BAY OF BENGAL NEWS

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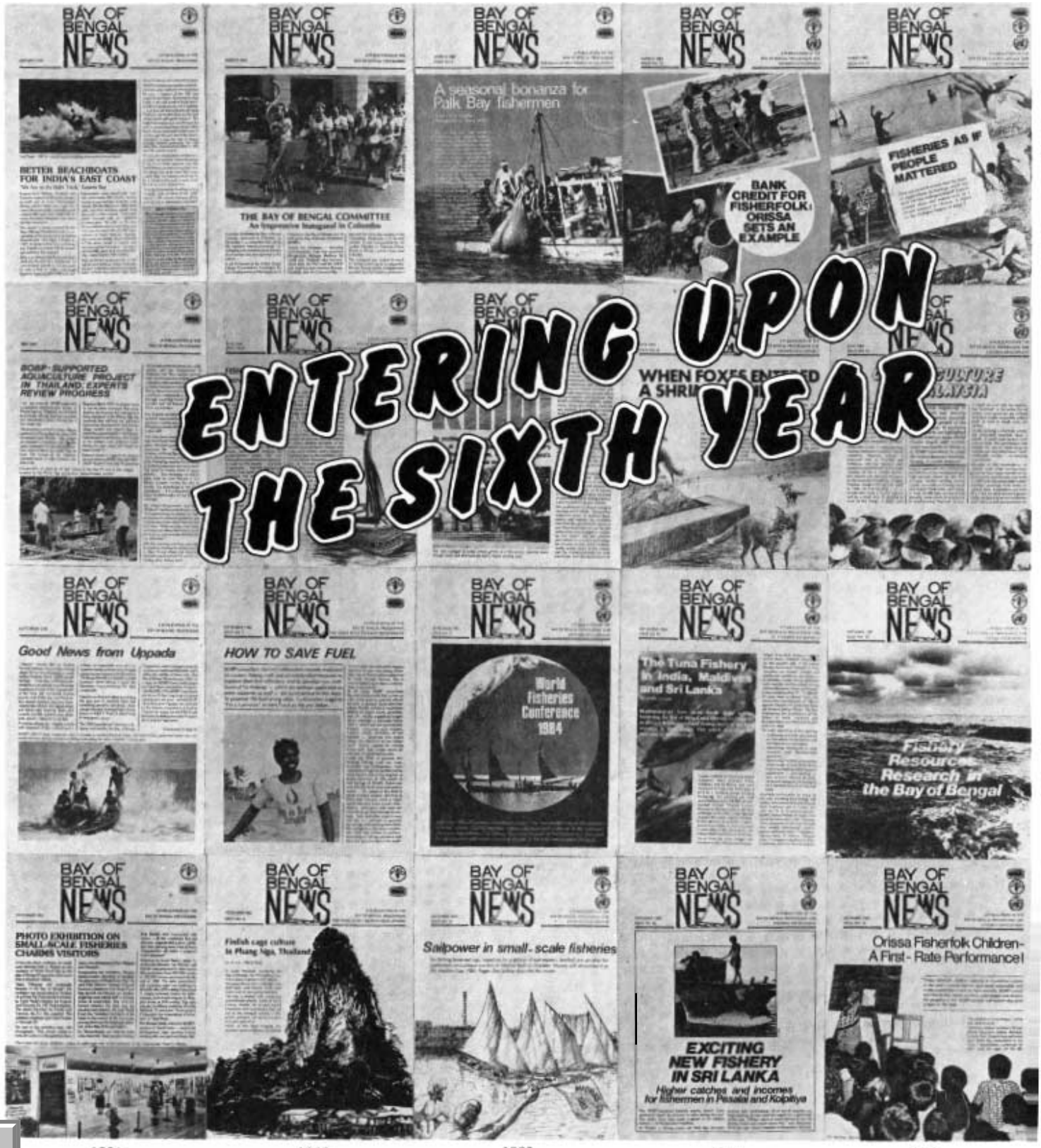

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Bay of Bengal News : Fifth Anniversary Reflections

This is the first issue of the sixth year of *Bay* of Bengal News. Infant mortality is high with such publications : they are usually the first victims of work pressure, time constraints and budget crunches. That Bay of Bengal News ("the newsletter", as it is referred to within the BOBP) has survived, is partly because we get a terrific kick out of producing it : it's hard work but great fun; and partly because of the enthusiastic response the newsletter has generated.

Fisheries officials and decision-makers perhaps absorb the gist of our technical work quicker from a simply written newsletter article than from a valuable technical report that demands time and effort to read. Our experts too like the visuals that brighten up the description of their technical work. Newspapers and fisheries magazines find it convenient to reprint our articles, which speak the journalistic idiom.

Two responses we still await are good unsolicited articles from fisheries scientists (a daily newspaper on the other hand gets voluntary contributions by the score), and thoughtful letters from readers. We like the complimentary letters we get, but they are not substantive enough for publication.

Over the years, our technical staff have contributed more and more to the newsletter, and cribbed less and less about editorial changes. Bay of Bengal News has indeed become an exercise in teamwork, a joint venture in communication, which has educated and enriched all staff to some degree.

In a pictorial magazine, such teamwork is particularly vital between editors and artists, who together work out the integration of text with visual elements. Editors brief artists about the text and about suitably effective layout concepts. But a creative artist, particularly one with oodles of natural talent like the BOBP's E Amalore, can make a magazine sparkle in a way the most talented writer or editor cannot.

The cover pages of the 20 newsletter issues till December 1985 have all looked different. "In fact we have never repeated a single layout — front page or inside pages" says Amalore. That's an ambitious claim. However, there have been some outstanding layouts and the stories behind them are worth recounting.

