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THE ESTUARINE SET BAGNET FISHERIES OF BANGLADESH



THE ESTUARINE SET BAGNET FISHERIES OF BANGLADESH

A Bio-Socio-Economic Study

This article summarizes the findings, conclusions and recommendations of eight technical papers prepared by 12 biologists and two socio-economists in Bangladesh for presentation at a BOBP-sponsored seminar. The seminar, held in Cox's Bazaar, Bangladesh, in January 1992 was attended by officials from the Department of Fisheries, Ministry of Fisheries and Livestock, the Agricultural Research Council and several universities in Bangladesh as well as by observers from Myanmar, Thailand, Malaysia and Indonesia.

The background

The set bagnet fishery, a traditional type of fishery in the coastal, marine and estuarine brackishwater areas of the Bay of Bengal region, is practised in one form or another in India (West Bengal), Bangladesh, Myanmar, Thailand, Malaysia and Indonesia. In Bangladesh, the bagnets are mainly used in the estuaries, being set during high and low tides.

Of the 72,000 t of fish produced by Bangladesh's marine sector (31 per cent of all fish production in the country), about 70 per cent is

contributed by set bagnets in the estuarine environment. These are operated by some of the poorest of Bangladesh's fisherfolk.

Objections to the operation of this gear have been raised by shrimp culturists and trawler operators in Bangladesh on the grounds that juveniles of shrimp and finfish were being caught. Consequently, a preliminary survey of this fishery was carried out in 1988 by the Bay of Bengal Programme (BOBP) at the request of the Department of Fisheries. It was confirmed that juveniles of many species were being caught. Based

on the findings, a comprehensive study was planned and executed, between 1989 and 1991, by the scientific officers of the Marine Fisheries Research and Development Project in Chittagong, with the assistance of BOBP.

In approaching the subject, it had to be taken into consideration that many species caught by the estuarine set bagnets were also caught by many other marine fisheries, such as the pushnet and bagnet fisheries that collect shrimp seed for culture, the marine set bagnet fishery, the beach seine fishery, the trammelnet fishery,

A bagnet is set in estuarine Bangladesh (on the cover) and is hauled in with the catch (below).



the bottom longline fishery for jewfish, and the trawl fishery for shrimp and finfish. As all this results in interactive and/or competitive fishing among the various fisheries, the relative impact of the estuarine set bagnet fishery on the resources exploited had to be examined for any meaningful management consideration *vis-a-vis* that of other fisheries exploiting the same resources.

Considering that the estuarine set bagnet fisherfolk are among the poorest in Bangladesh, it was also essential to assess their earnings from the estuarine set bagnet fishery, their income from other sources, their socio-cultural characteristics (to determine appropriate alternative employment), and their ability to participate in any community-based approach to management of the estuarine set bagnet fishery, if such measures were found to be necessary. Hence a bio-socio-economic approach was taken.

The set bagnet fishery

GEAR

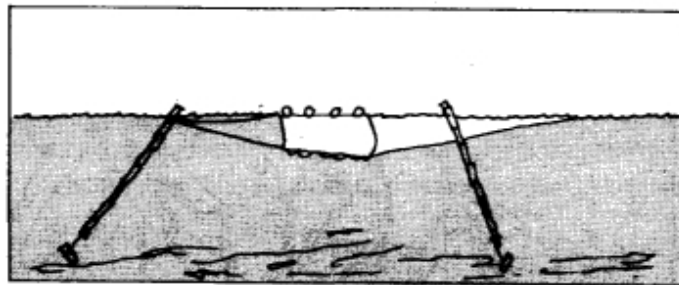
The set bagnet is a conical net, like a trawl, with a rectangular mouth opening. Two wings spread out diagonally from the sides of the mouth opening. The gear is kept fixed in position with poles planted at the bottom holding up the ends of the wings and keeping the mouth of the net open. Mesh size decreases steadily towards the cod-end of the net. The gear has been described in detail by Akerman (1986). During high tide, the mouth of the net faces the sea. The fish trapped in the cod-end are emptied by lifting the end of the net. The net is then turned to face the land during low tide, to catch fish moving out to sea as the water recedes (see Figure 1).

The estuarine set bagnet is classified, in Bangladesh, into small, medium and large categories, primarily on the basis of its length. During the preliminary survey it was observed that the size of the mouth opening has a more significant effect on the performance of this net than its length. The gear was, therefore, classified for the study into four sizes, according to the size of the mouth opening. Since most of the sampling of the catches was done at the fishing site, where the net was fixed under water, an index of the size of the mouth opening was taken to be the distance between the two poles fixed on either side of the mouth opening. Consequently, the four sizes of nets arrived at were as follows

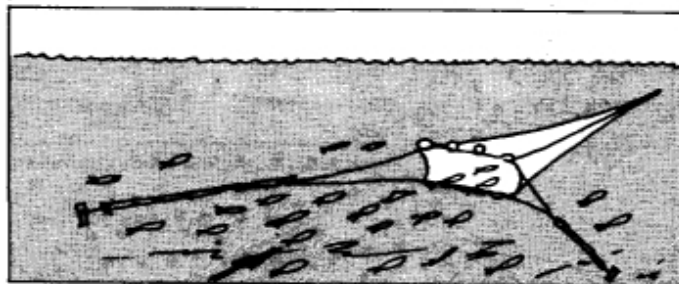
Size	a	b	c	d
Distance between poles (in)	<6	6.1-10	10.1-15	>15
Appx. area of mouth opening (m ²)	<16	16-50	51-90	>90
Estimated no. of units	4739	4705	3054	63+3852 (marine)
Cost/unit of gear (Tk)*	7-10,000	10-15,000	15-25,000	20-35,000
Cost/craft (Tk)	Range 1k 3000-30,000.		Average	1k 10,000

* US \$1.00 = 35 TK (Appx.)

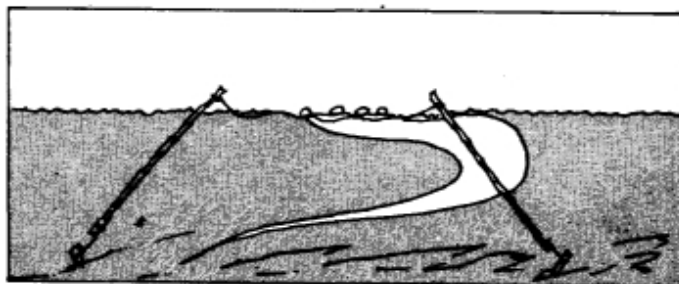
Fig. 1. How the set bagnet (Behundi Jal) is operated



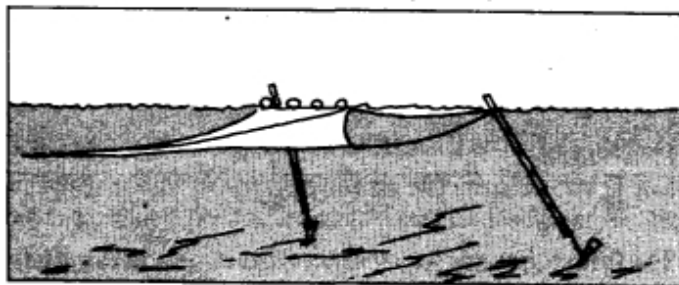
1. During the intertidal period the net is set in the current by attaching it to holdfasts. The net floats on the water surfaces.



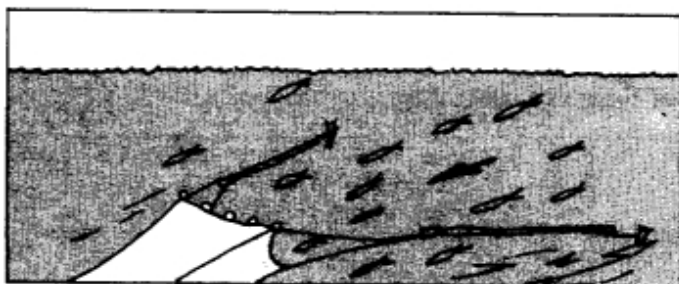
2. When the current gets strong the net sinks and stretches. Fish drift in with the current.



3. During a subsequent intertidal period the net comes up to the surface and is emptied of catch.



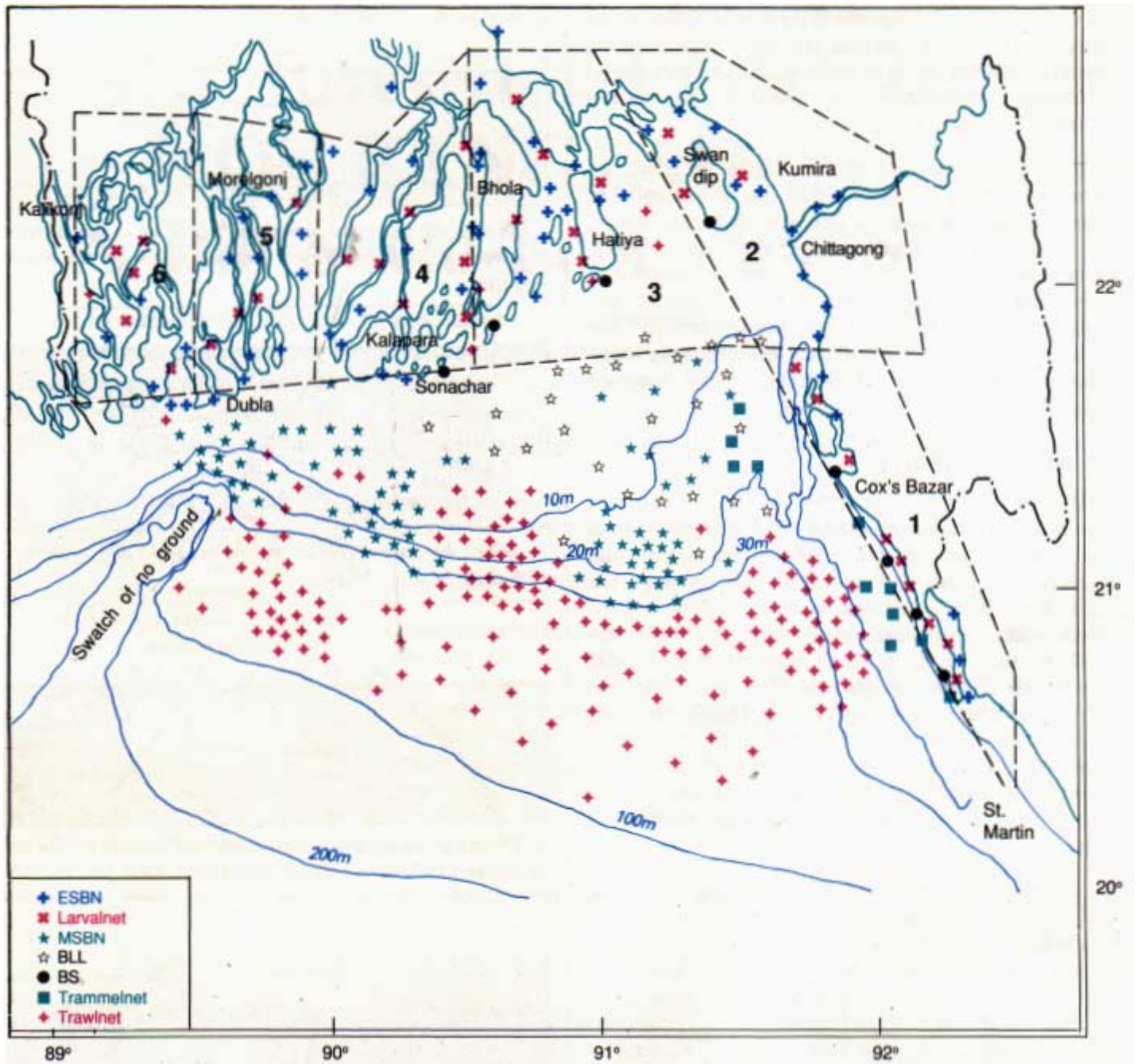
4. The current reverses itself, and the net is set in the opposite direction.



5. As the current gains strength the net once again sinks and stretches this time in the opposite direction.

The sequence of operations may be repeated as long as
(a) satisfactory catches are attained
(b) the gear remains undamaged and
(c) the weather remains fair

Fig 2. Area of operation of interactive fisheries



The fishing grounds for all seven types of gear in this study and the six stations in the six strata sampled, are shown in Figure 2. The hand-operated pushnet and fixed bagnet are simple and cheap structures operated mainly by children and women close to the bank of the estuary and seashore. The number of units of relevant gear and the estimated number of fishermen using them are tabulated below:

	Shrimp seed collection	Estuarine set bagnet (ESBN)	Marine set bagnet (MSBN)	Beach seine	Bottom longline	Trammel net
No. of units	75,000	12,561	3876	550	300	400
Avg. size of crew	2	3	3	15	9	6
Fisherfolk engaged	150,000	37,683	11,628	8370	2700	2400
Periods operated in a year (months)	5-8 (Months vary with location)	10-12 (Jan-Dec)	6 (Oct-Mar)	12 Nov-Feb (Seashore Mar-Nov (Estuary)	7 (Aug-Feb)	8-11 (depending on sea conditions)

SPECIES

Typical of tropical fisheries, the estuarine set bagnet catches 15 different types of penaeid shrimp, three non-penaeids, nine freshwater prawn (the juveniles live in brackishwater), three crab, three mollusc, 90 pelagic finfish and 62 demersal finfish, in all about 185 species. A comparison with other fisheries is given below

Variety	ESBN	Pushnet Faed bagnet	MSBN	Beach seine	Bottom longline	Trawl-net	Trammel net
Penaeid shrimp	15	6	5	7	0	3	11
Non-penaeid	3	1	1	1	0	0	0
Freshwater prawn	9	4	1	4	0	0	0
Crab and mollusc	6	4	6	4	0	1	5
Finfish	152	50	30	38	15	14	57
Others	0	20	2	2	0	0	3

Some of the important species caught by more than two of the methods of fishing listed are *Pmonodon* (Tiger shrimp), *P indicus* (Indian white shrimp), *M. monoceros* (Speckled shrimp), *P stylilera* (Kiddi shrimp), *P sculptilis* (Rainbow shrimp), *Acetes indicus* (Sergestid shrimp), *M rosenbergl* (Giant river prawn), *P styliferus* (Roshna prawn), *L. savala* (Ribbonfish), *H. nehereus* (Bombay duck), *O. pama* (Croaker), *J argentatus* (Croaker), *J. belangeri* (Belanger croaker), *S. taty* (Hairpin anchovy), *I. filigerii* (Jewelled ilisha), *E tetradactylum* (Four-finger threadfin), *P paradesius* (Grunt), *P argenteus* (Silvergrunt), *Arius thalassinus* (Giant marine catfish) and *S. phasa* (Gangetic anchovy).

SPECIES DISCARDED

During shrimp seed (post-larval) collection, only two per cent of the catches by pushnet and half a per cent of the catch by fixed bagnets are of the *P monodon* (tiger shrimp) sought for culture. The larvae and juveniles of other valuable penaeid shrimp species (14% in PN and 8% in FBN) and fresh-water prawn, non-penaeid shrimp, finfish and other planktonic forms (84 % in and 91.5% in FBN) are discarded on the banks of the estuary – a tremendous loss of valuable resources.

In the estuarine and marine set bagnet catches, though over 50 per cent of the catches are juveniles, hardly any species, except jellyfish, squilla etc, are discarded. Trammelnet and jewfish bottom longline catches generally have no discards. The shrimp and finfish trawis, however, discard 28-38 per cent of their catches of very small size commercial species, such as ponyfish, silver biddy, lizardfish, shrimp, crab, squila, cuttlefish, squid, octopus and even shark and ray.

PRODUCTION

Total pmduction and production of some of the selected species are presented in Table 4, both by estimated catch weight and catch numbers, for the estuarine set bagnet and interactive fishing methods.

