster production from the east coast drops considerably and local prices rise by **10%** to 20%.

The harvest size of oysters reflects the intensity of local demand, and may indicate over harvesting. In Melaka where the demand is very high, oysters are extremely small; collectors return to the collecting spots at short intervals. The size of oysters sold to hawkers is around 1.5 cm in diameter and some of them are even under 1 cm.

In Penang and elsewhere, oysters are slightly bigger. Muar oysters which have a diameter of around 3.5 cm find a good market in Melaka, Johor Baharu and in Muar itself.

All the consumers interviewed said that old people dislike big oysters while youngsters prefer medium size oysters of 2.5-3 cm. This would indicate that possible future production should aim at slightly increasing the size of shucked oysters.

Ninety percent of the oysters consumed are eaten outside the home. Most fresh oyster consumers are Malaysian Chinese, who are well known as oyster-lovers. They are regular customers and the great majority reported they

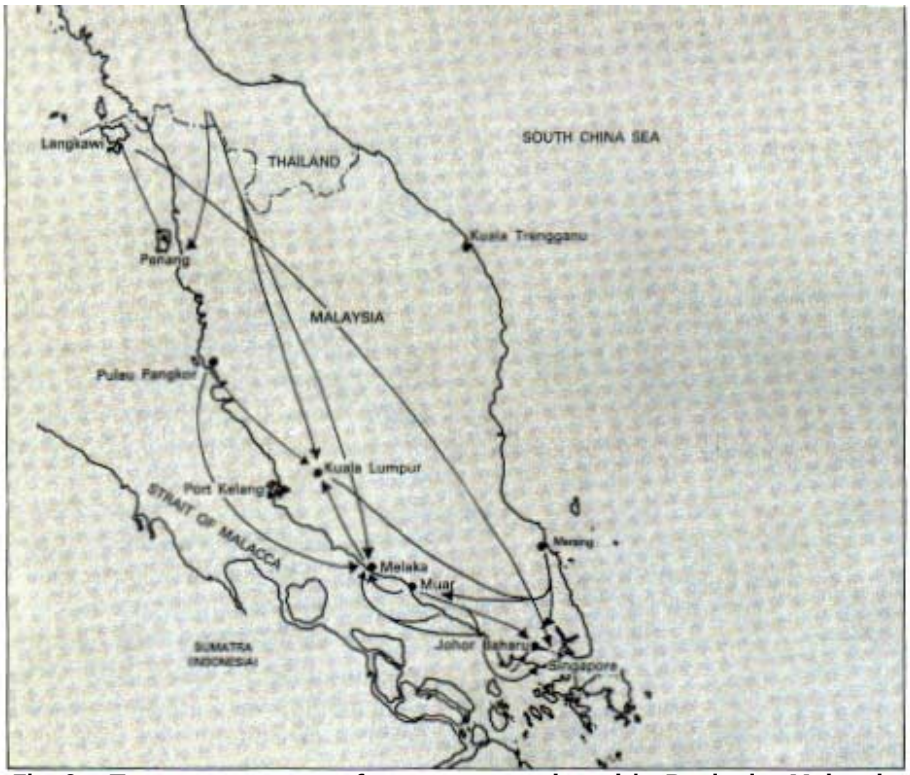


Fig. 2 : Transport patterns for oysters marketed in Penisular Malaysia.

mind paying high prices. However, oysters are considered an expensive delicacy, not exactly an everyday dish. Very poor people do not consume oyster omelettes outside the home. Malays very rarely eat fresh oysters in omelettes, but according to hawkers and open restaurant managers, their number is increasing.

More sophisticated dishes cooked usually with bigger fresh oysters are served in the south, in Melaka and Muar. They are prepared by air conditioned restaurants and attract the wealthier customers. Aphrodisiac qualities are attributed to oysters, and though it is not often openly admitted, many people consume oysters for their supposed therapeutic qualities. This is with particular reference to a dish of raw oysters prepared with ginger and vinegar and chilled for some time. However, with the consumer concern over shellfish sanitation, raw oyster consumption has drastically declined. As there is some interest in trying new dishes, introduction of larger oysters on the menu by open restaurants might well find an expanding market.