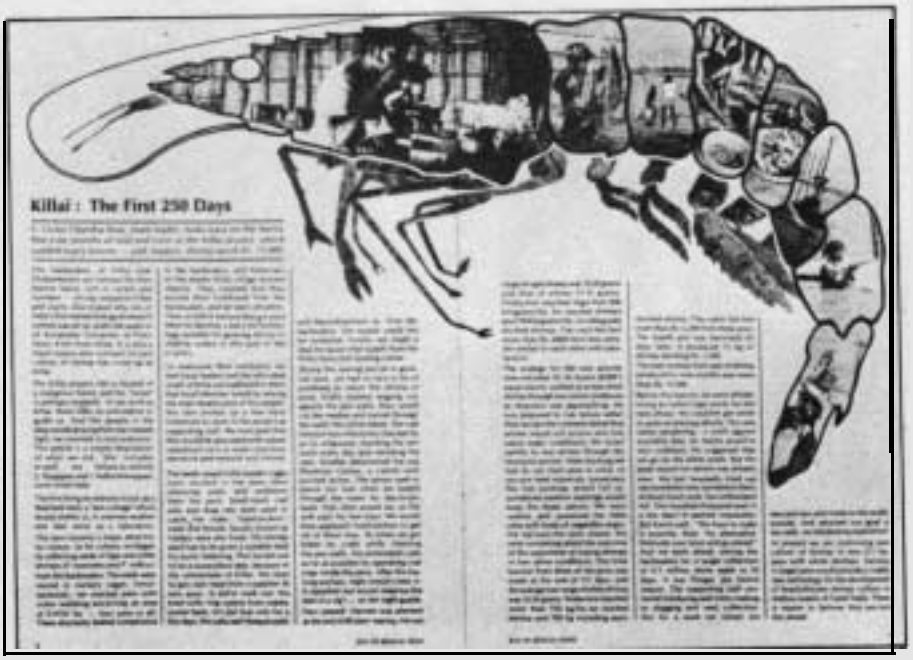
Layout *problem* : To illustrate a cover page bearing the heading "When foxes entered a shrimp pond . ..1 We had no picture of the foxes. Amalore visited various libraries and asked for books on foxes (One librarian : "Do you mean fishes?"). He finally drew an authentic – looking Andhra Pradesh fox attempting to invade a shrimp pond. Take a look at Bay of Bengal News, June 1984.

Layout problem : To illustrate an article on our shrimp culture project at Killai. We had many workmanlike pictures, none of them of award-winning calibre. Amalore drew a giant-sized shrimp, arranged eight pictures within it, and got it reduced to the right size (July 1983). The BOBP Information Service secretary was so taken up with the att-work that to this day it adorns her drawing room table,

A graphic device Bay of Bengal News has used very little so far is cartoons. They are only occasionally appropriate for our articles, but we will explore possibilities of using them in future to make telling editorial points.

Most editors have **problems with their** proprietors — or publishers, as the case may be. I've had none with mine. While other publishers may try to sweep organizational problems under the carpet, the publisher of Bay of Bengal News brings them out into the open. "One learns more from failures and problems than from successes" says Lars Engvall. In his own articles analysing BOBP work, he has highlighted* failures — perhaps to compensate for an editor who plays up successes!

Bringing out Bay of Bengal News; conveying the pleasure and the pain of a development project in action, has been for us a labour of love. We hope some of that shows. — S R **Madhu**



A Letter from the Publisher

RESOURCES ASSESSMENT

In the Bay of Bengal region, as in many other places in the developing world, there is a high demand for international assistance in fishery resources assessment. Nowadays it is often referred to as resources management, but the crucial issue is resource assessment. This may, at least to a layman, seem a little surprising after all the national and international effort that has gone into the subject over several decades. Even a casual look at the records reveals a startling number of projects and fair sums of money spent. What progress is being made towards self-reliance?

The availability of competent scientists is one of the fundamental issues. The usual measures of short-term training courses and in-service training under stock assessment or survey projects have apparently not helped much to create a cadre of trained and experienced scientists. Common deficiencies of training are that the subjects taught are often above the heads of many of the trainees; they lack the basic knowledge of biology and mathematics required. Many of them are not actively engaged in resource management work at their home stations but have been nominated for other reasons. The drawback of survey or assessment projects from a training standpoint is that the scientists responsible are more inclined to complete the work and show results in the short time usually given them than to train younger researchers. From casual observations, it appears that long-term fellowships for scientists at universities or specialized institutions lead to the best training results.

The other major problem is the lack of data. Not even the best stock assessment method can be applied without a certain minimum quantity and quality of data. The theoretical and practical aspects of statistical systems are well understood in most countries but data are not being produced. It is mainly a matter of funds. Data collection is not given sufficient priority, whatever be the reasons. The monitoring and training of field staff also leaves much to be desired.

In the absence of national capability, and with information and data lacking, countries often turn to bilateral and international agencies for help. Expectations of "magic" answers from these agencies

are quite common. But without the essential data, expert advice is of limited value. A quick survey by a sophisticated research vessel might provide a snapshot of the resources situation at that particular time but little more. A research vessel offered as a gift may be seen as a drain on the fisheries budget when it becomes operational. The glitter from the magic fades all too soon.

What then should be done? A couple of suggestions :

– Give more scientists an opportunity for post-graduate studies at specialized institutions. But be careful in selecting the subject and the place. The purpose is not primarily to obtain a degree but to acquire knowledge relevant to the problems at home.

– Arrange for long-term in-service training for gradual build-up of capability; supervision and guidance should be continuous but the presence of foreign experts need not be; Twinning or exchange with more experienced institutions may be a suitable arrangement.

– Give priority and provide the necessary funds and training for implementing statistical systems and sampling programmes. Cut out one of those expensive surveys if necessary to make.the funds available.

– Seek more active cooperation with the commercial fleet in obtaining resources information.

LARS O ENGVALL

BAY OF BENGAL NEWS

BAY OF BENGAL NEWS is a quarterly publication of the Bay of Bengal Programme (BOBP).

The BOBP is a regional fisheries programme executed by the Food and Agriculture Organisation of the United Nations (FAO) and funded by the Swedish International Development Authority (SIDA) and the United Nations Development Programme (UNDP). It covers countries bordering the Bay of Bengal.

The BOBP's main aims are to develop, demonstrate and promote appropriate technologies and methodologies to improve the conditions of small-scale fisherfolk, and to assess and monitor fishery resources.

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Fishery Resources Researëh in the Bay of Bengal: A Factsheet on Sri Lanka

Resources surveys and exploratory fishing have been conducted in Sri Lanka from the beginning of this century. The earliest surveys were mostly to discover potential trawl grounds and to determine suitable gear for exploiting marine fish resources. The activities led to commercial trawling operations on the Wadge Bank and to trawling for prawns and small fish in inshore waters. Most of the surveys carried out during 1970 aimed at better exploitation of skipjack and other tuna from the waters around Sri Lanka. Surveys carried out by Fridtjof Nansen were noteworthy for the estimates of fish potential around the island's coastal waters.