EXPLOITATION OF BROODS BY ALL FISHERIES

The length or weight of an organism is related to its age. Generally, the animals move from shallow water into deeper waters as they grow older and larger. Consequently, their vulnerability to different fishing methods varies

Table 1: Estimated catch by weight (t) and number (N) of selected species caught in different fisheries.

	ESBN	Puthnet/ Fixed bagnet*	MSBN	Beach seine	Trammel- net	Bottom longline	Trawlnet
<i>P.monodon</i> (t)	118.5	—	Neg	Neg	4.9	—	212.2
<i>x 10⁶</i> (N)	4.38	2035	Neg	Neg	0.054	—	4.4
<i>M.monoceros</i> (t)	381.7	—	Neg	5.97	2.37	—	2278.8
<i>(x 10⁶)</i> (N)	230.46	205.23	—	5.09	0.22	—	179.52
<i>P.indicus</i> (t)	727	—	182	12	35	—	Neg
<i>x 10⁶</i> (N)	48	122.11	11	—	0.85	—	Neg
<i>L.savala</i> (t)	250	—	3668.4	55	79.0	—	2212
<i>x 10⁶</i> (N)	52.28	—	126.06	23.25	0.91	—	21.97
<i>Johnius</i> spp (t)	3639	4	469	6150	385	2853	4258
<i>H.nehereus</i> (t)	2183	—	7833	—	333	—	1034
Total (t) for ALL species caught	72,784	176927x10 ⁶ (numbers)	26,111	6150	1754	2853	8332

* Total catch for pushnet/fixed bagnet was estimated in numbers of individuals only.

** Neg = Negligible

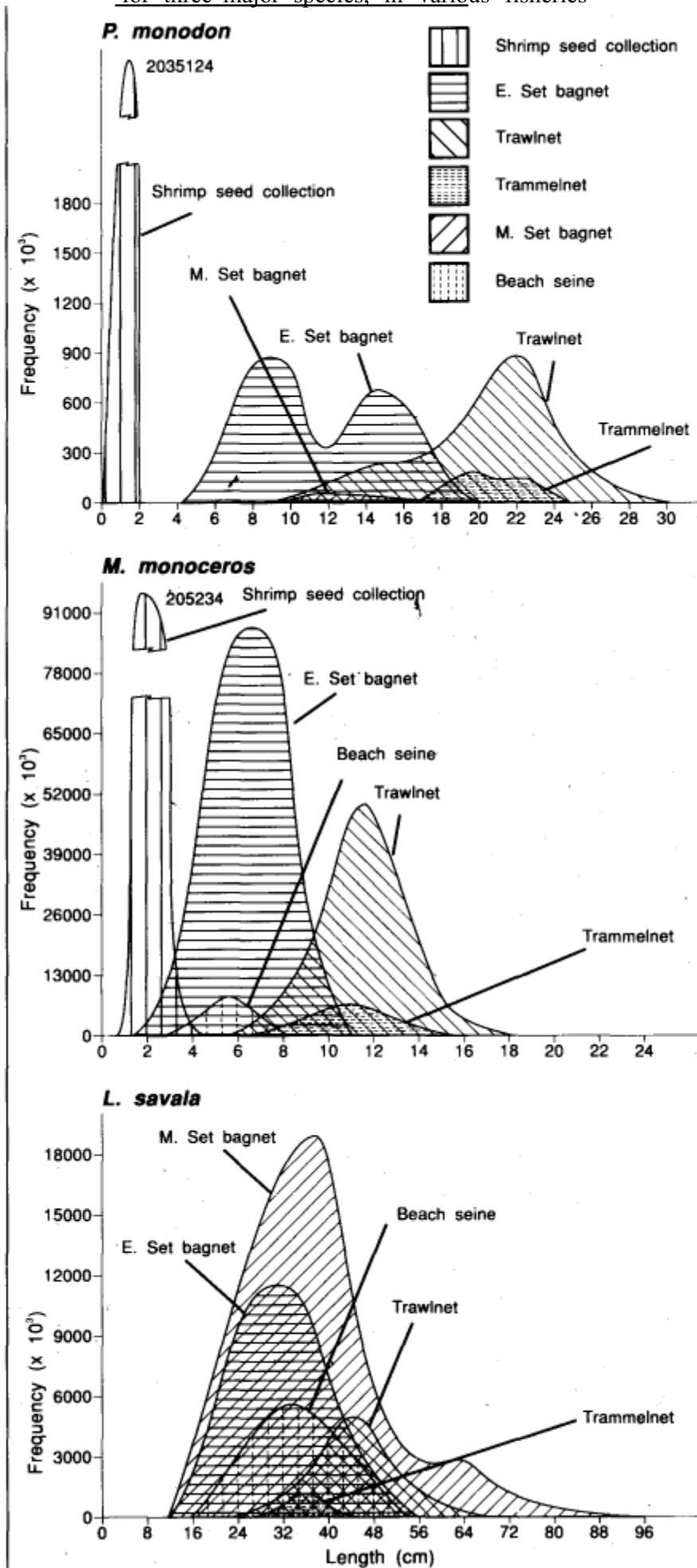
*** All species = Selected species listed PLUS other species



A typical Bangladesh fishing village which depends on the estuarine set bagnet fishery for a livelihood (above) and (below) hundreds wait on the shore for the catch to be brought in.



Fig 3. Catch in numbers according to the length for three major species, in various fisheries



with the different stages of their lives and the different ecological conditions they live in. The size composition in relation to the estimated number of individuals caught by each fishery (catch at length for each fishery) is shown for a few of the selected species in Figure 3. Much of the resources of each species is being taken by each fishery at different sizes (or ages) and in different grounds.

SEASONALITY IN CATCH RATES

The estuarine set bagnet fishery discussed here exhibits a seasonal variation in species caught. There are, generally, two peaks in the catch rates for each species. These peaks occur around the latter part of the first and third quarters of the year, showing that there are two broods; one produced during the winter season (Dec-Feb) and the other during the summer season (Jun-Mg). There is, however, a shift in the peak seasons of other gear catching the same species, depending on the mean sizes/ages of the animals entering each fishery and the time taken to grow to those sizes from the season of birth. With the knowledge of the life cycle (Figure 3) of the different species, and the size ranges and quantities exploited by the different fisheries, as illustrated for tiger shrimp in Figures 3 (first graph) and 4, it would be possible to identify measures for the management of each resource. This could be done by regulating one or a combination of the fisheries, to maximize the production and revenue while reducing the damage to the respective juveniles.

Comparative analysis of the fisheries exploiting the major species showed that, due to the exploitation of predominantly smaller size fish, the yield in weight from each individual of the animal recruited to that fishery is 20 or 40 per cent less than what could be realized if the animal were not caught by estuarine set bagnet and allowed to remain free until caught by trammelnet or trawl-net (example shown in Figure 5). Since the value/kg also increases with the size of the animal, economic gain becomes manifold. In the case of shrimp, for example, the relative gain in revenue is many times the relative gain in weight; full grown exportable shrimp caught by trawlers or trammel-net fetch a price five times that of the young ones caught by the estuarine set bagnet for the domestic market.

Fig 4. Two broods of *P. monodon* (Tiger shrimp) per year, their spawning periods and their exploitation by various fisheries at successive stages of their life cycles (indicated by their length)

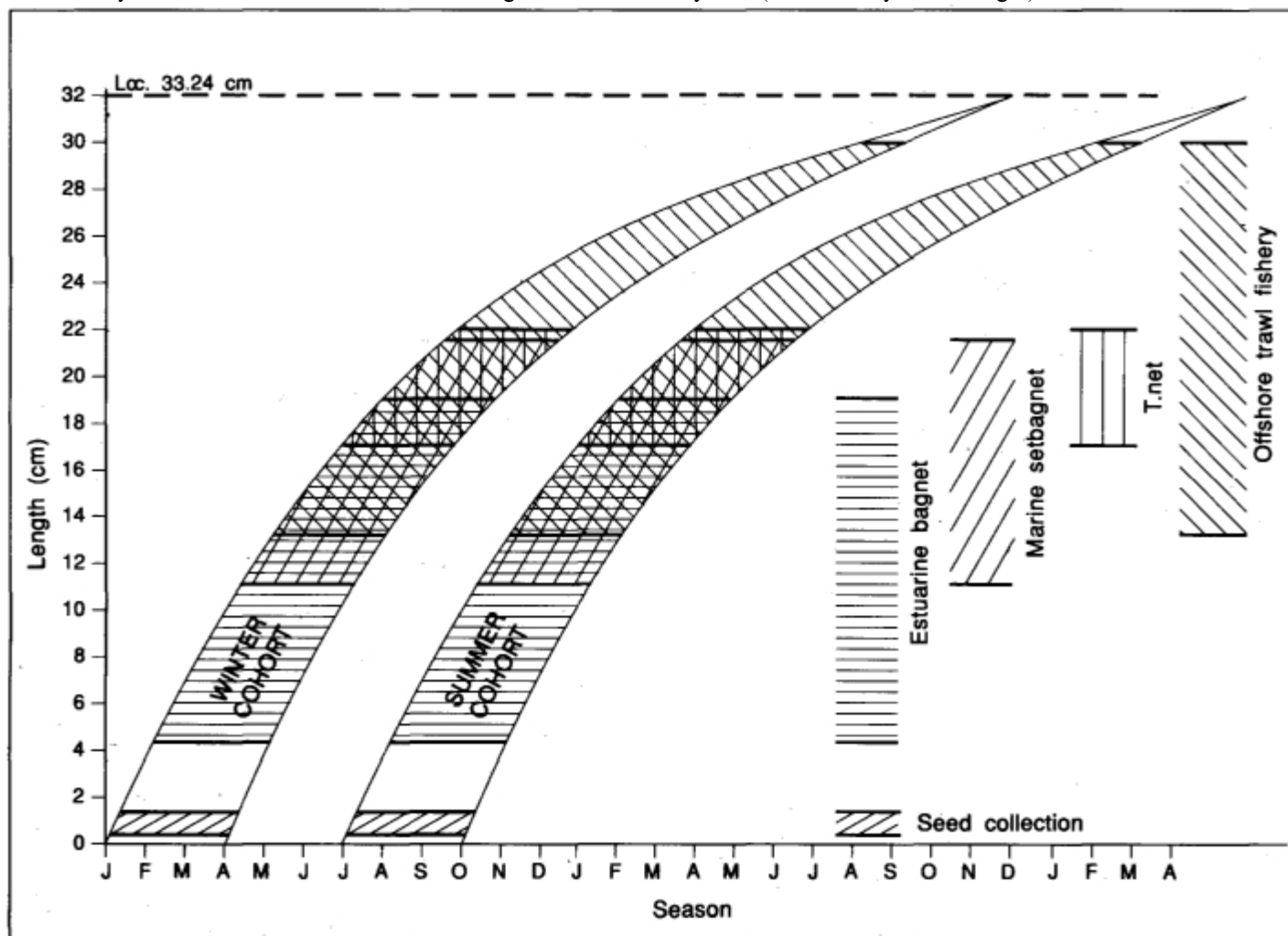
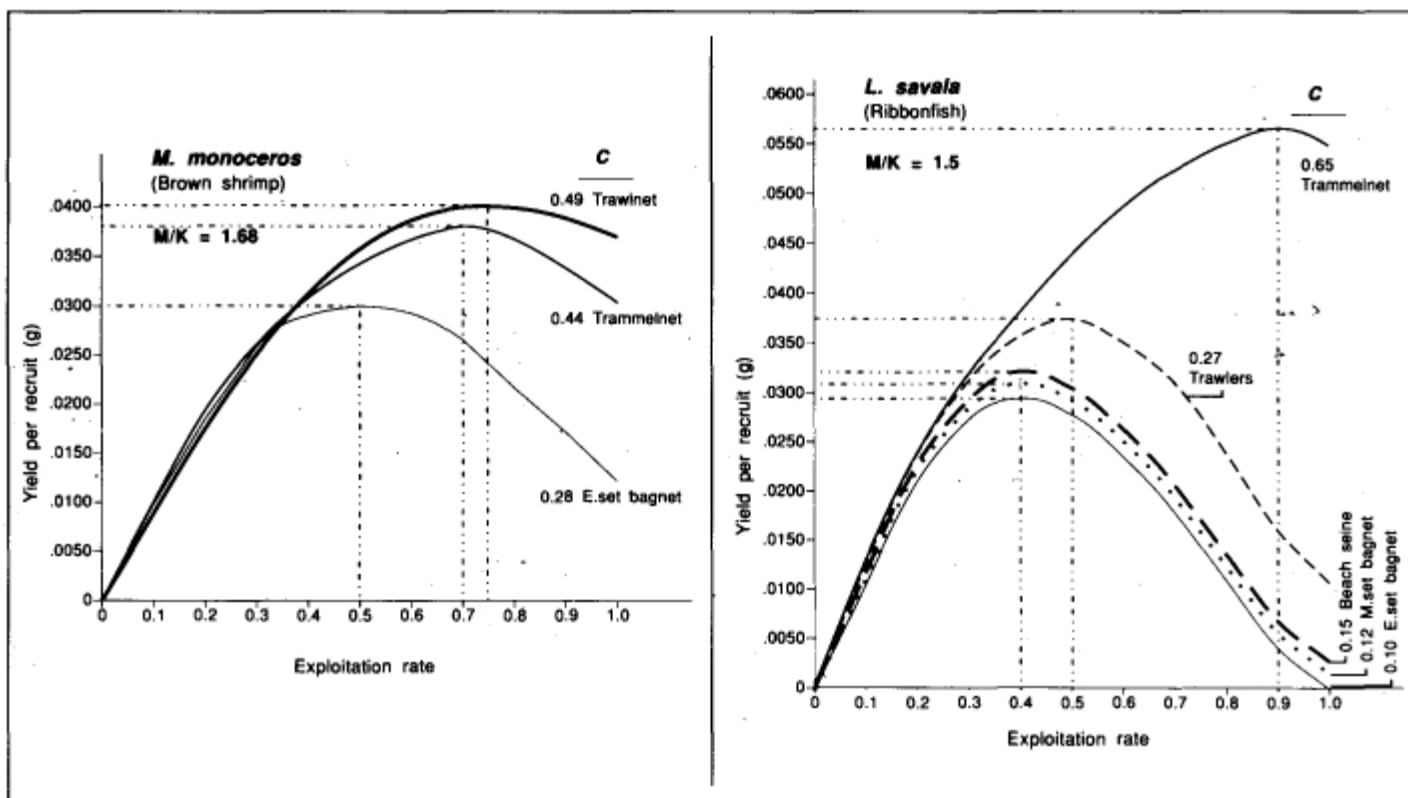


Fig. 5. Yield per recruit changes with different levels of exploitation rate, for different mean lengths at first capture in different fisheries



EARNINGS

Table 2 summarizes the average monthly income from different sizes of set bagnets operated in different estuarine areas of Bangladesh.