From producer to consumer — the market "chain"

Our study highlighted the active trading in oysters; it moves north-to- south along the west coast of peninsular Malaysia. In addition, supplies reach major west coast consumption centers from east coast harvesting sites. (Fig. 2). In some production centers collectors have several alternative outlets for their harvest. We found that direct sales from collector to retail outlets, both restaurants and public markets, are common. Collectors may also have a preferred list of private customers to whom they sell. This is the case in Langkawi, Penang, Pulau Pangkor, Lumut and Muar. East coast oyster fishermen deal with brokers who supply restaurants in Johore Baharu, Kuala Lumpur and Muar.

While a few brokers, particularly women in Muar, Penang and Melaka, deal only in oysters, many brokers do not specialize in oysters; the trade is not big enough. They are normally brokers dealing in marine products in general. Langkawi is worth a closer look as the major production center on the west coast. One wholesaler dominates island trade and is very well organized. Not only is he supplied by four brokers, who buy from 40 female collectors locally, but he also employs some 40 Thai women who are provided with a boat. He plays a traditional "middle-man" role through credit ties to his suppliers. This wholesaler has extensive contacts on the mainland and ships oysters to Kuala Lumpur, Penang and Singapore. While shucked meats are sent to Kuala Lumpur, whole oysters are shipped to more quality-conscious Penang and Singapore.

There also appears to be a considerable amount of direct marketing by collectors. They may sell to hawkers, openS air restaurants, retail fish markets and the occasional household. A few collectors may act as brokers too; Penang and Melaka for example have such arrangements. No cases were found of collectors organizing themselves to obtain market leverage.

Diagramatically, market chains for several of the more important centers of Langkawi, Penang and Melaka and Muar are illustrated in **Fig. 1.** The diagrams point out the disadvantageous position of Langkawi oyster collectors as a result of the island's remoteness from major market centers. Supermarkets are not yet widely involved in oyster retailing, but the potential is there. Irregular supply may be one inhibiting factor in the supermarket picture, which aquaculture could alleviate.

The bar chart of Fig.3 presents the price structure in the market chain for some of the major production and consumption centres. We found the lack of comniunication betwen production and consumption centers to be quite striking in some cases, resulting in wide price variations and sometimes high margins. For example, collectors working the beds in the Pulau Pangkor-Lumut area get only M$ 4-5 per kg, while brokers working out of nearby Setiawan sell these same oysters for M$7 to Kuala Lumpur retailers where consumers pay M$ 13 per kg.

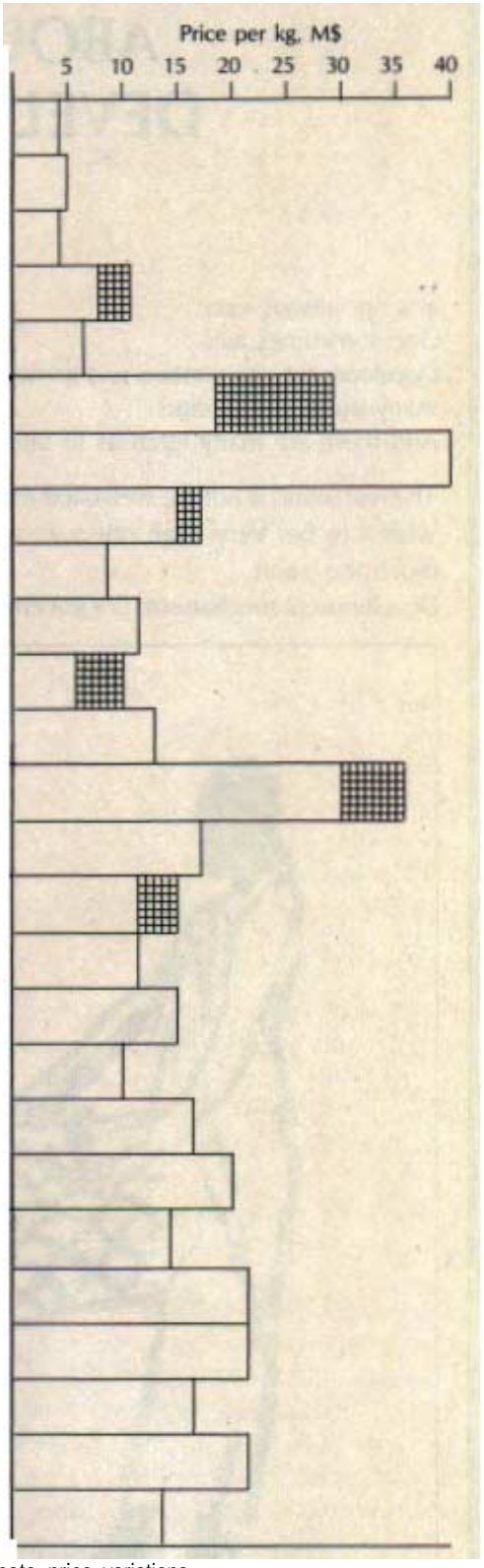
Analysisof market margins taken by different intermediaries indicate that in general the more the quantity handled, the less the mark-up. But the most striking characteristics of this market are the parallel channels of marketing. Wholesalers, middlemen and retailers are not dealing with local production where it is exceeded by local demand. It can be assumed that if production is encouraged outside ofthe consumption centers it will be channelled through middlemen and it is unlikely their mark up will increase. This could have a depressing effect on oyster prices collected at the consumption location, particularly at Penang and Melaka.