This factsheet relates only to marine fisheries. However, substantive R & D work concerning other marine living resources and related ecosystems is also done in Sri Lanka. The National Aquatic Resources Agency (NARA), the premier institute for R & D activities on marine fisheries, also has other specialised units covering non-fish ecosystems and brackishwater aquaculture of finfish and oysters. In addition, a 24.5 m oceanographic research vessel owned by NARA conducts marine biological and oceanographic work in the coastal waters of Sri Lanka.

Besides NARA, the Inland Fisheries Division of the Ministry of Fisheries is also engaged in experimental brackishwater aquaculture. University scientists conduct research as well, in brackishwater fisheries and in other activities related to estuaries and lagoons.

Table 1: Resources Surveys and Exploratory Fishing

PERIOD	VESSEL	TYPE OF SURVEY	LIMITATIONS	REMARKS
1907	Violet	Exploratory bottom trawling on Wadge on Wadge Bank	Trawl used small because of limitation in engine efficiency	
1920-23	RN Lilla 40.6 m, 249 GT, 500 h.p.	Bottom trawl surveys around Sri Lanka, including Wadge and Pedro Banks		Reports by Malpas and Pearson
1955-56	RN Canadian 14.5 m, 80 h.p.	Bottom trawl surveys in inshore waters around Sri Lanka		
1954-57	RN North Star 14.5 m, 80 h.p.	Experimental/exploratory fishing using handlines, bottom longlines, shark longlines, troll lines, gillnets		
1963-67	RN Canadian 14.5 m, 80 h.p.	Exploratory trawling on north and east coasts		
1967	FV Myliddy 33 m, 240 h.p.	Investigation of bottom conditions and of the possibility of fish/prawn trawling in north and east coasts	Survey limited to a short period, May to July	Report by S Berg
1970		Aerial survey for surface tuna spools, jointly by a U S company and by Fisheries Research Station, Ceylon	Limited coverage, only five trips in July	Report by K Sivasubramaniam
1972	RN Optimist 500 GT, USSR	Exploratory bottom trawling in deeper waters off north west and north east, also including Wadge Bank	Coverage from March to December 1972	Report by Demidenko
1972-75	Kosei Mara 21.2 m, 59 Ct *(PIL)*	Exploratory pole and line fishing for tuna in offshore waters through FAO/UNDP Project	Reduced coverage for tuna fishing due to problems in the bait fishery	Report by K Sivasubramaniam
1972-77	Hingura 11.6 m, CRP Salaya 11.6 m, GRP	Survey of live bait and small pelagic fish resources around Sri Lanka through FAO/UNDP project	Survey conducted with light attraction in the night using purse seine/ lampara nets	Reports by C Pajot L Joseph
1973-74	Seishomaru 265 CT, P/L Kuroshiomaru 240 CT, P/L	Pole and line fishery survey for skipjack by Nichiro Fishing Co. of Japan for possible joint ventures	Results below expectations due to poor live bait fishery	Report by K Sivasubramaniam
1975	RN Hoyomaru 496 CT, 1000 h.p.	Exploratory fishing in north west/north-east using handlines, drift nets, shrimp baskets and meteorological and oceanographic observations	Limited to north west and north east during January - February .1975	Report by Japanese Marine Fisheries Resource Center, January 1975
1975-78	R/V Hurulla urn, 96 h.p. R/V Lagga 8.4rn, 22 h.p.	Bottom fish trawling in inshore waters of north west (Palk Bay/Culf of Mannar)		Report by I C Hinrikssori
1978-80	RN Dr. Fridtjof Nansen 48.4 m, 1500 h.p.	Fish resources in coastal waters using acoustic methods/bottom trawl, bottom longline	Around Sri Lanka except Palk Bay and Culf of Mannar. Three coverages in three years	Reports by Fisheries Research Station, Ceylon and Institute of Marine Resources, Bergen, Norway
1984	F/V Celebesdos/ Philippines	Exploratory purse seining for tuna around FADs	Inconclusive due to limited coverage	

Table 2: Statistics: Review **of present** system for marine **fisheries**

INSTITUTE	SYSTEM USED	COLLECTORS OF BASIC DATA: TYPE, NUMBER	PROCESSING PLACE! METHOD	SPECIES	EFFORT	VALUE	REGULAR PUBLICATIONS! REMARKS
Ministry of Fisheries	2-stage stratified random sampling	Fisheries inspectors at selected landing sites in the 14 coastal areas (District Fisheries Extension Officers)	Statistics section, Planning & Programming Division, Ministry of Fisheries, Colombo 10. By hand	30 groups since 1984	5 vessel categories and various gear categories. Data not processed.	Yes	Annual report of the Ministry of Fisheries (Cyclostyled)
National Aquatic Resources Agency	1. 2.stage stratified random sampling 2. Systematic random sampling	Research Officers & Research Assistants. Catch and effort of specific fisheries in specific areas	NARA/Crow Island, Colombo 15. By hand	Tuna, sardines prawns.	In terms of• gear and craft	—	Technical publication (Journal, National Aquatic Resources Agency)

Table 3: Marine Fishery Resources Research Facilities

INSTITUTE	LOCATION	TYPE OF RESOURCES RESEARCH	BIOLOGISTS	GEAR	ACOUSTI(	COVERAGE OF KEY AREAS	RESEARCH VESSEL	REMARKS! PUBLICATIONS
National Aquatic Resources Agency	Crow Island Mattakkluliya Colombo 15 Substations 1 Trincomalee 2 Kalpitiya	a Monitoring of fishery studies on biology & distribution of tunas	3	—	—	— Monitoring of fisheries for stock assessment. — Biology & distribution of main fish & shellfish varieties — to increase efficiency & as management measurE.	'Samudra Maru' 24.5 m Marine biological oceanographic vessel	Journal of National Aquatic Resources Agency
		b Monitoring inshore pelagic fisheries & studies on biology distribution of main species	3	—	—			
		c Monitoring of prawn fisheries!studies on biology and distribution	2	—	—			
		d Study of lobster fishery	1	—	.—			
		e Experimental fishing with newly designed trawl nets	1	(Gear technologist)	—			
		f FAD for inshore pelagic resources	1	(Gear technologist)	—			
University of Sri Jayawardenapura	Gangodawila Nugegoda	Distribution and biology of major varieties from commercial fish sampling	1	—	—			Papers read at annual sessions of Sri Lanka Association for Advancement of Science (SLAAS)
University of Colombo	Colombo 3	Undergraduate and postgraduate (M.Sc) research projects of 3 — 6 months duration on biology/taxonomy from commercial fisheries	1	—	—			Project reports available at science library, Colombo University.