Table 2: Average monthly income from set bagnets of different sizes operated in the estuaries, and the percentages of set bagnet fishing households and all households, by income levels, in the six villages surveyed in the six strata. (Income in Taka)

Item	Stratum 1 Moheshkhali	Stratum 2 Kumira	Stratum 3 Hatiya	Stratum 4 Khepupara	Stratum 5 Morelgonj	Stratum 6 Khaligonj	Overall Average
Average monthly income from SBN "a" size	(0)	2064(12)	2553(11)	2496(8)	(0)	2299(12)	2209
Average monthly income from SBN "b" size	11,099(10)	3336(12)	3361(9)	3416(12)	3151(11)	2171(9)	4973
Average monthly income from SBN "c" size	19,825(11)	-(0)	-(0)	3103(9)	5327(12)	-(0)	8975
Average monthly income from SBN "d" size	- (0)	- (0)	- (0)	- (0)	5829 (4)	- (0)	5829
Note: (Operational months in parenthesis)							
Monthly av. income to SBN labour HH	No hired crew	1000-1500 (Feb-Dec)	No hired crew	1000 (Jun-Jul)	1000 (Mar-May) 3000 (Aug-Oct)	No hired crew	
Percentage of SBN HH with income less than TK 5000/month from SBN fishing	0	65	82	80	36	93	61
Percentage of SBN HH with income between TK 5000-8000/month from SBN fishing	8	35	18	10	19	7	18
Percentage of SBN HH with income between 1K 8000-80,000/month from SBN fishing	92	0	0	10	45	0	21
Percentage of all HH with income of less than 1K 5000/month from all sources	42	52	70	45	56	75	55
Percentage of all HH with income between 1K 5000-8000/month from all sources	8	28	17	28	13	19	19
Percentage of all HH with income between 1K 8000-80,000/month from all sources	50	20	13	27	31	6	26

Table 2 shows that income from this fishery in the Moheshkali area is far more than in any of the other areas (92 per cent – of the set bagnet – households earn 8000 - 80,000 TK/month). However, the households so benefitted are only 50 per cent of all the households in the village.

The income structure in the other villages is influenced by the sizes of set bagnets and their relative proportions. In the villages with more than 60 per cent of the set bagnet households below TK 5000/month income, the income from other sources significantly increases the percentage of households falling within the TK 8000-80,000 income category, while the reverse of this pattern is established in the villages which have over 40 per cent of the households with incomes of over TK 8000/month from the set bagnet fishery.

Not less than 30 per cent of set bagnet fishery households and 25 per cent of all households in these villages receive an average income of TK 12-20/day/person. This would not provide three square meals a day, leave alone other necessities such as clothing, housing, education, health, transport and other essentials! Crew members of estuarine set bagnet operations are generally members of the owner household, except in Kumira and during certain months in Morelgonj and Khepupara. These crew households receive a low income (Table 2), which is considered to be much less than that paid to crew members of other fisheries, such as marine set bagnets, trammelnets and bottom longline. Seasonally, when estuarine set bagnet catches are poor, some of the estuarine set bagnet owners become crew members or labourers in other fisheries – hilsa gillnetting, marine set bagnet fishing operations.

Eighty per cent of the fishing households are engaged in operating 'a'-size nets, 12 per cent 'b'-size, 6.8 per cent 'c'-size and 0.2 per cent 'd'-size. Some households own and operate two or more of these nets, with a few owning as many as five to ten nets per household. Such households have a reasonably good income, irrespective of the size of net they own.

IMPROVING VALUE OF ESNB CATCHES

A marketing study was undertaken to identify how the value of large, export-quality shrimp, small shrimp, juveniles, small fish, and high value fish (e.g. Bombay duck) from the estuarine set bagnet fishery could be improved. Little evidence was found of processing of these catches, which would add to their value.

There are three marketing channels – exporters using agents to bulk-up partially processed exportable shrimp for which prices are fixed bi-monthly; tied-marketing arrangements between seller and buyer, with some flexibility, for small shrimp and juveniles; and wholesalers, who take the fish by boat long distances for distribution, and who usually have credit links.

Hawkers, mostly women, who supply door-to-door or transport the fish by

rickshaw, supply fish to the poorest of the fish consumers. Most of the estuarine set bagnet fisherfolk also consume fish they catch or operate the gear as a subsistence fishery during very lean seasons, because it provides them the minimum affordable source of animal protein and, hence, survival. The very low price offered for the majority of fish varieties caught in estuarine set bagnets gives little scope for additional value through processing, improved marketing or storage.

Socio-economic conditions

From what has already been said, it would be evident that, in most areas, a very large percentage of the estuarine set bagnet fishing community has a

poor income and their fishing operations are primarily family affairs, with the exception of a few villages where hired labour is used. As long as it is a family operation, it is possible to operate this fishery as a subsistence fishery, as hardly any operational expenses are incurred. But the fishery at the same time catches a large quantity of juveniles of shrimp and finfish, endangering the resource.

Investigations do not hold out much hope for improved gear that would reduce catches of juveniles without decreasing the income of the fisherfolk nor do they indicate any potential to improve the value of the catch through

better processing and marketing. Opportunities for non-fishing activities that might generate income are also few, because of the large number of unemployed in the country and the lack of such assets as land for cultivation or to use as collateral for loans to invest in small-scale business, industries or even to improve the marketing of fish. Though these fisherfolk participate periodically in other fisheries, these are generally not more remunerative than the estuarine set bagnet fishery except in places like Kumira where they operate hilsa gillnets, which give them a very much better income during the hilsa season. In fact, in this particular instance, the estuarine set bagnet operation is not their primary income source. The preliminary results of the study reveals that about 34 per cent of the households in the six villages surveyed are dependent purely on fishing for their income, about 25 per cent depend

on fishing and fish marketing, 9 per cent on fishing and agriculture, 8 per cent on fishing and livestock, 6 per cent on fishing labour and fishery related labour, 5 per cent on fishing labour and marketing and the rest include traders, middlemen, salaried job holders, agricultural labour, firewood collectors, carpenters etc. Twentyfive per cent of the households in Khaligonj are involved only in SBN fishing, while the rest combine fishing with other activities like fish marketing, petty trade, agriculture, livestock etc. In Moheshkhali and Hatiya, about 70 per cent of SBN households are engaged in other income-generating activities. The rate of participation in other income activities in Morelgonj

and Kumira is less than 40 per cent, while in Khepupara it is about 50 per cent. This obviously shows the importance of such activities in supplementing household incomes. Frequency distribution of households in the six villages according to the pooled income from all sources showed that the range of income per household varied from <10,000 TK/annum to 100,000 TK/annum. About 55 per cent of the households sampled from all six villages had a total income of less than TK 60,000/annum/household, TK 5,000/month/household or only TK 33/day/member of a household with five people. Only Moheshkhali had

households (3.2 per cent) with a total income in excess of TK 400,000/annum.

About 13 per cent of the households in the estuarine set bagnet fishing villages are non-fishing ones. Fifty-seven per cent of the males and 81 per cent of the females in this community are illiterate and have little interest in educating their children, though educational facilities are available to them for primary and secondary education in all six villages surveyed. This community has poor shelter, sanitation, drinking water supply etc. In fact, 59 per cent of these fisherfolk live in temporary huts and 35 per cent live in mud-houses.

Conclusions & recommendations

Based on the eight presentations, summarized above, the participants at the seminar came to certain conclusions and made a number of recommendations concerning management of the marine fishery in general. These included the following which pertain to the estuarine set bagnet fishery in particular:

- Set bagnet operation in the estuarine as well as marine environments less than 10 m deep should not be permitted. Considering the tidal variation, the isobath line at 10 m depth, during the mean tide level, could be used for such regulation. Any reduction in this depth limit, under specific conditions — such as seasonality in tidal variation, bottom configuration of certain locations, mesh size etc — should be specified. Special arrangements should be made to permit catching of non-penaeid shrimp (*Acetes* spp) and goby (*Gobidae*) by operating set bagnets during the specific season and in specific locations.
- Seasonal reduction, in selected locations, of the fishing effort with estuarine set bagnets, to be identified from high percentages of juveniles of highly valued species and the areas and seasons of their occurrence, as reflected by the estuarine set bagnet catches. The June-July period tends to exhibit fairly high catch of juveniles of

Improvement of the estuarine set bagnet

A consultant technologist, J. Hansen, from the Danish North Sea Fisheries Center, studied the estuarine set bagnet and reported as follows:

- The ropes to which the net is attached are much shorter than the netting and take all the strain.
- The distance between the poles, normally half the length of the rope and nets, indicates that the gear might be overspread.
- If the meshes in the wings and front part of the belly are wide open at the same time, this could lead to a great loss of fish and shrimp through these meshes, in which case the catch in the cod-end might be more or less accidental.
- If the spread of the net is reduced, the net straightened up in the wings and upper belly and mesh size in the rear part increased. Then, larger fish and shrimp, if they are present, have a better chance of being retained in the net.
- Some sort of a flapper, to retain the larger individuals in the cod-end, may also be useful. Cod-ends were found to be very narrow; they not only slow down the flow in this part of the net, but also lead to panic among the fish, provoking them to swim out. With a wider cod-end, more fish might be retained.

Fishermen claim that increase in the mesh size would result in a collapse of the net. This is contrary to the experience with trawl behaviour. Mesh size will normally have very little influence on the overall shape of the net or the entrance to the cod-end.

Flume tank testing is required to further assess the behaviour of this net, because the turbidity of the estuarine water in the natural fishing environment prevents underwater observations.

valuable species in the major production areas of Moheshkhali, Morelgonj and Khepupara.

- Test fishing should be conducted, with the participation of set bagnet fisherfolk, to establish suitable, economically viable alternative fishing methods to replace estuarine set bagnets, e.g. mud-crab catching, crab fattening, hook-and-line fishing, trammel netting, bottom drift gillnetting etc.
- Scope for further expansion of gillnetting and hook-and-line fishing, in the light of the reduction in the fishing effort with estuarine set bagnets, should be determined.
- Special programmes should be undertaken by the DOF to motivate the fisherfolk to replace estuarine set bagnet with alternative income-generating fishing methods.

Recommendations were also made on socio-economic and extension services relevant to this fishery. These included the following:

- Extension programmes, to educate fisherfolk on Resources

and Management issues, should be undertaken and extension material prepared before management measures are introduced. Understanding and participation of fisherfolk and NGOs in the implementation of management measures are essential.

- Before introducing any restrictions on estuarine set bagnet operations, the economic effects of it on the very poor set bagnet fisherfolk should be assessed, and they must be motivated to take up already tested alternative fishing methods that might compensate for the loss of income from the set bagnet fishery as well as enhance their incomes.

On institutional strengthening the seminar recommended:

- Greater coordination among various national institutions concerned with Fisheries Research and Management.
- Improved fishery management courses in universities, with more emphasis given to the practical side.

Training the small entrepreneurs for shrimp aquaculture

An Indo-Malaysian experience

by Lisa C Durante

As part of the various training schemes being undertaken in India, the Bay of Bengal Programme teamed with the Division of Fisheries, GOI, and sent out a group of entrepreneurs for brackishwater shrimp culture training in Malaysia whose National Prawn Fry Production and Research Institute (NAPFRI) is internationally recognized for the quality of training it offers in this field.

India trains manpower for brackishwater culture

Decreasing catch rates at sea, increasing global prices for the sea harvests, extensive areas of waste land and backwaters, a swelling, often impoverished, coastal population and the need for greater foreign exchange returns have made policymakers look at the potential of brackishwater culture in India.

The brackishwater area available in India is estimated at about 1.2 million ha, of which a mere 65,000 ha are under shrimp farming today – mostly harvested through traditional systems (50,000 ha), and partly by extensive culture (15,000 ha). In the next five years, a further 20,000 ha of brackishwater area, of which 13,000 ha will be under extensive and 7,000 ha will be under semi-extensive shrimp farming, have been earmarked to “really give shrimp aquaculture the boost it deserves,” says Dr Sampath, Assistant Commissioner of Fisheries, Government of India. Of this 20,000 ha, 12,000 ha will be developed through the Brackishwater Fish Farmers’ Development Agencies (BFDAs) and the rest through entrepreneurial development. A further 3,800 ha will be developed under a World Bank project concentrating on Andhra Pradesh, Orissa and West Bengal.

Dr Sampath says there are several provisions “in the pipeline” to make shrimp farming attractive for those who’ll dare. At least 15 more BFDAs are to be established in the coastal areas to provide the necessary extension, financial and technological support to small entrepreneurs and marginal farmers, as well as financial assistance for the establishment of semi-intensive shrimp farms, 2-4 t/year capacity shrimp feed plants, and hatcheries capable of producing 2~.5 million shrimp post-larvae/year (“our requirement for seed by 2050 will be

a staggering nine billion/year,” he estimated). The Indian Government is determined to channel funds into manpower training towards this end. Experts agree that shrimp aquaculture is an “applied art”, which requires a delicate balance of technical knowhow and sharp intuition; “for this reason,” says Isaac Rajendran, an Overseas Development Administration (ODA) fisheries consultant, “initial training is a must. The intuitive sense will inevitably grow with the expertise of the farmer and the success rate of his or her crop”. For this, ‘pilot farms’ or demonstration-cum-training centres are currently being developed on “revised Taiwanese lines” to give batches – up to 20/30 operators at a time on two-month stints – the chance to become trained shrimp aquaculturists. They, in turn, will, it is hoped, impart their knowledge to colleagues. “It will be like the bushfire effect; it will undoubtedly spread,” Rajendran is confident.

As part of the various training schemes being undertaken in India, the Bay of Bengal Programme teamed with the Division of Fisheries, GOI, and sent out a group of entrepreneurs for brackishwater shrimp culture training in Malaysia whose National Prawn Fry Production and Research Institute (NAPFRI) is internationally recognized for the quality of training it offers in this field. This was the first time that the BOBP had turned its attention to the small-and medium-scale private sector entrepreneurs and it looks forward to the proof of success in the direction these entrepreneurs will take in the next year or so.

The trainees’ Malaysian experience is recorded here.

What do you get if you put an ad in *The Hindu*, the leading newspaper in South India, and call for small-scale entrepreneurs to try their luck at shrimp hatchery farming by joining a month-long, all expenses-paid course in the National Prawn Fry Production and Research Institute (NAPFRI), in Kedah, Malaysia, during June-July 1992?

“You get a bunch of highly-motivated aspiring shrimp farmers who can hardly wait to translate what they have seen and experimented with in Malaysia in their own, Indian context,” says 40-year-old Usha Ranganathan, the only woman participant in the 8-strong group.

The training programme, without precedent in the gamut of BOBP extension activities targeted the “interested lay person” as opposed to the standard pool of fisheries’ officers and assorted experts usually enlisted for similar programmes. Also, it helped reiterate the commitment the BOBP has to ALL segments of the small-scale fisheries, not just the

“smallest of the small”, as one consultant put it. Between the marginal fisherman and the large fishing operator, there are, in fact, “many shades of grey we must address,” he adds.