We don't want to leave the reader with the impression that oyster consumption is limited to the west coast of peninsular Malaysia. However, oyster consumption on the east coast of peninsular Malaysia is much less widespread, compared to the west.

Can the market absorb 'additional supplies? In the absence of any sort of time-series data on consumption and prices, we have to rely on the anecdotal

Fig. **3: OYSTER PRICE STRUCTURE AT IMPORTANT CENTERS IN** MALAYSIA

	SELLER	BUYER
LANGKAWI	Collector	Wholesaler
	Broker	Wholesaler
	Collector	Local Broker
	Collector	Consumer, restaurants
	Retail market	Consumer
PENANG	Female collector	Hawker
	Supermarket	Consumer
	Female collector	Open restaurant
	Importer for Thai oysters	Broker
	Broker for Thai oysters	Consumer
	Langkawi oyster broker	Local broker
	Broker for Langkawi oysters	Consumer
PORT KLANG	Collector	Open restaurant
	Supermarket	Consumer
MELAKA	Collector	Hawker
	Central Market	Consumer
	Broker for east coast oysters	Consumer
	Broker	Consumer
	Collector	Open restaurant
	Collector	Aircon restaurant
MUAR	Collector	Middlewoman
	Middlewoman	Hawker
	Middlewoman	Open restaurant
	Middlewoman	Aircon. restaurant
	Collector	Open restaurant
	Collector	Aircon. restaurant



The chart above shows who sells oyster to whom, where and at what price. Shaded areas indicate price variations.

evidence supplied through the study. A number of respondents at the retail trade end of the market chain felt that oysters were becoming too expensive, implying that an increase in supply could lower prices enough to expand consumption. Restaurant owners in Muar are worried about declining production from the river and retailers in other towns about inconsistent supply. Penang hawkers foresee increasing demand but are also concerned about high prices. Shucked oyster meats are imported from Thailand – another indication of short domestic supplies.

Market promotion can increase consumer awareness of oysters as a desirable addition to the menu. Several of our respondents suggested as much. Hotels, supermarkets and air conditioned restaurants offer opportunities for modern promotional' methods, not to mention TV, radio and the printed media. Product sanitation is an increasingly worrisome issue in Malaysia and aquaculturists will have to convince the consumer that their product is wholesome. Growing in clean water along with the introduction of depuration are a start, but good post harvest handling practices must be adhered to.

From the studies we believe that cultured oysters do have market potential. Given the widespread over-harvesting of wild stocks of oysters, farming is the only way to increase supplies in the Malaysian market.