SHRIMP PEN CULTURE IN KILLAI : *Is it ready. for extension to fisherfolk?*

by Edel Drewes and G Rajappan

Eight private fishermen of Killai are present/y engaged in testing shrimp pen culture technology developed by BOBP. To make this technology economically viable, the price of pelletized feed should be reduced *and an annual vie/d of at /east* **1100** *kg per hectare should be established, says the author.*

In 'mid-May 1982, BOBP launched a project to test pen culture technology for shrimp for improving the incomes of small-scale fisherfolk and increasing the production of exportable shrimp. The backwaters of Killai in South Arcot district, Tamil Nadu, were selected as the project site.

Trials were carried out over 21 months. Several factors had to be tested : pen wall materials and the mesh sizes of pen walls, pen sizes and outlays, feeding techniques, feeding rates and composition, shrimp species, stocking sizes and densities, stocking and harvesting techniques, seed collection and nursing techniques, water temperatures, salinity and predator control techniques. In retrospect, the 21-month technical trial period was insufficient for conclusive findings. The production variation (yield/ha) during the technical trials was too high. Small-scale fisherfolk cannot afford the risk of adopting an insufficiently tested technology and developing it further at their own expense. They should be expected to invest in shrimp pen culture only after its techno-economic feasibility has been convincingly demonstrated. A recommendation based on a few culture trials and on extrapolation of yields from 0.1 ha to 1 ha pen size can lead to drastic failures during technology transfer.

BOBP therefore decided late 1984 to extend the technical trials to determine the technical package and its economic viability.

A new project phase

During the first phase (1982-84), technical trials had been managed by scientific officers from the Department of Fisheries who occasionally hired local labourers. During the new phase, it was decided to engage fisherfolk actively in the shrimp culture trials. Project planners would thereby get to know whether fisherfolk accept shrimp culture technology (as an additional source of income) or reject it. It would also help to determine what kind of technical training and management

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support the Killai fisherfolk will need once the feasibility of shrimp pen culture is demonstrated.

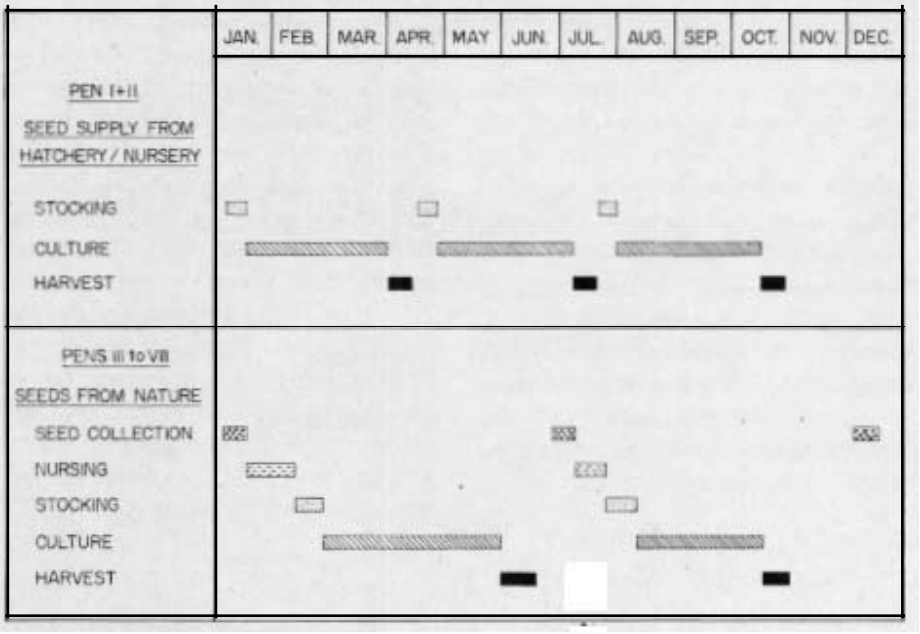
During this new project phase a wider project approach was adopted. It did not restrict itself to testing and demonstrating a new shrimp farming technology, it also looked into the appropriateness of the technology for the people who were to apply it.

Participation of fishermen in culture trials

It was planned to conduct culture trials with the active participation of eight local backwater capture fishermen. A four ha area was to be put under culture. Standard pen sizes, stocking densities and seed sizes were aimed at, apart from standard feeding rates, feed compositions and culture periods. During the first phase the project field team consisted of three natural scientists/aquaculturists; one of them was now replaced by a social worker with experience in community development oriented extension work. Her role was to establish a communication link with the fishing community to facilitate the selection and successful participation of eight fishermen in the pen culture trials.

In January 1986, the first contacts were made with fisherfolk, and meetings held with their leaders and with interested fishermen. When the project plan was explained, most people expressed reservations. Some felt that it would not pay. They cited the example of earlier pond culture operations in the area which had failed; some fishermen had lost money. Others were dubious about the selection of only a few fishermen for the culture trials; the other fishermen would be deprived of fishing grounds if pen culture was extended to further areas. In particular, fishermen who fish with dragnets and those who have no canoes from which to operate cast nets, depend on shallow water areas for fishing. As pen culture too requires shallow water areas, fishermen feared competition from pen culture for these grounds. It was suggested to them that those likely to be hit by future pen culture expansion could take to shrimp pen culture themselves. This softened critical opposition to the new technology somewhat. Killai leaders approved of the idea of eight selected fishermen taking part in the pen culture

KILLAI PEN CULTURE PROJECT : CULTURE CYCLE PLAN FOR 1986.



trials on a fixed payment basis for a minimum period of one year.

Door-to-door visits were made to 300 families to brief them individually on the project plan and to give people affected by the project a chance to participate in it. During these visits basic data was collected on occupational patterns (backwater or sea fishing, castnetter or dragnetter, fish merchant or fishermen, farmer-cum-fisherman or fishermen), income patterns and attitudes towards shrimp culture.