Ten candidates out of 350 who responded to the advertisement were chosen by BOBP to attend the training course. Of these, two opted for a freshwater prawn hatchery programme which is yet to be held. The decision to pinpoint shrimp hatcheries was attributed to several factors, namely

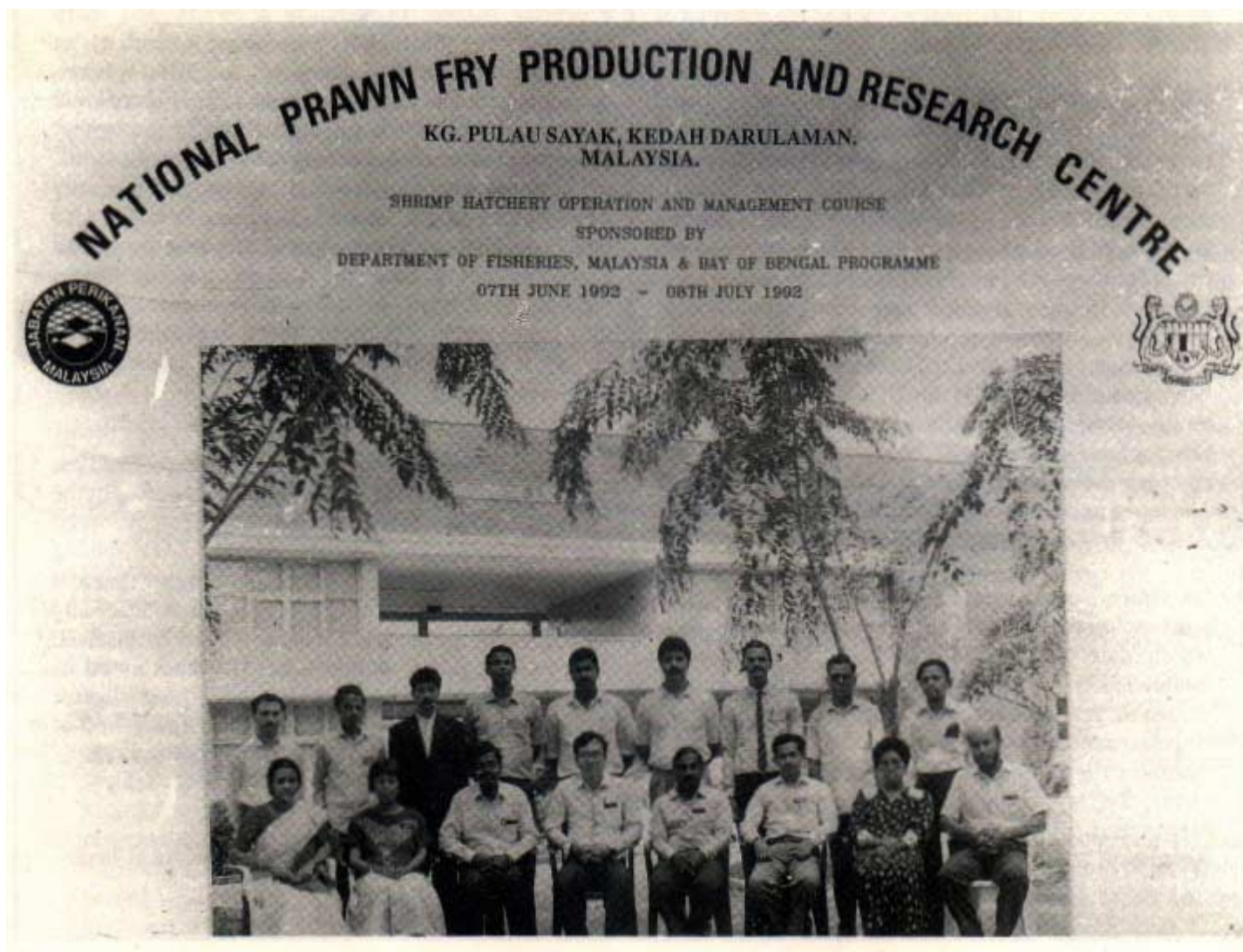
- Since the prevalent, highly wasteful, custom of wild seed collection could have adverse effects on future fishery resources, an alternative source of seed supply is urgently needed.
- Most of the larger-scale, government-run hatcheries established abroad are run on demonstration and training centre lines. This has proved successful. Equally, small-scale hatcheries in the private sector have created their own niches

and demonstrated that they are capable of efficient integration with the state sector. Both enhance the overall system.

- It is not exclusively through government-organized programmes that the poorer segments of the fishing community can be strengthened. The need for the active participation of the private sector in fisherfolk development is also essential.

With these priorities in mind, the NAPFRI shrimp hatchery was the place to be for the trainees. According to Usha:

“The course really served our purpose, which was to get theoretical knowledge on the one hand and gain practical experience in managing our own tanks on the other. Which we did. Not everybody’s seed survival rate was fantastic, though. We had initial troubles with the nauplii (first stage of shrimp larvae after hatching of eggs), which all died immediately; we managed a little better during the





National Prawn Fry Production and Research Centre, Malaysia.

subsequent attempts. I got only a 25 per cent success rate — but I'm still not discouraged. Raju (a participant from Kakinada, Andhra Pradesh) was great; he got a 90 per cent survival rate. But he's been involved in shrimp culture for some time; I'm an absolute beginner."

K.S. Raju felt "It was a very comprehensive programme — breeding, hatchery, brood stock management, egg collection.., everything, plus lots of field trips as well as the preparation of a project report which I enjoyed. We also visited efficient hatchery farms as well as complete losers. I enjoyed seeing the losers, it gave me hope."

A.K. Balaji, a fisheries technocrat from Tirupathi, Andhra Pradesh, observed, "In Malaysia everything looked so simple, but since getting back to India, I've been going crazy trying to organize myself. I'm confident, all the same. The Malaysians didn't part with all their

information, though. I had a feeling they still had quite a few 'trade secrets' up their sleeves. That's only to be expected, but we learnt a lot anyway."

Thirtyseven-year-old Shekhar Charles, an engineer from Madras with no previous exposure to shrimp aquaculture before the Malaysian trip, was enthusiastic. "I really appreciated the intelligent use of time the course organizers made: 8.15 to 10.45 every morning was devoted to lectures — biology and use of *artemia* (shrimp larvae feed), broodstock maintenance and selection, shrimp biology, larviculture and egg collection as well as talks on processing, packaging and marketing. In the afternoons, we would either have practicals — algal growth monitoring, for instance, was fascinating — or go on field trips to visit neighbouring hatcheries. The best bit, however, was working on our own tanks. I loved it."

Soosal Joseph, a traditional fisherman turned businessman from Kanniya-

kumari, Tamil Nadu, and Chidambaram Narendran, a Madras-based engineer, both agreed that the field trips were "the best part; we got to see how sudden infections could wipe out the entire stock within 24 hours". Discussing the group's seed survival rates — Rajendran nearly 90 per cent, Charles 50 per cent, Raju 90 per cent, Joseph and Narendran 28 per cent each and Usha 25 per cent — they felt these did not entirely "reflect our abilities; disease and seed mortality strike unexpectedly, despite all precautions being taken". It's a bit of a gamble really, they felt.

Whether it's a gamble or a "technical art", as one consultant describes shrimp aquaculture, Lars Engvall, BOBP's Programme Director, feels the Rs. 60,000-65,000 spent on each student was well worth spending if one or two of the participants really do follow up on their plans and break into the shrimp hatchery business successfully. The trainees are determined to do just that.

AN UNFORESEEN IMPACT

When Nias fisherfolk adapt BOBP technology to suit their means

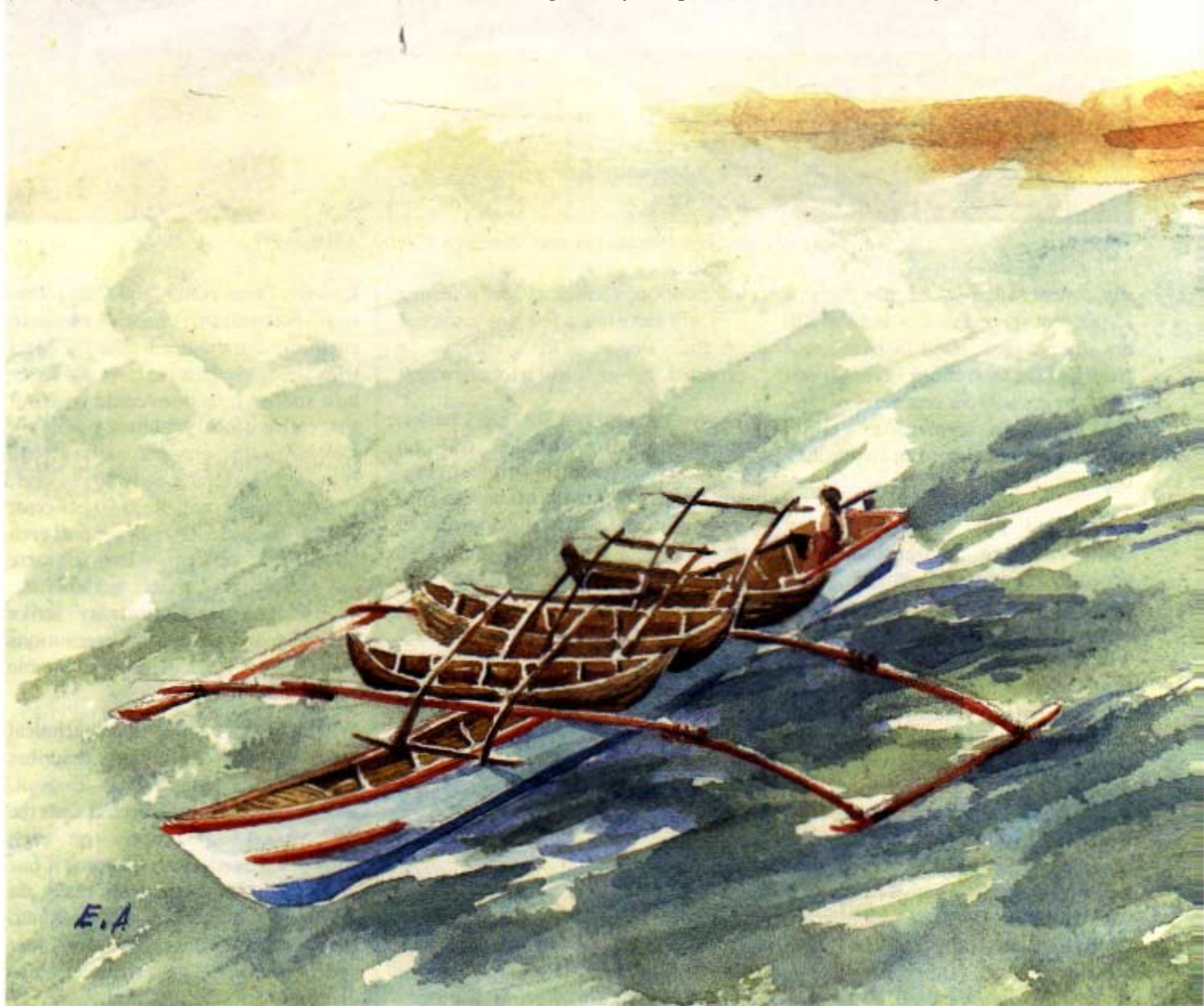
by Robert Hall
(Economist, A.P.O.)

The impact of a project is not always what the project planner had intended. On the one hand, the immediate objectives are often not met during the time given. On the other, in some rare cases, the project is so well accepted that the project impact, however unexpected, is clear even before the project concludes. This is the case with an outrigger canoe subproject on Nias Island, North Sumatera, Indonesia, in which the Bay of Bengal Programme (BOBP) is involved.

In 1988, the Provincial Fisheries Service of North Sumatera, together with BOBP, began developing an improved outrigger canoe to replace the small dugout outrigger canoes that dominate the Nias fleet. Prior to this, only two other craft had been introduced to this isolated island, 60 km off Sumatera's northwest coast. These were the OBM 'speed boat', which came in the mid-Seventies, and the 'Chinese boat', appearing in about 1980, both brought in by the private

sector. While the 'speed boat' is now seen as not being economically sound, the profitable Chinese boat demands an investment that small-scale Nias fisherfolk simply cannot afford.

The subproject's approach to the work was new to Nias; outsiders came to work WITH Nias fishermen to develop a better canoe based on traditional design but using technology from the South Pacific and Sri Lanka. The result of the joint effort was swift



acceptance and comprehension of the new technology by the Nias fishermen after they had seen demonstrations of the fishing craft's economic feasibility during trials in Gomo.

Frustration, however, soon developed among the fisherfolk, who had carefully watched the building of the new-design craft. They found the craft would not be accessible to them as formal credit is non-existent on Nias. But they were determined to make use of this technology. And so, to overcome the financial problem, they adapted the new techniques demonstrated by the subproject to suit their means.

Incorporating the plank technology and the inboard diesel system into the traditional design but in a smaller and less expensive craft, the fisherfolk of Moawo, near where the subproject was building and testing its canoe

prototypes, had independently built eight 6-7m plank-built canoes, by June 1992. The Rp. 2 million* required for each craft was about half the cost of the original design.

Six larger craft of varying quality have also been, or are being, constructed by both fisherfolk and small-scale investors. One of these craft is Dali Zomasi Lasi's. Lasi, a fisherman, was determined to copy the subproject's design. He abandoned his 'speed boat' in the tall grass by the beach and set about building a craft based on the new design. He could not, however, afford "recommended quality", but he found a way to build a cheaper boat. The 9.8 m hull he built in August 1991 cost about Rp 1 million and, in it, he installed a second-hand 15.5 hp diesel engine (Rp 0.5 million for the engine and an additional Rp 0.5 million for marinization).

Lasi's craft, basically the same size and design as the recommended craft, is less than half its cost. But Lasi paid for sacrificing quality. Stooped over his broken-down engine, covered with black oil, he admits that the old engine means that he loses one day of fishing each week.

He also accepts as unavoidable the fact that his hull will not have a long service life. But, as things are now, he has no choice but to work within his means. He, however, hopes for a better tomorrow. With the financial return he is currently making on his craft, he is confident that the next boat he builds will be both bigger and of better quality.

What makes Lasi's operations so profitable? Partly (as for all fishermen with the new motorized craft) it is the wealth of frigate and bullet tuna he can troll for and the grouper and red snapper he can get on handline. But what sets Lasi apart from many of the other operators of improved canoes is his involvement in an unexpected and unplanned impact of the subproject's work, the so called "mother ship practice".

While a few fishermen have been able to motorize, most Nias fishermen are still bound to the drudgery of the energy-demanding fishery of large pelagic trolling in a paddled canoe. The poorest fisherfolk cannot even dream of having an inboard propulsion system, while the outboard motor is both expensive to buy and to operate. Therefore, Lasi arranges to carry a few smaller dugouts on each trip, neatly stacked crossways on his canoe, and their fishermen.

Once the fishing grounds are reached, the small craft are launched and go about trolling, while Lasi's 'mother ship' also fishes. After a few hours, the dugouts are collected and stacked for the return trip to shore. The result is an astounding doubling of income for the dugout fishermen and relief from the drudgery of paddling to the fishing grounds. For Lasi, it means 25 per cent of the catch of the dugouts as well as his own catch. That's what's made him now aim for a bigger and better quality craft. Such impact is not easy for project planners to foresee.



The INS-5 on which Lasi's boat design was based.

*US \$ 1 = Ins Rp. 2030 (appx)

MAJOR PROMOTION OF OYSTERS IN MALAYSIA

The Department of Fisheries, Malaysia, is undertaking a major promotion of cultured oysters in the country. It is also hoping to develop a considerable export market for them.

Speaking at a promotion of local oysters at the Fish Quarantine Centre near the Kuala Lumpur International Airport, the Department's Director General, Datuk Shahrom Abdul Majid, said, "The worldwide demand for oysters is very encouraging. Thus,

if there is concerted effort from all to promote and market our oysters, it can become a multi-million ringgit industry. Our aim is to eventually emerge as the leading producer and exporter of oysters in the region". (NOTE: Last year, 533 tonnes of oysters valued at \$600,000 were exported from Malaysia while 150 tonnes were imported, mainly from New Zealand.)

"We are also working closely with those in the local food industry, particularly restaurants and hotels, to help promote local oysters to their customers," Shahrom said.

The Department, with technical help from the Bay of Bengal Programme, which provided technical expertise on the cultivation of oysters, started researching and rearing oysters in 1988. Coastal areas in Perak, Penang, Kedah, Kelantan and Terengganu were identified as suitable sites for rearing oysters.

Shahrom stated that the technology involved in rearing is simple and cost effective. "Fishermen need not worry about having to feed the oysters, as they eat plankton in the sea, which costs nothing and is abundant," he said and urged more fishermen to diversify into oyster farming. "The Department will provide the necessary technical expertise and advice to anyone interested in venturing into it," he promised. The local species being promoted by the Department is the slipper oyster (*Crassostrea iredalei*), which is known for its white texture.

The Department has also introduced an oyster depuration system which is the way to successful marketing. It is a 36-hour filtering process to clean the oysters and make them safe for eating.



Aaora Ibrahim of the Department of Fisheries, Malaysia, shows off a tray of oysters at the promotion organized by the Department. (From a picture by Shahiman Sharip that appeared in the New Straits Times).