ABOUT DEVELOPMENT AND DEVELOPMENT COOPERATION

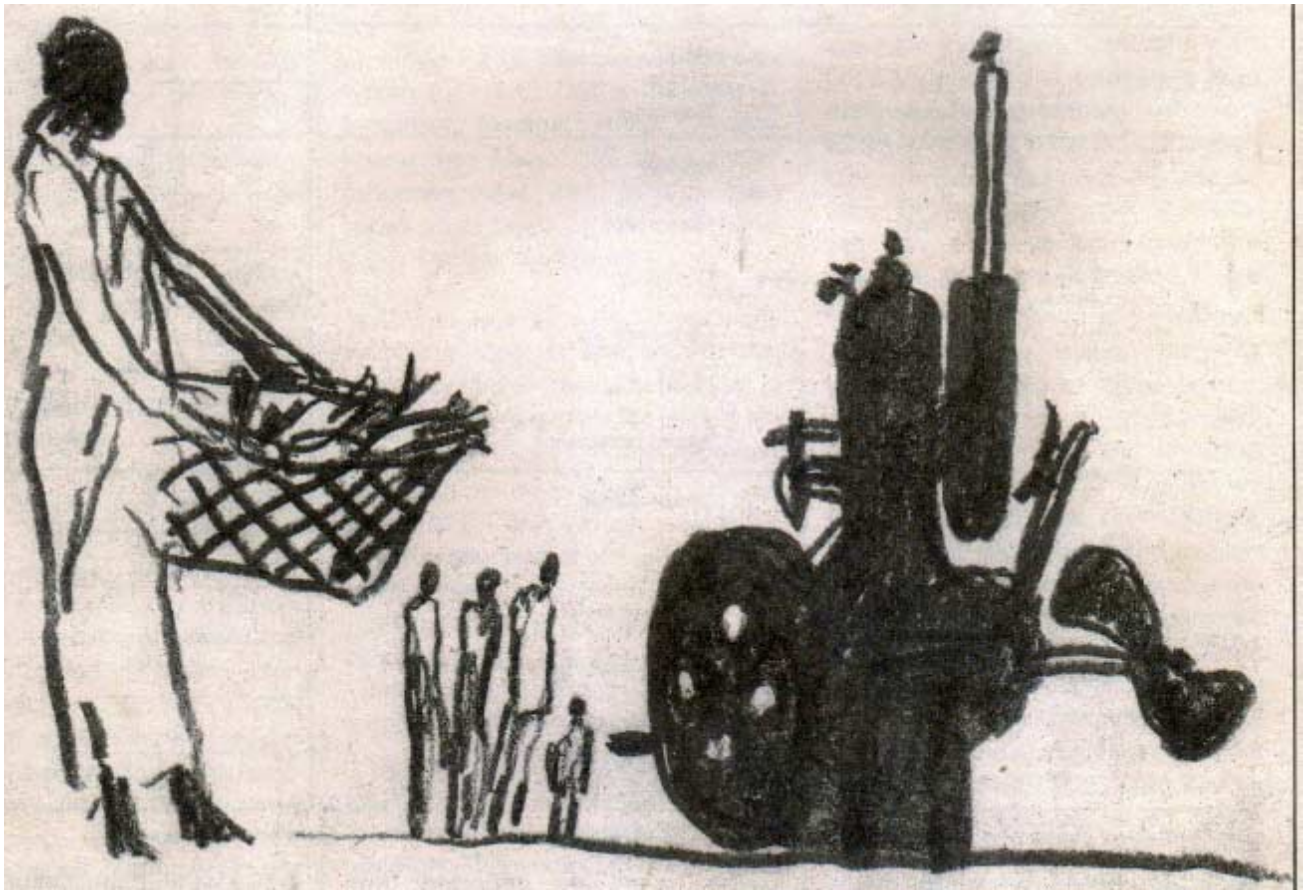
by Signar Bengtson

(Text translated from Swedish)

It is not always easy.
One sometimes fails.
Development cooperation is a game with many unknown factors.
And there are many interests to safeguard.

The real world is not the well-oiled machine one would wish it to be. Very often one. wants too much too soon.
Development mechanisms are governed by their own laws.

It isn't easy to know which ones.
It's difficult to predict how things work.
Sometimes a word, a gadget or a cage of ducklings produce unexpected effects.
Fisherwomen see new prospects or openings.
Children of village schools learn to see **their world in a** different perspective.
Perhaps we outsiders have the wrong priorities.
May be education ought to have come before engines?



BAY OF BENGAL NEWS

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/1 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.

Published by Lars O Engvall for the Bay of Bengal Programme, 91 St. Mary's Road, Abhiramapuram, Madras 600 018. Photo-typeset and printed by Nagaraj & Co., Madras 600 041. Processing by Colour Grafix, Madras 600 028. Editor: S.R. Madhu. Layout artists': E. Amalore, S. Jayaraj. Tel: 456894, 456896. Fax: 044-456102. Telex: 41-8311 BOBP.

<<