A castnet fisherman without his own canoe would lose nothing by taking part in the project, since a fixed payment equal to his present average annual income from castnet fishing was offered to him. Yet the castnet fishermen hardly evinced any interest in the project. Apparently they did not wish to forego the flexibility and independence of their present workstyle and accept a fixed regimen. Instead of the few hours they normally spend every morning on fishing (generally between 4 a.m. and 11 a.m.), they would have to work several hours during the day, and spend less time with family members, neighbours and friends. Their wives would have to alter their daily working routines too, and carry mid-day meals to the project site 1½ km away.

Special efforts were made to encourage women to participate in the pen culture trials. As their traditional occupation is however restricted to fish handling and fish trade they could not accept the idea of switching to shrimp farming which calls for working in the water and catching fish.

Only after establishing close contact with the families, clarifying several points and dispelling some misapprehensions, were eight fishermen mobilized for project work. All of them were initially criticized by neighbours and friends for having joined the project. They were labelled "fourteen rupees" men (this was their daily wage paid by the project) for exchanging their independence as capture fishermen for work under supervisors in a project that used the traditional fishing area of Killai fisherfolk.

The new project phase became operational in April 1985 with the construction of new standard size pens and nursery cages. Prior culture trials suggested that from the standpoint of technical management one 0.25 ha (30m x 85m) pen would be optimal. Though this meant an increase in investment cost compared with the previously suggested 0.5 ha and 1.0 ha pens, the yield would be higher in 0.25 ha pens since pre-stock pest removal and harvesting could be carried out more effectively. The culture operations bore out this assumption (see costs and earnings table).

The eight fishermen carried out all the work relating to pen culture, including pen construction. They were treated as trainees on-the-job rather than as labourers, though initially strict

supervision had to be exercised. As pen culture operations were to be carried out with naturally available seeds, and with fresh animal feed instead of ready-made pelletized shrimp feed (which was not available early 1985), the fishermen had to be trained in seed collection, nursing and feed preparation. In addition, they had to acquire skills in pest removal and pen maintenance, stocking, shrimp growth monitoring, calculation of feeding rates, shrimp harvesting, sorting and selling. A culture operation plan was prepared which aimed at three culture operations (crops) per year. This plan, however, had to be revised since sufficient natural seeds are available only twice a year (around Nov./Dec./Jan. and around July).

Results of culture trials and technical constraints faced

Culture trials were carried out from August to mid-October. They showed good results as regards survival rates and yields. Shrimps (nearly all *P. indicus)* stocked at 2 g body weight, could not however be grown to more than 12 g within this limited period. To prolong the culture and thereby grow the shrimps to around 16 g is not possible, as the October monsoon rains generally lower water salinity and affect the survival of P. indicus. Earlier trials (1982-84) had indicated that during the first part of the year too (February-June), a body weight of more than 12 g could not be achieved, probably because water temperatures are rather high in April and May. Therefore, pen culture based on naturally available seeds faces two constraints : seasonal availability of seeds and unsuitable hydrological conditions during certain months.

Higher profits per unit area may be eventually possible if the annual yield is increased by culturing hatchery-bred P. monodon seeds obtainable throughout the year, provided hatchery technology is well established. With hatchery-bred P. monodonm three culture operations (crops) might be possible per year (see culture plan below).

This will be tried out in 1986. As the hatchery has no nursery attached, there are problems to be overcome with seeds which are delivered to the project at the post-larval stage and nursed in cages, resulting in poor survival. This needs to be improved. The Tamil Nadu Department of Fisheries intends to carry out nursing trials in mud ponds from mid February 1986. Whether it will pay to culture hatchery-bred P. monodon remains to be seen. Breeding and nursing costs have still to be worked out.

In 1985, culture operations yielded further valuable results concerning feed availability. It was found that fresh animal protein is insufficiently available for a 4 ha farm area if feeding is done daily and if small low-cost fish species, which are consumed by the very poor, are not used as shrimp feed. Though a new feed source (Palayar fishing harbour) was identified, only between 100-250 kg of trash fish could be collected daily even during the main fishing season. It consisted of prawn heads, squid offal, squilla, small crabs and small fish species not used for human consumption. Hardly any trash fish was available during the monsoon, as most trawlers stopped fishing. The problem of animal protein feed shortage could be overcome by producing pelleted shrimp feed at the project site. This was possible only at the initial culture stage, when daily feed requirements were less than 50 kg – trash fish left over from the daily collection could then be used for pellet production. Pellets were then stored and used in addition to fresh trash fish during the second half of the culture period, when feed requirements are much higher. The cost of project produced pellets worked out to around Rs. 2.50/kg.

By mid-I 985 a private company brought the first pelleted shrimp feed to the market – at a rate (Rs. 4.50/kg) however, that would make the economic viability of shrimp pen culture questionable.

Economic viability and scope for family-operated shrimp pens

Culture operations with P. indicus seeds collected from nature are continuing in 1986 to find out the regular annual yield per 0.25 ha pen. If the "summer" crop (mid-February – mid-May) leads to the same yield as the "winter" crop

(Continued on Page 13)

Harvesting of cultured shrimp at Killai with a cast-net.

E. Amalore.

BEACHCRAFT IN I Workshop Re

How have the beachcraft developed by BOBP do they face? How can these be solved? These an and BQBP specialists who took part in a worksh

Since 1979, when BOBP began work on beachcraft development, a dozen prototypes of various designs, sizes and materials (plywood, fibreglass, timber and aluminium) have been built, developed and tested. Technical and fishing trials over the years have led to two boats (known as IND-20 and IND-25)* of feasible design. Of the two, IND-20 has undergone extensive commercial fishing. Significant work has been carried out on engine and engine installations, sails and beach-hauling devices — most of it for the first time in India.

At present nine BOBP boats (six IND-20 and three IND-25) are fishing in six locations : one in Orissa (Gopalpur), three in Andhra Pradesh (Uppada, Manginapudi, Bandaravanipeta), one in Pondicherry, one in Tamil Nadu (Tranquebar). Systematic monitoring and collection of catch data began in 1984. All craft, except the one in Tranquebar, are now owned and controlled by the respective state governments.

The Government of India proposes to introduce BOBP craft on the east coast under a central government scheme. So far, some 40 BOBP boats have been built by four boatyards, with BOBP experts providing advice and guidance as necessary.