2

1. A promotion of locally cultured oysters was organized by the Department of fisheries, Malaysia, at the Fish Quarantine Centre near the Kuala Lumpur International Airport. Visitors who attended the promotion included hotel executives, restaurateurs and traders.
2. Datuk Shahrom AbdulMajid (left), Director General, Department of Fisheries, Malaysia, at the promotion.
3. 'Safe' oysters after they have undergone a 36-hour filtering process at the Department's depuration system on the right, in the picture.
4. Visitors examine the 'spread' of raw and cooked oysters laid out for them 'to enjoy a taste', at the Department's promotion.



4

3



A PROPULSION SYSTEM that makes small fishing craft more versatile

by G. Pajot
(Senior Fishing Technologist)

Most of the traditional fishing craft in India, Sri Lanka and Indonesia are small, operate from beaches and shallow water outlets and, mainly, fish inshore. Since its inception in 1979, the Bay of Bengal Programme (BOBP) has been supporting the development and introduction of new small fishing craft that, operating from shallow water outlets (lagoons, rivers) and beaches in these countries, could fish further offshore. Besides developing a new design for small fishing craft, BOBP has worked extensively on their motorization, improved propulsion being essential if full advantage was to be taken of the new designs.

As a consequence, some 300 beachlanding are now operational and they have been fitted with the BOBP-developed diesel propulsion system.

Some of the advantages the new craft and propulsion system provide include:

- Better fuel efficiency compared with outboard motors.
- Greater operational range.
- Longer fishing time.
- Better preservation of catch.
- Improved operational efficiency.
- Reduction of physical strain on crew.
- Better safety and working conditions.

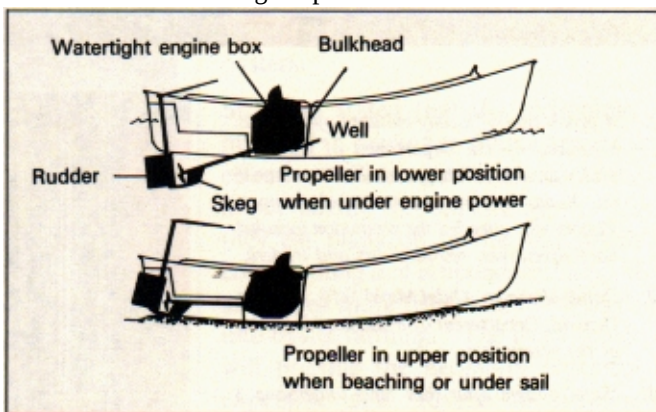
The ultimate objectives of the motorization of the new craft was to improve the earnings of small-scale fishermen-owners and operators of craft by improved access to less exploited resources and increased fish production.

Most of the new fishing craft were designed for motorization with marinized industrial diesel engines, instead of outboard motors and other marine engines, to take advantage of their low initial and running costs.

For the motorization of a suitable craft to operate in shallow water, cross the surf, land on the beach and operate in rough sea conditions, a special engine installation called the 'Box Drive' was developed. This drive is based on the longtail idea used in Thailand and elsewhere. But the engine, whether air-or water-cooled, is mounted in a watertight box, the shaft length thereby being considerably reduced. The rudder is coupled to the skeg. By lifting the rudder, the whole unit tilts until the rudder and propeller are completely retracted. The liftable propeller system has the advantage of idling neutral when the propeller is out of the water, thereby doing away with the complication of a gear box. Clearing of nets or rubbish stuck in the propeller is also very easy.

What has really been the experience with the Box Drive after all these years? The Box Drive is better suited for water-cooled engines and is not recommended for aircooled ones.

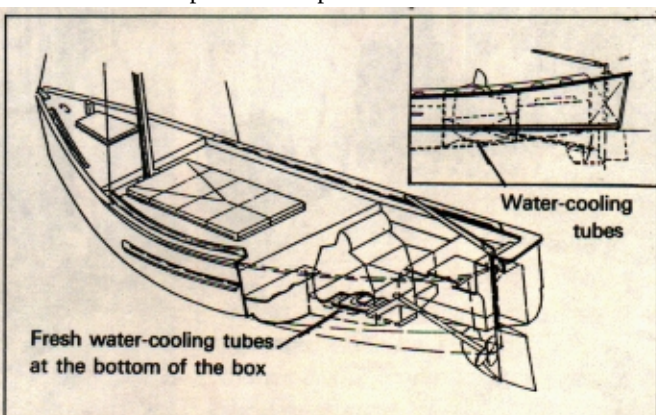
In the case of the aircooled engine, the fresh air circulation in the box with the lid on is not enough to cool the engine for long-range fishing operations. Though more complicated, the freshwater keel cooling system in the case of the watercooled engine performs better.



Box Drive

As for speed, the fisherfolk feel it is low with either engine for fisheries that are further offshore and which require 5-6 hours for the fishing grounds to be reached.

Though the basic concept of a longtail engine mounted below the waterline in a watertight box, and fitted into a flooded well of the hull, has proven robust and suitable for surf crossing and beachlanding, the box installation does have some disadvantages. The access to the engine for maintenance is difficult. A watertight well is also necessary. And this takes up a lot of space in a narrow craft such as



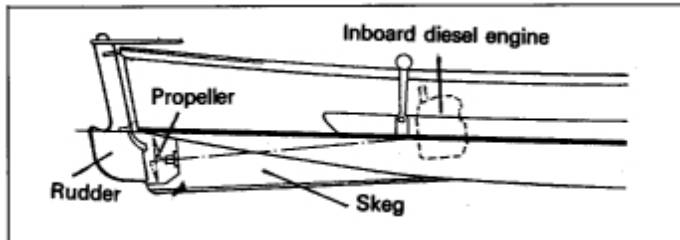
A perspective view showing the water cooled engine installation and the position of water-cooling tubes.

an outrigger canoe. The experience over the past eight years, both with BLCs as well as with such smaller craft as the plywood canoe in Kerala and the outrigger canoes in Sri Lanka and Indonesia, prompted BOBP in 1989 to take a second look at the different types of diesel engine installations for beach-based fishing operations.

What were the new ideas tried?

Fixed inboard installation with shallow skeg

A fixed inboard installation with shallow skeg was adapted for planked outrigger canoes in Nias Island, Indonesia, where there was no need to beach the craft every day and where shallow water outlets were available. It worked well, but the shallow skeg restricted the aperture, resulting in the use of direct drive and a small propeller with reduced speed.



Fixed inboard installation with shallow skeg

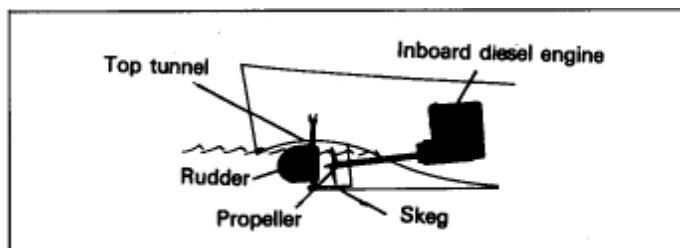
Tunnel Drive

A tunnel installation was tried out in Kerala on a 9 m plywood canoe. In this installation, the propeller sits partly out of the water when not in motion. When the power is applied, the tunnel fills with water. To avoid sucking in air, the tunnel exit must be below the waterline.

The main drawbacks of the tunnel are:

- loss of speed;
- loss of manoeuvrability for surf crossing;
- need for reduction gear box with neutral; and
- nets and/or rubbish getting stuck in the propeller and having to be cleared.

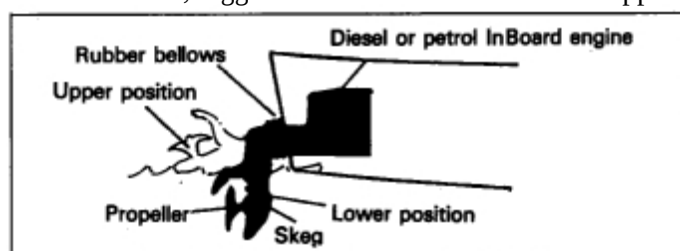
After trials, it was concluded that the tunnel drive was inferior to the Box drive and the idea was abandoned.



Tunnel Drive

Z Drive

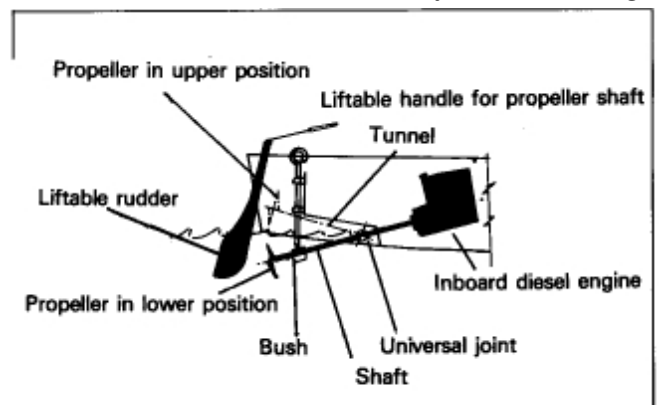
The Z Drive, much used on motorized pleasure craft in industrialized countries, was found to be too expensive. Various technical problems, experienced with the Z Drive in India earlier, suggested that the idea should be dropped.



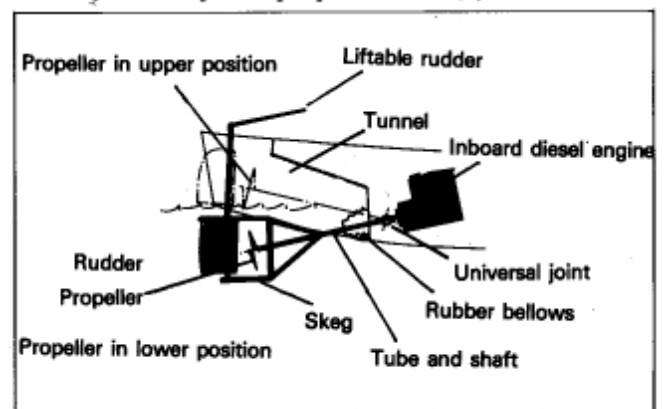
Z Drive

Liftable propeller drives

- a) The liftable propeller drive with a universal joint is a common system in Japan for boats which are hauled regularly on to the beaches. Earlier trials with French *dhonis* in India and in Africa showed they were not suitable for surf crossing because there was no protection under their propellers. They were, therefore, not considered for further trials.
- b) In a similar drive with the universal joint coupled straight to the engine, watertightness is achieved with rubber bellows. The propeller and rudder are connected and the whole stern gear tilts upward. Side support is provided for the rudder. An advantage with this system is that alignment with the engine is no problem. Trials over several years in Africa, with 20-25 hp diesel marine engines, have demonstrated that it is a workable system, but it had not been tested extensively in surf crossing.



Liftable propeller drive (a)

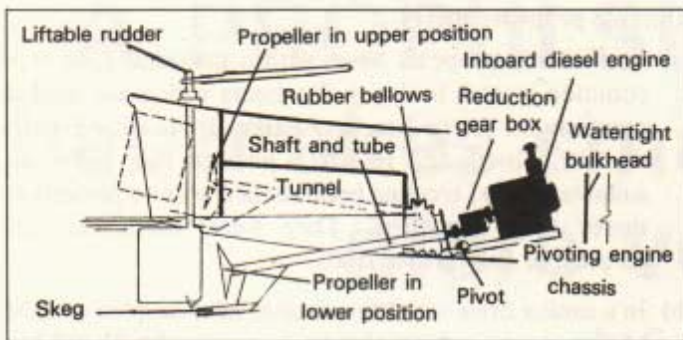


Liftable propeller drive (b)

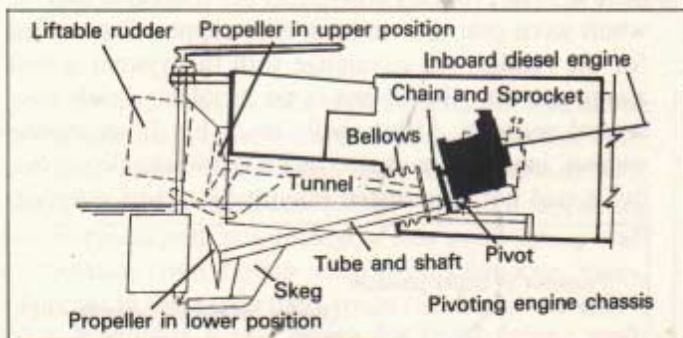
The BOB Drive

After reviewing the past experiences with all the different driving arrangements, the BOBP team decided to take another look at an old idea, which O. Gulbrandsen, naval architect and BOBP consultant, had suggested but which had not been tried out during earlier trials. This idea proposed that the rubber bellows be combined with the pivoting engine installation used in the Box Drive.

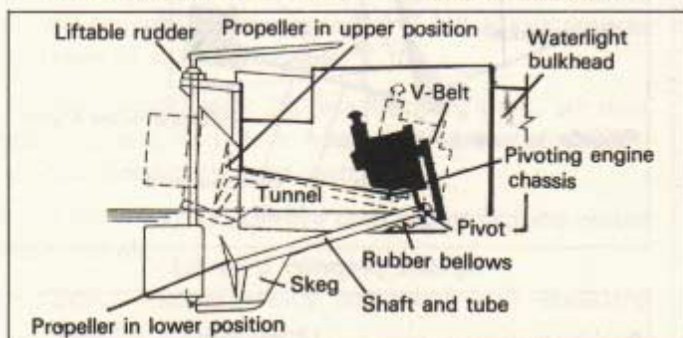
To retain the better characteristics of the Box Drive but, at the same time, reduce the disadvantages of the box fitted into a well, the rubber bellows is placed around the stern tube to ensure watertightness and permit tilting of the shaft. The new BOB Drive also permits, through the use of belts or a chain transmission, considerable space-saving by allowing the engine to be turned around. This transmission system ensures a 2:1 reduction, thus permitting the use of a large propeller.



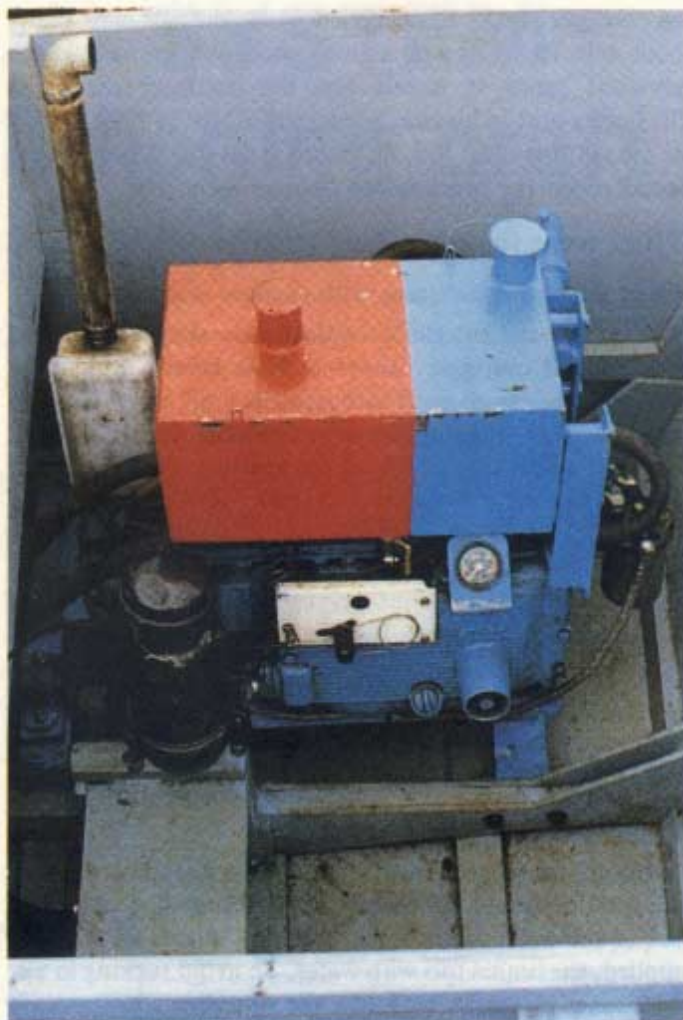
BOB Drive (a) with gear box transmission



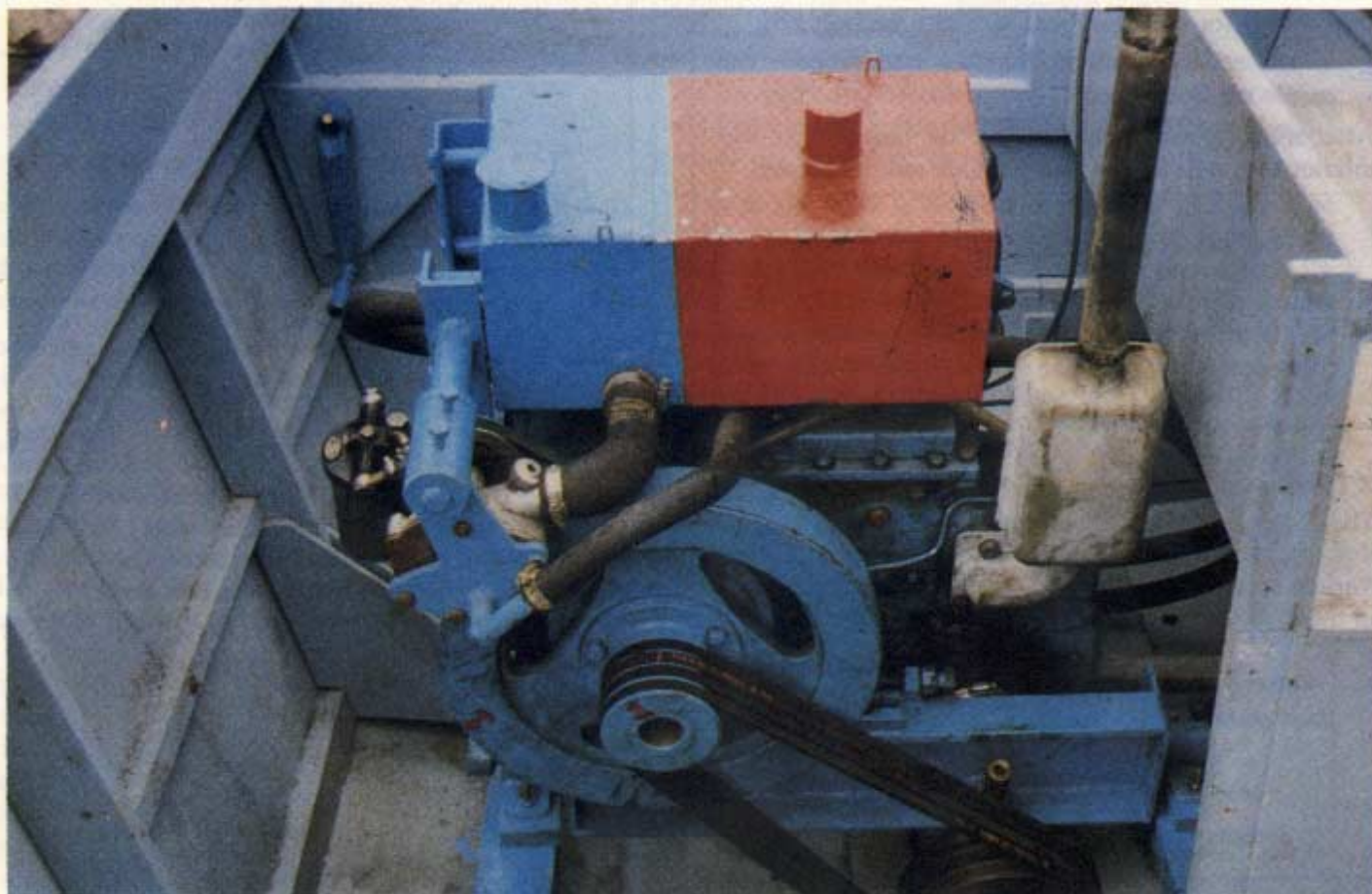
BOB Drive (b) with chain and sprocket transmission



BOB Drive (c) with 'V' belt transmission



Aft view (above) and front view (below) of BOB Drive with VWH-120 freshwater cooled engine installed in IND-28 plywood canoe.



Question and Answers

Has the use of simple rubber bellows instead of a large heavy box made the new BOB Drive more suitable for small engine and craft and, more important, acceptable to fisherfolk?

Given the experience of two years of development and the very extensive testing and demonstration of several different units done together with selected engine manufacturers, workshops and fisherfolk, the answer is YES.

The response from fishermen and craft operators who have been exposed to the new BOB Drive suggests that the fifteen units already in use in India, Sri Lanka and Indonesia will be followed by many more.

What are the merits of the new BOB Drive which make it attractive and acceptable to fishermen?

The rubber bellows, a crucial component of the Drive, has been developed in collaboration with a small-scale private rubber company in Madras and extensively tested. It has proved grease- and diesel-resistant and, as a consequence, durable. The minimum service life of the rubber bellows is estimated to be one year; with preventive maintenance and care, it may extend up to even two years. Costing as little as US \$ 10 and easily available in India, it is an attractive proposition for fishermen.

An additional advantage is that it is safe.. In case of any fracture of the rubber bellows, resulting in flooding of the engine compartment, the watertight bulkhead in front of the engine prevents flooding of the craft. The maximum level the water reaches in the engine compartment in such conditions is well below the engine, enabling the engine to continue to run, though at low speed, and assuring a safe return to shore.

The replacement of the heavy box fitted in a flooded well has reduced the weight of the craft considerably. As a result, the speed has been increased, the cruising speed of the 9m BLC using a 9 hp engine being about 7 knots.

The BOB Drive system is robust, simple and reliable. It can be constructed locally in a small workshop by any mechanics who can read engineering drawings.* It must, however, be emphasized that the mechanics should be skilled and should have good workshop facilities; only that will ensure the high standard of construction necessary for reliability.

The light weight of the BOB Drive system and its compactness permit installation of this Drive in a wide range

*NOTE: Drawings of the BOB Drive and of fishing craft discussed in this article are available from the Bay of Bengal Programme, Madras.

FRP outrigger canoe SRL 19A, Sri Lanka



of fishing craft — the BLC, the **FRP** *nava* and the plywood canoe in India and even the narrow outrigger canoes of Sri Lanka and Indonesia.

By adapting the chassis, different makes and types of diesel engines can be used. They can be aircooled, hopper seawater cooled or freshwater cooled in open fishing craft or hopper seawater cooled and freshwater cooled in decked fishing craft. In decked craft, the engine compartment provides ample space and good protection for the easy use and maintenance of the engine and drive. The engine and drive can also be easily removed from the fishing craft for repairs.

A wide range of transmission devices can be used, according to the preferences of the fisherfolk and the availability of engine and transmission components. A gear box, with or without neutral, tooth belt, V. belts (3 or 4 A-section) and chain have proved to be suitable. However, the testing and demonstration carried out suggest that the A-section V-belt transmission is the cheapest, simplest, widely available and most acceptable to the fishermen of India and Sri Lanka. While all who have been involved in the development of this new drive, which addresses one of the most important technical needs of fishermen calling at beaches and shallow water outlets in the Bay of Bengal region, have good reason to be satisfied, the BOB Drive is yet to be introduced in large enough numbers to achieve a long-term impact. (See next page for the some thoughts on popularizing the BOB Drive)



FRP IND-20-type nava, India (Andhra Pradesh)

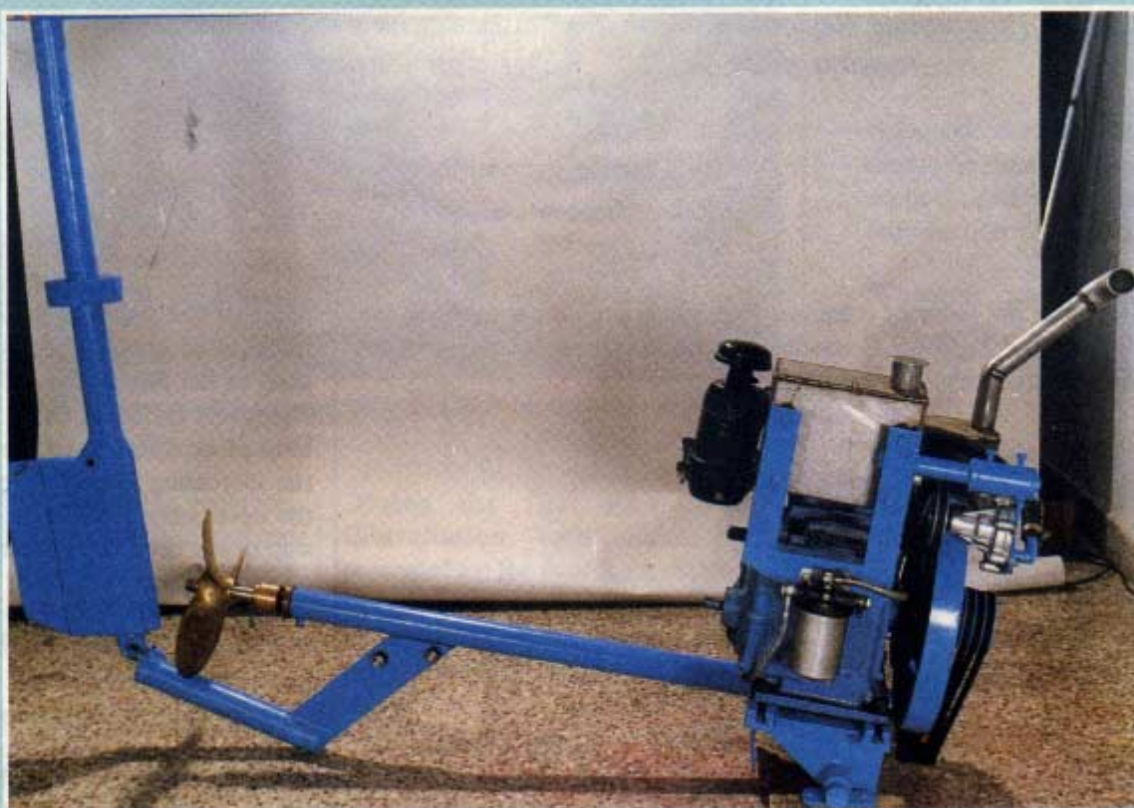


Plywood canoe (IND-28A), India (Kerala)

FRP Beachlanding craft (IND-20), India (Kerala, Tamil Nadu, Andhra Pradesh and Orissa)



Some steps to popularize the BOB Drive



The BOB Drive

It is to be hoped that such a useful tool as the BOB Drive will not remain the privilege of only the fishermen of Puri, Kakinada or Trivandrum in India, and of the fishermen in parts of Sri Lanka and Indonesia, but will be made available in other areas where the same needs are felt. For such an introduction to be successful the following should be ensured.

- Continued good marinization of industrial diesel engines by manufacturers;
- Training more mechanics in constructing new drives of high quality standards and reliability;
- Prolonged testing of the new drives wherever introduced (fishermen should not be exposed to unproven technical solutions);
- Promotion of fishing craft best suited for the BOB Drive and small-scale fisheries;
- Training of private mechanics in the repair of engine and stern gear of new BOB Drives and training of fishermen in the use and maintenance of the same;
- Initial introduction of new BOB Drives only in places where spare parts and the services of trained mechanics are readily available;
- Introduction of enough fishing craft and new BOB Drives in such fishing centres. (There is need for a critical mass before a technology reaches a take-off stage; too few units in operation may not have sufficient impact to open the eyes of the fishermen); and
- Facilitation of finance for access to new technology in the initial stage itself. (Fishermen are often dependent on finding their own finance to purchase new craft, engines and stern gear. Due to lack of funds, they often adopt the cheapest available technology and not necessarily that with the lowest long-term cost.)

When and how may new craft be introduced

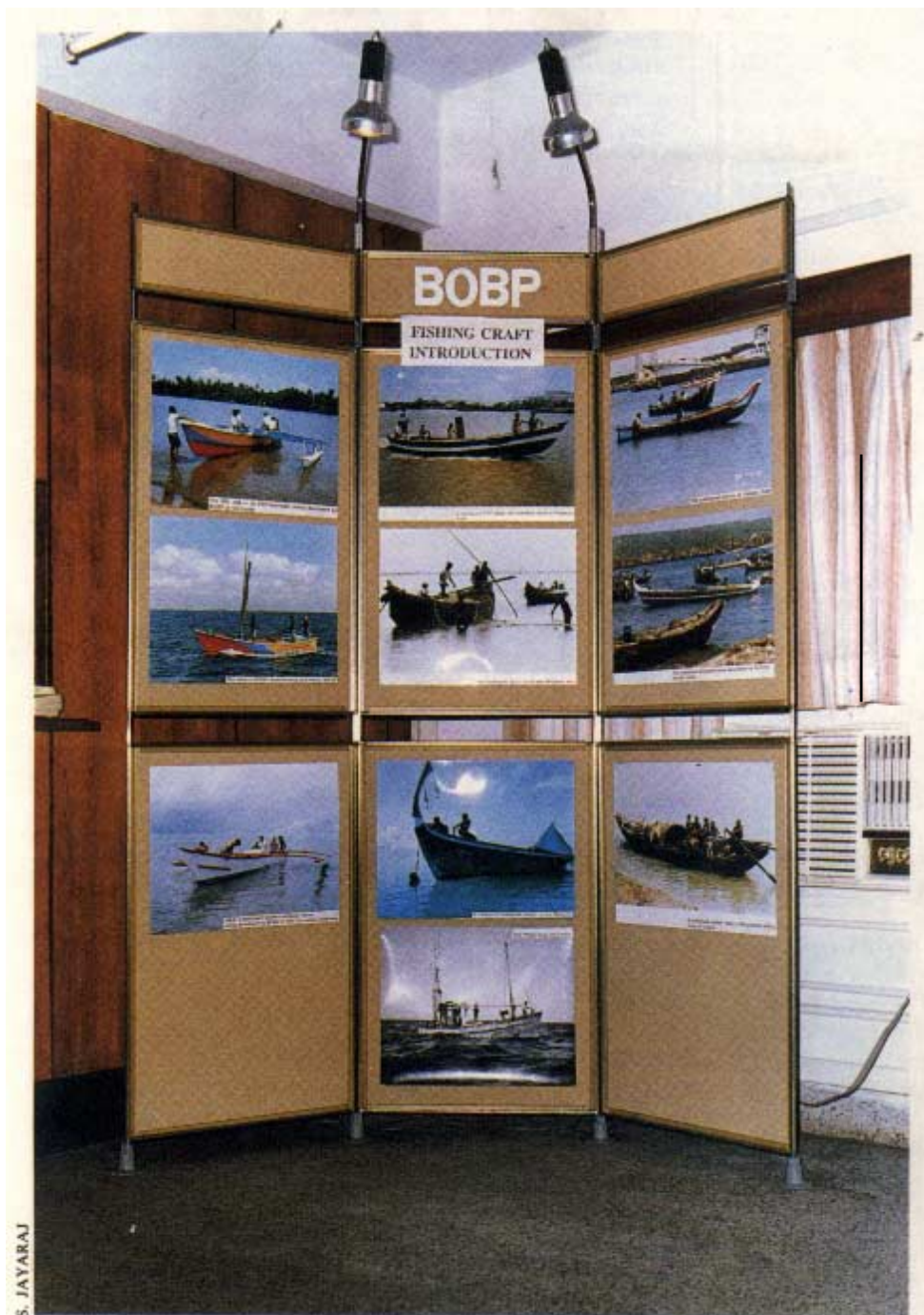
A Bay of Bengal Programme Regional Consultation discusses how enlightened resource management requires more cautious fishing craft introduction.

by Claude Fernando
(Sr. Development Adviser)

The craft which were the focus of attention in the case studies presented at the recent BOBP-sponsored Regional Consultation on Craft Introduction were the subjects of this display at the Consultation.