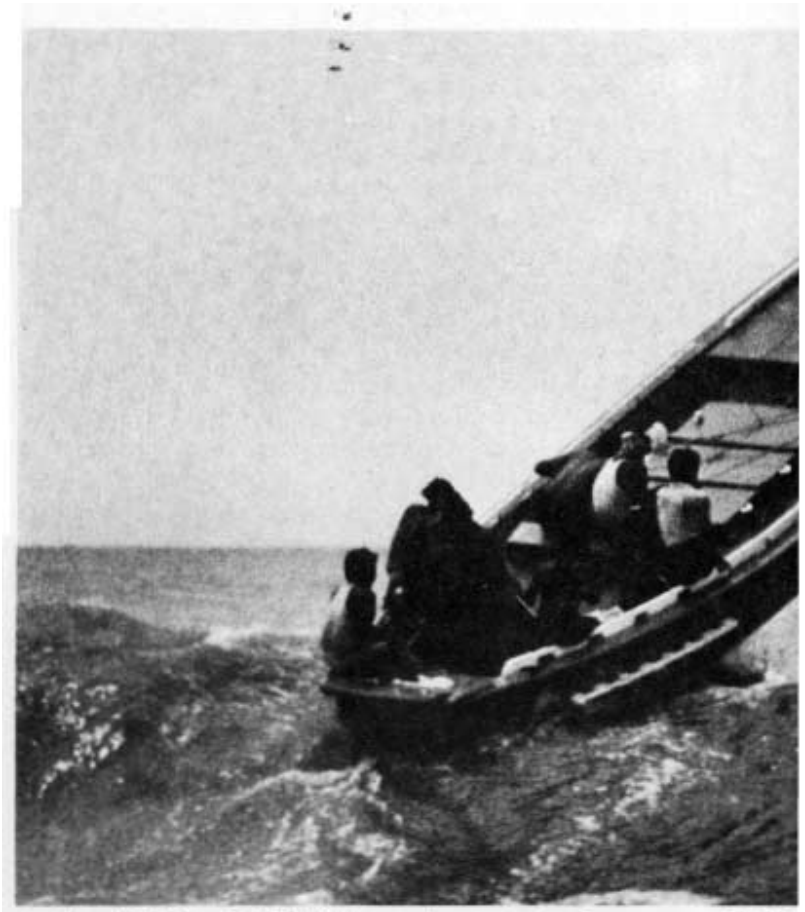
The recent performance of BOBP boats, problems encountered and future action, were discussed at a two-day workshop in Madras held November 25-26, 1985. Taking part were fisheries officials from the Government of India and the Governments of Andhra Pradesh, Tamil Nadu and Pondicherry, the DANIDA-supported Integrated Fisheries Project in Tranquebar, several BOBP staff and consultants.

Mr B C Gillgren, BOBP economist (associate professional officer), briefed workshop participants about the performance of BOBP craft (BLCs) in 1985. Some highlights

- The performance of BLCs has varied considerably from location to location. Monthly catch value varies from a high of Rs. 8,000 in Manginapudi (IND-20) to a low of Rs. 2,000 in Gopalpur (for IND-25).
- Four boats of the IND-20 design recorded earnings above the "breakeven point" (calculated at Rs. 4,700 per month) in 1985, as against two boats in 1984. The other four craft (two IND-20 and two IND-25) did not touch this figure. Some reasons : their crew did not venture out on long trips; the catch share system on the BLCs was found inadequate by the crew; inshore resources and marketing opportunities were not enough.
- Utilization of the BLCs in villages traditionally using kattumarams improved in 1985 as compared to 1984. More fishing trips of longer duration were recorded.
- The performance of kattumarams in relation to BLCs improved in 1985 as compared to 1984. BLCs earned 142% more per trip than kattumarams in 1984 but only 54% more in 1985.

Mr Gillgren concluded : "One and a half years of commercial test trials with beachlanding craft show that the BLCs can be economically viable, provided the craft are equipped with fishing gear of the right type and the right quantity, and the crew has learned to utilize the potential of the craft and are willing to go out on long fishing trips".

* The IND-20A is a 8.45 m motorized fibreglass boat. It has a 8 hp inboard diesel engine, in an air-cooled engine installation. A slightly different version, IND-20B, has a water-cooled installation.
IND-25 is a 6.70 m open motorized boat in fibreglass with a 8 hp inboard engine.



The BOBP craft IND 20 has undergone extensive commercial fish

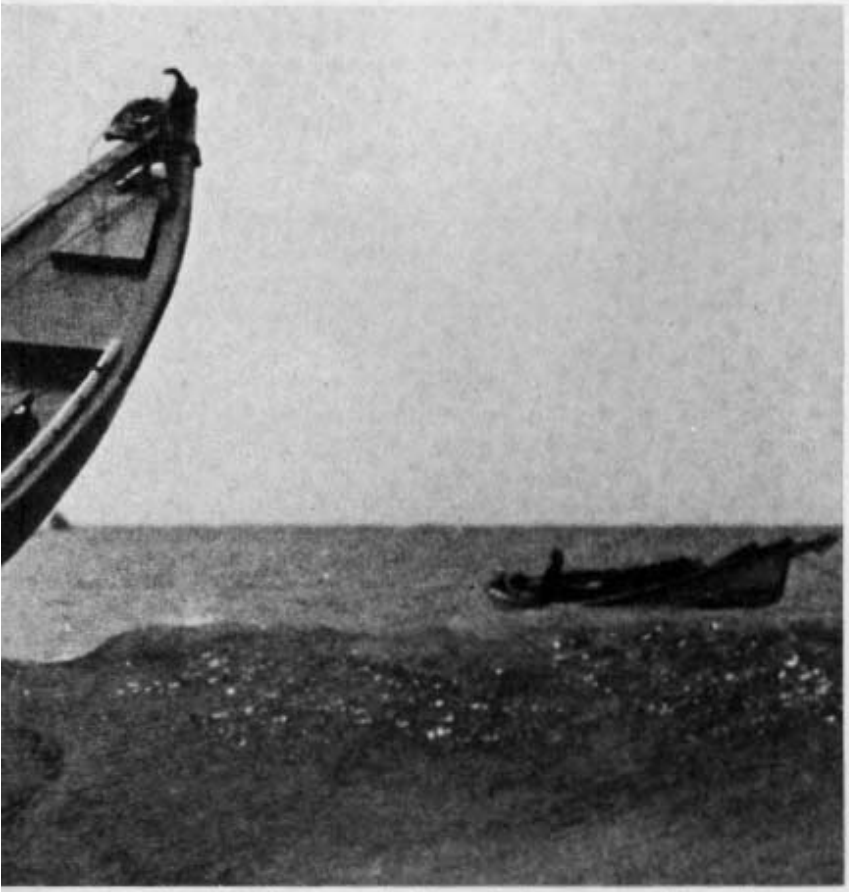
During discussion following Mr Gillgren's presentation, workshop participants suggested that BOBP prepare a cash-flow analysis in addition to the costs and earnings study. This would give them a better idea of the monthly loan repayments from fisherfolk for bank capital to be obtained to finance BLC introduction.