Most of the fishery resources within the coastal areas of the continental shelf in the Bay of Bengal region are intensively exploited. Given the present level of exploitation of the resources, the increasing fisherfolk population, the developing skills of entrepreneurship of the fisherfolk, the modernizing of fishing craft and gear (including motorization of craft) and the increasing demand for marine products, it is unavoidable that all the available coastal resources will be fully exploited in the near future. Future development work in the coastal fisheries will, therefore, have to be management-oriented if the small-scale fishermen are to reap the maximum benefit from these resources while still sustaining them. This necessarily calls for re-thinking of policies and strategies with regard to introduction of fishing craft.

In response to the resource problems in the coastal areas, a process of expanding fisheries to the off-shore zone in order to exploit the under-utilized or unutilized demersal and pelagic resources has been in progress in several of the member countries of the Bay of Bengal Programme (BOBP). Now, however, it has become necessary that the introduction of new fishing craft for operation in the extended areas should also be done more cautiously to avoid any harmful impact on the existing fisheries as well as on the resources to be exploited in the extended areas. Attention also has to be paid to the problem of expanding fishing fleets causing increased pressure on shared stocks of fish and, consequently, creating conflicts between the fisherfolk of neighbouring countries. Though the countries of the





A speaker at the BOBP-sponsored Consultation on Craft Introduction in Madras.

region appear to realize the problems connected with uncontrolled increase in the issue of fishing craft, these concerns are not adequately reflected in their fisheries development plans, policies and strategies.

It was against this background that the BOBP recently convened a Regional Consultation focussed on the planning of fishing craft introduction. The objectives of the Consultation were:

- to review the past and on-going schemes for the introduction and issue of fishing craft, including motorization of traditional craft in the Bay of Bengal region, and
- to highlight the management needs and concepts relevant to regulating existing fleets and the introduction of craft.

The Consultation, which was held in Madras over four days (July 21-24) was attended by thirty participants and included twenty persons from the member countries who were invited in their individual capacities in recognition of their expertise and knowledge on craft introduction programmes in their countries. Among the others who participated were personnel from FAO Headquarters and the BOBP. The Consultation was chaired by L O Engvall, Director, BOBP, while K M Joseph, Development Commissioner of Fisheries, Government of India, as a consultant to BOBP, acted as the consultation's Technical Secretary.

During the first part of the Consultation, case studies were presented on the four main categories of craft introduction, namely motorization of craft, replacement of craft, new craft and commercial expansion. The case studies on motorization discussed *chandi* boats in Bangladesh, canoes in India and *dhonis* in the Maldives. Odtrigger canoes in Sri Lanka and Nias (Indonesia) and the FRP *navas* and plywood canoes of India were looked at in the studies of craft replacement. New craft introductions studied the Beach Landing Craft in India and the Abu Dhabi boats in Sri Lanka, while the Malaysian purse seiners in the Straits of Malacca and trawlers in the Andaman Sea (Thailand) were the subjects of discussion on commercial expansion of craft. The presentations of each case study was followed by discussions.

The second part of the Consultation took up several important issues arising out of the case studies. They were introduced by the moderators and dealt with fisheries resources, fishing technology, fisheries economics and social considerations. The major conclusions which emerged were:

- A sound resource information and monitoring system is imperative for any planned additions to the existing fishing fleets.
- In view of the inadequacy of resource information, an empirical

approach, involving staggered introductions of craft and their continuous monitoring, was recommended.

- Plans for introducing new craft should take into consideration and detail the species already exploited and the species to be targeted by the new craft.
- Adequate fishing demonstrations should be conducted and extension support provided prior to the introduction of new craft.
- Wherever possible, small-sized craft, using passive gear, should be given priority when replacing trawlers.
- In monitoring catches for cost and earnings data, the sample should include several vessels and monitoring should be over a period of at least 12-24 months.
- Indicators such as the IRR should, in view of their limited usefulness in certain cases, be used in conjunction with other indicators, and sensitivity analyses should be resorted to in all profitability studies.
- Economic analysis should be carried out in the case of craft introduction schemes; the absence of such studies may lead to wasteful investments.
- Subsidies can be used as a promotional measure in introducing craft only if there is full justification from the national perspective.
- Fishery agencies should concern themselves more with social issues when introducing craft; particularly by identifying the target groups and understanding their real needs.

— It is necessary to explore, orient and train the existing staff in social analysis and action.

The Report of the Consultation has been forwarded to the fisheries administrations in the member countries and their suggestions regarding future action to be initiated by BOBP are awaited.

SRI LANKA MOVES TOWARDS FISHERIES MANAGEMENT

Driven by a desire to exploit the wealth of the seas surrounding it, Sri Lanka embarked on an ambitious programme of fisheries development after independence. For over four decades, successive governments have progressively accorded increasing priority to fisheries — and, so, new technologies have been introduced and promoted, foreign assistance garnered, substantial public funds invested on building infrastructure and institutions, subsidies and incentives provided, and vital supporting services rendered. The result is that production of fish has increased considerably.

Since the mid-80s, however, production has stagnated and, although this has been partly due to the disturbed conditions in the northern and eastern areas, there is a growing concern that there are resource constraints. Falling catches have been noted in certain coastal fisheries and in other areas; conflicts between fisherfolk groups using competing gear and social unrest among them are another symptom of the emerging resource problems. There is, as a consequence, a growing realization that fisheries policies and strategies oriented towards production increases cannot continue and that a management orientation is imperative. In fact, the current development plan

itself sets the tone for serious thinking and action on fisheries management in Sri Lanka. The development strategy for the period beyond the current plan, which is already in blueprint, also accords high priority to fisheries management.

Despite the existence of a few traditional management practices in certain specific areas, fisheries management is largely a new concept in Sri Lanka. Thus, lack of adequate awareness, understanding and appreciation of the needs and benefits of coastal area management in general, and fisheries management in particular, among those concerned with fisheries and coastal communities is a major constraint inhibiting fisheries management in Sri Lanka. It is primarily in order to meet these needs that the UNDP has agreed to support the implementation of a Marine Fisheries Management Project over a five-year period commencing 1993. The project will be nationally executed by the Ministry of Fisheries with the cooperation of the Food and Agriculture Organization (FAO).

The Project has three immediate objectives

- to strengthen the capability of fisheries field staff in fisheries management; and
 - to promote the participation of fisherfolk, their organizations and other industry stake-holders in fisheries management.
- Immediately the Project gets underway, a Fisheries Management Unit will be set up within the Department of Fisheries to act as the implementer of the Project. It will assemble all relevant information, statistics and research findings, develop fishery management plans and implement them. The information gathering process will include a census of fisheries — a long-felt need — an inventory of craft and gear and an improved statistical system.
- A weakness in the present fisheries organization in the island is the inadequate capacity of the field staff to cope with management issues, to communicate satisfactorily with the fisherfolk in order to make them receptive to management measures, and persuade them to participate in the consultative and negotiating processes. The Project will address these problems and strengthen their capabilities by clearly spelling out the functions of the field staff and by providing them the knowledge,



training and experience necessary to carry out their management-oriented mandate.

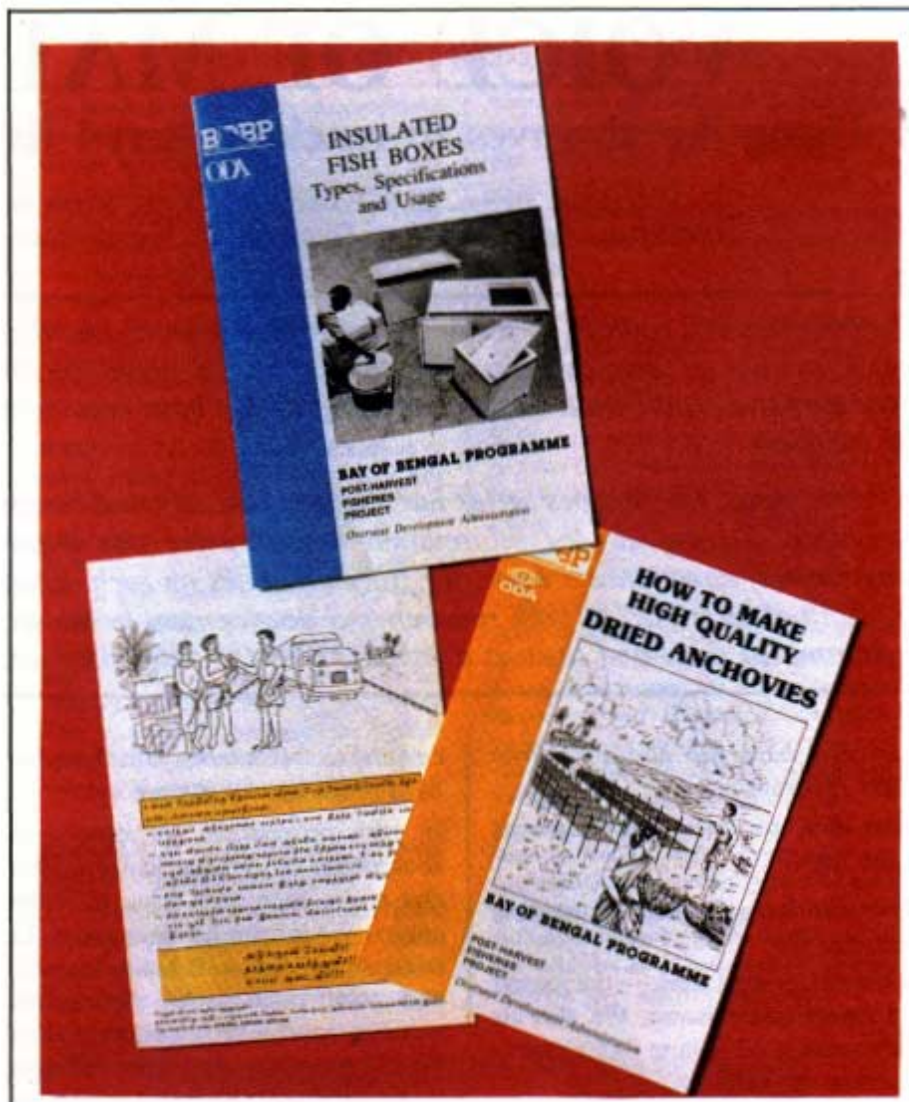
Organizing the fisherfolk and industry groups to participate in management is another major component of the Project. This entails identifying the stake-holders, analyzing their needs and formulating appropriate awareness-building strategies and communication packages to meet the identified needs.

This Project will also work in close coordination with 'the Asian Development Bank-funded Sri Lanka Fisheries Sector Development Project, which, in addition to the development of fisheries infrastructure, also contains some important elements necessary to support the diversification of fisheries and the development of alternative income-generating activities in coastal areas.

Experience from the countries where fisheries management has been introduced indicates that acceptance and implementation of fisheries management ideas is a slow and gradual process and can take a long time for full implementation. Hence, it is not realistic to be too ambitious and optimistic. However, what is clear is that it is a great challenge and requires a team of dedicated personnel with understanding, tact and foresight.

C.F.

Motorized fishing craft crowd the fishery harbours of Sri Lanka.



Publications to help improve end-product quality

The Overseas Development Administration-supported Post-Harvest Fisheries Project of the Bay of Bengal Programme has recently released two publications to help improve end-product quality and increase users' incomes. One is a booklet on ice boxes for storing fish and the other is a folder on making high quality dried anchovy. These publications, at present available in English, will shortly be available in various Indian languages.

The booklet on ice boxes points out that fish stored in ice in an insulated box keep fresh longer and that the insulated box helps reduce ice melting. Both these facts, says the booklet, can help to improve fish quality and increase users' incomes. The booklet discusses and describes various designs of insulated boxes and explains how these may be obtained either through purchasing from a local supplier or through simple self-construction using low-cost and readily available raw materials. Construction details of a wooden ice box are included in the booklet.

In the second publication, it is pointed out that in India, anchovies are commonly spread on the sand to dry, thereby drying slowly and also becoming contaminated with dirt. Lower prices are inevitable. The folder says that drying racks like the one illustrated in it ensure better quality dry fish and better incomes for small-scale producers. Here too details of constructing drying racks are provided.

VOICE OF MALDIVES

Using the airwaves to reach scattered fisherfolk communities

(A M Haglund Heelas, Socio-Economist, A.P.O., of the Bay of Bengal Programme

interviews Badru Naseer, Director of Programmes, Voice of Maldives)

The Maldives is a country of scattered, and often isolated, island communities for whom fishing is the major avenue of employment. Due to constraints posed by the country's geographical features, communication is difficult. Hence, radio broadcasts have become an important information source for the islanders.

In recent years, the fisheries sector has changed radically and become more commercially oriented than previously. To provide the information necessary for this important sector, special fisheries radio programmes, aired twice a week, for fifteen minutes on each occasion, provide a comprehensive range of information related to both research and development in the sector. In addition, a weather forecast is transmitted daily and there is a fisheries-oriented radio play weekly.

How long have you had a Fisheries Radio Programme?

From 1978; it is one of the older ones in the region.

How often is the Fisheries Programme broadcast?

At present, twice a week — the second is a repeat transmission. We also air every week a 30-minute radio drama aimed at the fisherfolk.

Can you tell us something about the contents of your programmes?

Obviously this varies, depending on what is going on in the fisheries sector in the country. For example, when the countrywide programme for motorizing the *Masdhoni* fleet began in the early 70's, a lot of time was

devoted to this activity. But there has been much less on it since.

In each programme we attempt to concentrate on one particular subject and try to look at it from different angles. We inform listeners about the latest on legislation, fisheries research and good catch areas. A separate weather report is broadcast every day. We also have programmes on different methods of processing and preserving fish. Earlier this year, we produced, together with the Ministry of Fisheries and Agriculture (MOFA) extension unit, a series of programmes on reef resource management.

We, however, do not limit ourselves to talking only about fishery related issues. We also try to approach matters

of a more general nature, such as health, nutrition, the family, parenthood etc., which have a bearing on the lives of our fisherfolk.

And what about the drama programme?

Here we try to dramatize everyday situations in the fishing communities. From my experience I can say this is a very effective form of communicating both serious and sensitive issues. Recently, on a visit to an island, one family volunteered to make a dramatized version of an ordinary day in their lives. We just turned on the tape recorder and left them to it. Back in the studio in Male, we just added some sound effects and presented it without any editing. This programme turned out to be extremely popular and the listeners demanded several repeats.

In your opinion, what is the main objective of having a Fisheries Programme?

We are a nation of fisherfolk for whom the fisheries is of prime importance. Consequently, it is the concern of every one of us to take good care of both the sea and the reefs.

Do you get the fisherfolk involved in the making of a programme?

Unfortunately this happens very rarely. We seldom get an opportunity to visit the islands, due to both shortage of staff and funds. This is something that we would like to see changed. When MOFA is planning a field trip, they often invite us to join and, when possible, we try to do so. We

At dusk, on the beach, a group of Maldivian fisherfolk enjoy the radio play.





Badru Naseer in the transmission room — his voice is well-known to most Maldivians.

sometimes interview fishermen when they come to Male to market their fish. But, in general, fisherfolk participation is not very high.

One of our producers once went to an island to interview fisherfolk about their problems. He was literally bombarded with complaints, but none wanted to step forward and be interviewed on the radio.

Do you think people actually listen to the programme or do they just keep it on as background noise?

In most islands, every household has a radio — and it will be on all the time. The fishermen also take their small portables out to sea. So, of course, to some extent, it is background noise! But we do feel that there is some keen listening as well. We have just commenced a countrywide survey to get feedback on how many people are actually listening. What our data indicates so far is that radio is taken as a serious communication device by the fisherfolk. We do feel there is listening. One problem the listeners face is that broadcasting timings follow a four-month schedule, and, sometimes, they don't get to hear of changes in the schedule.

The Maldives experience indicates that the fisheries programme plays an important role in the development of the fisheries sector. When the audience survey is completed, the production team hope to have enough feedback and suggestions from the fisherfolk to ensure an even better and more significant programme. It'll then be happy listening for the Maldivian fisherfolk.

NEW BOBP PUBLICATIONS

The Bay of Bengal Programme from time to time 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/WP/74 — Economic Performance of Small Fishing Craft on the East Coast of India.

This paper compares the economic performance of the beach landing craft (BLC) and several other motorized and non-motorized small-scale fishing craft in three villages on the east coast of India viz Pentakota (Orissa), Tummelapenta (Andhra Pradesh) and Thirumullaivasal (Tamil Nadu). The relationship between the fishing operations of the craft and various factors affecting BLC operations are also discussed.

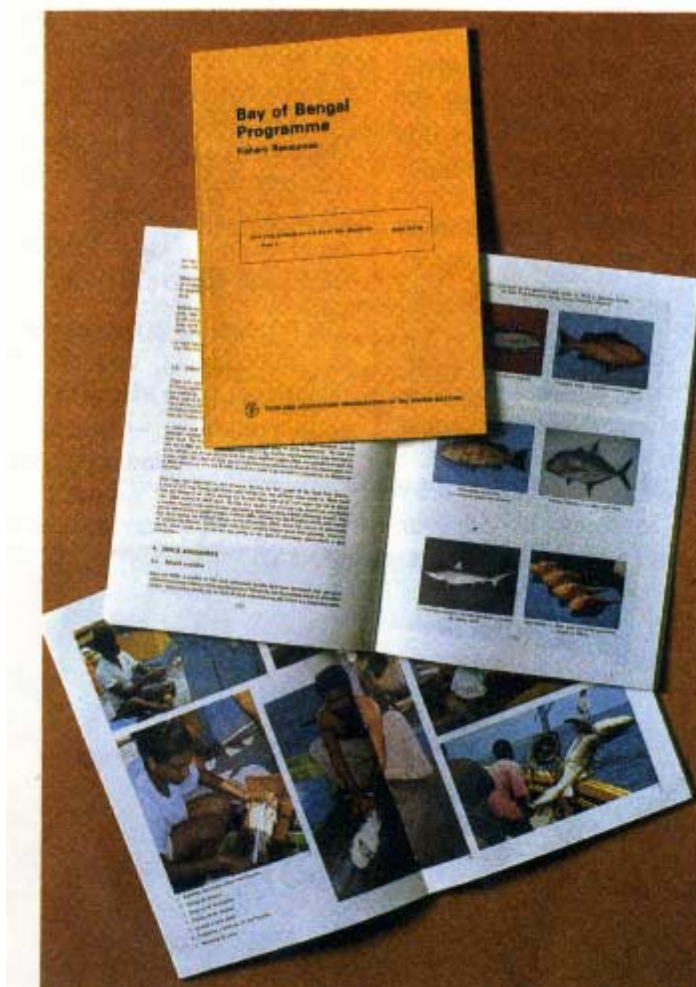
BOBP/WP/77 — Development of Canoe Fisheries in Sumatera, Indonesia.

The development, technical trials and fishing trials of larger plank-built outrigger canoes in Nias Island, Sumatera, Indonesia, are described in this paper. The outrigger canoes

were constructed during 1989. The technical and fishing trials were conducted during 1989 and 1990 in three villages in Nias Island. The purpose of the trials was to assess the technical and economic feasibility of the new outrigger canoes and their acceptability to the fisherfolk

BOBP/WP/80 — Reef Fish Resources Survey in the Maldives — Phase Two.

Preliminary estimates of reef fish densities and maximum potential yields are presented in this paper which describes the second phase of a reef fish resources survey carried out in the Maldives. This follows an earlier survey during 1987-88. The first phase established that handlines and longlines are the best gear for catching Maldivian reef fish and it made a first estimate of potential yields. The second phase established species compositions and catch rates for the major gear and fishing areas, noted regional and seasonal differences, and collected a considerable quantity of information on the biological characteristics of commercial species. Preliminary estimates indicate a maximum potential yield of commercial reef fish (i.e. medium to large snapper, grouper, emperor and reef-associated jack) of the order of $30,000 \pm 13,000$ t/year. The atoll basins (which constitute by far the largest part of the Maldivian atolls) are identified as having relatively large reef fish resources.



Cleaning up Phuket Fishery Harbour

by Ravi Kumar
(Consultant, BOBP)

Phuket, in Thailand, is an island paradise with a dozen different beaches and a reputation of being one of the better tourist resorts in the world. Quite in contrast is its dirty fishery harbour.

Rapid strides in tourism development have resulted in environmental planning to complement economic planning. Various agencies, like the Ministry of Science, Technology and Energy, the office of the National Environment Board (ONEB) and the Ministry of Industry have formulated environmental guidelines directly or indirectly linked to beach tourism, such as refuse disposal, surface water quality and waste water treatment. Alas, none of them are practised in Phuket's fishing harbour complex.

A survey conducted in 1991 by a team of experts (see BOBN No. 45) showed that pollution of harbour water and the port environment was a matter of growing concern. The causes for this environmental degradation are many.

Phuket is One of the main fishing centres of the Andaman Sea coast of Thailand. The fishing port is located at the mouth of the river Tajeau and provides berthing and landing facilities for over 400 fishing vessels, comprising of trawlers and purse seiners. Annual landings are of the order of 70,000 t and nearly 10,000 people are directly or indirectly involved in harbour activities. Nearly all activities in the harbour complex, such as berthing of fishing vessels, landing of fish, marketing, fish processing, bunkering of vessels, boat repairs, bilge discharge from boats, and toilet and kitchen wastes from boats contribute to pollution of the harbour Waters and the environment. Furthermore, inflow of sewage and domestic waste from habitations upstream exacerbates the problem. This localized pollution, affecting water quality, can lead to deterioration of fish quality, especially as harbour water is often used to clean

the fish at some stage after landing. The estuarine area has dense mangrove vegetation supporting an ecosystem that's important for nursing marine life. Pollution of the harbour complex, if left unchecked, will ultimately affect this mangrove ecosystem too.

A major constraint to pollution management is lack of control due to the presence of several private jetties alongside the government run facilities managed by the Fish Market Organization (FMO). Economic pressures have outweighed environmental considerations. The legal constraint to proper management is the paucity of specific and enforceable regulations concerning pollution of the port environment.

In keeping with the International Marine Organization's (IMO) strategy for the protection of the marine environment through co-operative efforts, a project to improve the port environment at Phuket Fishery Harbour is currently being implemented by the Fish Market Organization under the overall supervision of the Phuket Marine Biological Centre (PMBC).

The primary objective of the project is to immediately upgrade reception facilities at the FMO port for the two main pollutants – garbage and oily wastes. The secondary objective is to

organize the community, create an awareness of the importance of a clean environment and establish effective community control over the problem. Local support for pollution management is seen as vital to the success of the project.

Inputs to meet the primary objective are:

- Provision of garbage bins and a garage truck;
- Provision of a reception tank, for oily waste, and a pumping system, to collect bilge water directly from the boats; and
- Provision of a portable skimmer to remove surface oil in the harbour waters.'

Inputs to meet the secondary objective are

- Community organization efforts to create user awareness and voluntary acceptance of guidelines for a clean port environment;
- Information dissemination; and
- Training of harbour managers from the FMO and private jetties;

Improvement in the quality of the port environment as a result of this pilot project should show the way to port authorities to implement similar measures in other harbour complexes in Thailand and elsewhere in the region.

Garbage left on the jetty after fish handling in Phuket.



The case of the battered wife

by S. Salma Begum and Md. Wazed Ali

A Bay of Bengal Programme (BOBP) supported fisheries extension development project (EXT/FED/BGD) began in July 1989 in coastal Bangladesh and has, since, been implemented in 18 *upazillas* of the Patuakhah and Borguna Districts. During implementation it was found that when trying to address the whole community it was difficult to reach the women.

In most fishing communities in the Bay of Bengal region, the women are so unused to articulating their needs that it is almost impossible for them to get together and work out their problems. It is also difficult for the women to organize themselves in groups because of a variety of social and cultural constraints as well as their heavy workloads that leave them with little or no free time. This is especially so in Bangladesh. It was, therefore, felt that a separate activity for women alone would be the answer.

Fifteen groups, comprising 364 women in all, were formed in ten coastal communities and they were motivated to enhance their earnings through income-generating activities and savings. Other issues addressed by the Director of Fisheries' extension cadres and the BOBP-trained staff, have been health, nutrition, family planning and women's legal rights.

Now the groups meet weekly in the villages and discuss their work. The ten supervisors come to Patuakhah once a week for training and guidance. All group members attempt to save 8 TK/month (US \$ 0.25). Fifteen accounts have been opened. Each woman has her own pass book and savings are increasing.

Homestead vegetable gardening, for household consumption and sale, has increased in all villages. Some women have even invested the daily allowance they received during training. The group members have agreed to try and increase their income from paddy husking by utilizing the credit, provided by the Project, in the form of revolving funds. Sanitary pit latrines are being constructed. And greater attention is being paid to healthcare.

S. SALMA BEGUM, Project Coordinator, and MD. WAZED ALI, Project Assistant, have written this account of one aspect of the work they've been doing with the groups. They describe the impact the legal rights training they've imparted has had in a particular village.

A.M.H.

She lived in a remote village in Patuakhali District. One day, she was thrashed by her husband. Not only was she battered badly, but he threatened to divorce her — for no apparent reason.

She had been battered by her husband often in the past and she could never summon enough courage to protest. Neighbours and other villagers never interfered, considering the beatings the private affair of the husband and wife concerned. But on this day something different happened.

The woman, after being battered by her husband, went to the group she belongs to and told them the story. The group members got together to discuss what should be done. At the meeting, they took a decision to act collectively in protest against this incident.

Some of the members of the group went to the husband and had a talk with him. They managed to get him to promise not to hit his wife any more. He was also persuaded to withdraw his threat of divorce.

Two things are interesting about this case: Firstly, the woman had become bold enough to complain about her husband and, secondly, a women's group was able to talk to the husband and get him to agree to their suggestions.

Normally, in the rural culture of Bangladesh, particularly among the fisherfolk, husbands think they have the right to beat their wives and that the wives should not protest against this practice.

What made a wife protest and other women support her in this case?

It was the awareness of their legal rights that they got during their weekly meetings. At some of these meetings there were

discussions about women's rights. Previously, the oppressed women in rural Bangladesh, especially in the fishing communities, did not even know what their rights as a human being were. These rural women believed that they were born only to obey the male's orders. That had little or no confidence in their own ability to survive. The project's attempt to improve the lives of fisherwomen has changed things a little for the better; it has done this by uniting the women and getting them to share their views.

The group to which this woman belongs is only six months old. The 25 fisherwomen in this group meet once a week, gossip, chat, share views, discuss issues with each other. The confidence they've gained has changed their behaviour in a positive direction.

The women of one of the fifteen groups formed in the Patuakhali and Borguna Districts of Bangladesh meet to discuss issues concerning them.



The BOBP Library

“A library is the key to the world of knowledge”

— Jawaharlal Nehru

The Bay of Bengal Programme's Library, housed in the BOBP office in Madras, is a small but well equipped, specialized reference library which offers over 6000 documents that help meet the research needs of the Programme Staff, fisheries officials, scholars, development planners etc. The Library also plays a key role in the dissemination of information about the Programme and is, thus, an important component of BOBP's Information Service.

An open access system is adopted in the Library, with readers being free to browse through the shelves and pick a book of their choice. But being purely a reference library, books are issued only to BOBP staff and not to outsiders, though researchers are free to use the material in the library, with permission.

Collection and classification

The library was set up in 1979 with the help of Ms Clare Cuerden, Librarian, Fisheries Branch Library, FAO, Rome. Since then its collection has grown considerably and now comprises books, reports, monographs, articles from journals etc., each of which is given the status of a document, accessioned and processed.

The classification scheme adopted is a non-conventional one. The documents are broadly classified by the member countries of the BOBP — Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand and then by activities within the countries. For example, a title such as 'Aquaculture in Malaysia' would be classified under MALAYSIA.

Material pertaining to activities outside the region are classified by the major activities of the BOBP, such as Aquaculture, Extension, Fishery Resources, Fishing Technology and Post-Harvest Technology. These are further sub-divided as follows

1. Aquaculture: Finfish, Shrimp/Prawn; Aquatic Plants/Disease/Pathology, Aquaculture Engineering, Pen & Pond culture.

2. Fishery Resources : Stock Accessment; Species/Tuna/Shrimp/Mixed species/Hilsa
3. Extension: IRDP, Development, NFE, NGO, People's Participation, Women & Development
4. Post-Harvest Technology: Utilization and Marketing, Processing
5. Fishing Technology: Fishing Craft, Gear, FID, Safety at sea.

Among other subjects classified are Environment, Coastal Management, Pollution, Economics, Harbours and Fishery Legislation.

Documents are also classified under institutions, as for instance SEAFDEC, ICLARM, CMFRI, FAO TECH, World Bank, NRI, and by series FAO Fisheries, Tech. Papers, FAO Circulars, FAO Species Catalogue, FAO Training Manual etc.

Reference Collection

The Library has a fairly good collection of books which serve as quick and easy ready-reference tools. They include atlases, encyclopaedias, species catalogues, statistical yearbooks and other non-book reference material like maps and Admiralty charts. Some of the more popular reference books are: *Atlas of Living Resources of the Ocean*; *FAO Year Book — Fishery Statistics*; *The Times Atlas and Encyclopaedia of the Sea*; *Encyclopaedia of Marine Marine Pollution and Law of the Sea* (4 volumes); and *illustrated Identification Guide to Commercial Fishes*.

A mini-library on Appropriate Technology in micro-fiche is a special feature of the reference collection.

Audio-visuals

The library has a substantial audio-visual collection which includes, videos, photographs and slides. All are indexed and kept serially in files with details of activity, location, photographer and date.

For quick and easy retrieval a manual index is maintained. At present, the library has over 20,000 slides and 30,000 photographs in its collection.

Services

As part of awareness building, new additions to the library are displayed fortnightly so as to keep the Staff and readers informed of what's new. Also, photocopies of title pages of the new arrivals are circulated to the professional staff.

Bibliographies are prepared on request. Photocopying services are also provided at a nominal cost.

Being a specialized reference library, it attracts several researchers. There were more than 150 such users in 1991. They, like others who step in, discover a wealth of material on fisheries and related areas.

The Library is open to all interested in fisheries from 8 a.m to 4 p.m., Monday through Friday. Ms Catherine Joseph, who is in charge of the library, may be contacted for any assistance.



Cataloguing

Teh cataloguing of documents is purely alphabetical and entries are made under author, title and subject, where author and title are merged into one sequence.

Book Selection

Recommendations from experts, book reviews and publishers catalogues are useful tools which help in the ordering of books for the Library. The Library subscribes to more than 40 journals, both from India and abroad, including *Agricultural Information Development Bulletin*, *Appropriate Technology*, *ASEAN Food Journal*, *Fisheries Economic Newsletter*, *Fishing Chimes*, *IMO News*, *INFOFISH Trade News*, *Indian Journal of Fisheries*, *SEAFDEC Asian Aquaculture*, *Seafood International*, and *World Fishing*.



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).