Participants also suggested that the BLCs should demonstrate offshore fishing from villages where the craft are based.

How effective are the BLCs for offshore fishing? Good catches have resulted in Orissa, but fishermen have not been enthusiastic about taking part in BLC trials as their catch share is too low. Further, they have still to get used to long trips and to night work. (Early this year, after the workshop, large

DEVELOPMENT NDIA : views Progress

India's east coast been performing? What problems d other questions were addressed by fisheries officials p held recently in Madras, reported on these pages.



E. Amalore

ng. It is considered viable for gradual introduction on a wider scale.

quantities of fish were caught off Gopalpur, in offshore areas not exploited hitherto by fishermen).

Workshop participants agreed that offshore fishing trials should continue from various locations for at least a year, with active support from fisheries departments by way of fishing craft and manpower. These trials would have to be carried out by masterfishermen with local crew. Appropriate share arrangements for crew would have to be worked out to encourage their participation in offshore fishing trials. CIFNET is to make available the services of a master-fisherman.

Mr R Ravikumar, BOBP consultant, said that boatbuilding had made good progress during the year. BLCs are being constructed in four boatyards : the APFC yard in Kakinada (which had orders for 31 BLCs from Andhra Pradesh and Orissa at the end of 1985); Mechem, Bhubaneswar (which had five orders from Orissa), Reinplast, Bhubaneswar (which also had five orders from Orissa), and Gear Transmission, Pondicherry (which had four orders from Pondicherry). Problems with boat construction : dearth of skilled labourers (a problem that is being overcome by the Kakinada yard), delays in engine box construction and installation, mainly because of inadequate supply of engines from the Bangalore manufacturer.

Briefing participants about progress in the construction of engine boxes, BOBP marine engineer P A Hemmingyth said that till mid-i985, only one private boatyard in Madras was active in this area. Technical skills and knowledge concerning this special engine installation were lacking elsewhere. A one-week training course on engine construction was therefore conducted in Kakinada for workers from the Andhra and Orissa boatyards. Training was imparted to participants on reading standarthechnical drawings. Engine box construction problems were 'also discussed. It was stressed that BOBP would continue follow-up work on engine box construction with periodic quality control.

Briefing participants about government schemes to introduce the BLCs in India, Mr D Sudarsan, Deputy Commissioner of Fisheries, Government of India, said that the 7th five-year plan (1985-90) had budgeted for 330 BLCs to be introduced to east coast states under a NCDC (National Cooperative Development Corporation) scheme. Further, the government has decided to modernize traditional fisheries in India. At a meeting with coastal states, it was agreed that 1,500 to 2,000 BLCs were required during the next five years. Banks could finance introduction of BLCs on this scale. Such a scheme could be taken up in earnest only after BLCs under the smaller NCDC scheme were delivered to fishermen.

Mr Sudarsan requested information about action taken by BOBP to diversify BLC fishing gear. In response, Mr G Pajot, BOBP fishing technologist, said that a start had been made with the use of trolling lines in Uppada and the use of demersal and shark longlines in Pondicherry. But in view of BOBP staff limitations, stronger local inputs (personnel, funds) were needed wherever this experiment was conducted, so that the right answers could be obtained about the scope for diversifying BLC gear.

In discussions following Mr Pajot's remarks, three basic points were made:

- One should be cautious about numbers while motorizing country craft to prevent kerosene shortages and over-exploitation of inshore fishing grounds.
- Wherever BLCs are made available to fishermen, appropriate large-mesh drifnets should also be provided. Else, fishermen might use inshore gear with the craft. These would fail to tap the BLCs' full potential, and loan repayments by fishermen might suffer.
- Wider introduction of BLCs should await positive results from the smaller NCDC scheme.

In a brief talk, consultant Oyvind Gulbrandsen critically examined what BOBP had done so far and what the immediate tasks for the future should be (see box).

COMPARATIVE GROSS AND NET EARNINGS OF CRAFT

Type of craft	Gross earnings per month in Rs.		Total costs per month in Rs.		Net earnings per month in Rs.		Net earnings per trip in Rs.		Net earnings per hour in Rs.	
	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985
BLC	4500	4559	275	659	4225	3900	305	287	20	18
Kattumaram etc.	2596	4126	111	100	2485	4026	126	186	18	25
Nava	1876	2425	151	125	1725	2300	139	146	12	10

Summing up the main conclusions of the workshop, BOBP Director Lars Engvall said that the BLCs' performance had improved in certain areas. Systematic monitoring of operations and catches must continue. BLC construction must be improved and speeded up. Supply of marinized engines by the manufacturer should be speeded up, as also the construction of engine boxes in boatyards. Trials with water-cooled engines must continue till definite conclusions can be drawn about their techno-economic feasibility.

"Review workshops like this are as essential for successful introduction of BOBP beachcraft as the continuous and systematic monitoring of craft", said Mr Engvall. There will be more such.

— S.R.M.

Beachcraft Development: Looking Ahead

Consultant Oyvind Gulbrandsen, a key figure in BOBP's work on beachcraft development, looks back critically on what has been done so far and what are the tasks ahead These include follow-up work on beachcraft new designs and materials for kattumarams, motorization of country craft such as navas dinghies and chhoats

The Bay of Bengal Programme has managed to develop a beachcraft fitted with an inboard diesel engine which has been proven in operation during several years Thousands of landings through surf has been made with very few capsizes This is a pioneer activity and a major achievement Questions have been raised regarding the economic viability of BLC in some locations When discussing economic viability of harbour based boats one often forgets what a large subsidy the construction and maintenance of a fishing harbour represents If the Government is willing to provide this subsidy to the harbour based fishermen why should not the beach based fishermen also benefit from Government assistance?

— In the initial phase of introduction of motorized craft, one must expect failures due to lack of experience among the fishermen in engine maintenance The State Governments must foresee these problems and provide adequate training courses mechanic back up and spare part supply until the market has grown big enough to interest the private sector.

— With the main development work in the area of new diesel powered beachcraft for operation from surf-beaten beaches completed emphasis of the BOBP project in the field of fishing craft should — apart from follow up on ongoing activities — be in the future in the following areas

(a) The problem of getting enough Albizzia logs for the kattumarams will become critical in the future. The BOBP project has already done some work on pressure treatment of kattumaram logs but more work needs to be done to find alternative materials and designs to the existing kattumarams BOBP experience so far shows that the diesel engine becomes too heavy and costly for the near shore small mesh fishery done by the kattumaram This is why priority was given to developing the IND-20 type for the large mesh driftnet fishery further offshore

At present the only engine option for the small mesh fishery closer inshore is the kerosene outboard engine Kerala has seen an explosion in the motorization of traditional canoes with 4 hp outboard engines, with several thousands now in operation Will the same happen on India's East Coast? What has to be remembered is that a motorized craft needs to double the catch in order to pay for the increase in cost of the engine and the fuel. Given the number of kattumarams and fishermen on the East Coast is the fishery resource big enough to sustain the increased effort by a motorized fishery? Will the fishermen be better off with non-motorized improved sailing fishing craft as an alternative to the kattumaram? These are questions that need to be considered in the future.

(b) Motorization of country craft operating from sheltered areas or beaches with little surf This includes navas in Andhra Pradesh dinghies in Orissa and 'chhoats in West Bengal. Development work needs to be done on how best to fit an engine in these craft without destroying their sailing qualities.

Pic : E. Amalore

SHRIMP PEN CULTURE IN KILLAI

(Continued from page 9)

(August – mid-October), the total annual yield would be 1162 kg of shrimp *(P. indicus)* per ha, and the annual profit would be Rs. 4,983 (see costs and earnings table). The project fishermen have indicated that such a profit will be sufficient for them to take up shrimp pen culture on a family basis. They suggested that their family members and relatives be engaged in culture activities such as seed collection and harvesting; they were not sure, however, whether to pay the relatives a share of the profit.

If the price of pelleted feed can be reduced, and if ongoing culture trials establish an annual *P. indicus* yield of at least 1100 kg, the project technology would be ready for extension. This requires thorough planning to make optimal use of the scarce natural resources (80 ha of suitable water area) and to spread the benefits of shrimp pen culture to as many people as possible.

From the economic standpoint, one hectare would be the minimum area required for a family-operated unit. Though there are about 600 families living in the area around the backwaters it is doubtful if more than 80 of them will want to switch to shrimp pen culture, as it entails a major change in lifestyle and workstyle but offers incomes only slightly higher than what's possible from backwater capture fisheries.

COSTS AND EARNINGS OF A 1 HA SHRIMP PEN UNIT

(based on seeds from nature/2 crops per year)

I	*Investment Costs*	
	1 Pens	Rs. 19029
	2 Happas	Rs. 5503
	3 Seed collection gear	Rs. 2444
	4 Pest removal and harvesting gear	Rs. 4560
	5 Feed purchase/production gear	Rs. 5086
	Sub Total: Investment Costs	Rs. 36622
II	*Operating Costs*	
	1 Seeds *(P. indicus)*	Rs. 3724
	2 Feed[1]	Rs. 7865
	3 Hire or pen pest removal and harvesting equipment	Rs. 660
	4 Labour for harvesting	Rs. 784
	5 Labour for feeding, pen check, day and night watch pest removal	Rs. 2520
	6 Labour for pre-stocking pest removal	Rs. 1736
	Sub Total: Operating Costs	Rs.17289
III	*Fixed Costs*	
	(3-year life span for all investment materials)	
	1 Depreciation	Rs.12207
	2 Interest on investment capital	Rs. 3052
	3 Interest on operating capital for one crop, to be repaid in one year	Rs. 1080
	Sub Total: Fixed Costs	Rs. 16339
IV	*Total Annual Costs (II + III)*	Rs.33626
V	*Total Annual Gross Earnings*[2]	Rs. 386 11
	581 kg. shrimp/crop x 2 x Rs. 33.18 = Rs. 38555	
	13kg. fish/crop x 2 x Rs. 2.13 = Rs. 56	
VI	*Annual Profit*	Rs. 4983

1 Could be reduced if shrimp heads are sufficiently available in future.

2 Based on earnings from pens 1-5 in one crop (Aug. – Oct. 1985).

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glimpses into BOBP projects

Cockle Workshop in Penang

Several scientists and officials from Indonesia, Malaysia and Thailand as also ICLARM and the BOBP attended a workshop on the biology of the "Blood Cockle" or Anadara granosa, held in Penang January 22-23. The workshop was sponsored by BOBP, which is currently engaged in several cockle studies in Malaysia. These studies aim at better knowledge of cockles and of cockle seed production, to help decide appropriate management measures. The workshop reviewed information obtained from these studies, which have been conducted for the past 18 months by the Fisheries Research Institute, Glugor, Penang. Subjects for the studies were formulated by ICLARM (International Center for Living Aquatic Resources Management, Manila) on behalf of BOBP.

Cockle culture started in Malaysia in 1948, expanded rapidly and touched an all-time high of 121,000 tonnes in 1980. But in recent years the cockle culture industry has hit lean times. In 1985 production fell to 32,000 tonnes. The price has tended to decline too. Regulations to protect the natural source of cockle seed have come under fire — though enforcement of these regulations has been only partial. It was against this background that the Department of Fisheries of Malaysia had asked BOBP to lay down guidelines for assessing the potential impact of any future regulations on the industry.

The participants represented varied backgrounds and interests. Indonesia has an important cockle fishery in north Sumatra, close to Malaysia's natural and culture beds. Thailand is a major market for cockle ! it is trying to protect and develop its own culture and capture fishery. Staff of the Fisheries Research Institute, where the BOBP-sponsored cockle studies are being carried out, were present in strength. The workshop was chaired by Mr Ong Kah Sin from the institute. Other institute staffers who presented papers were Mr Ng Fong Oon, Mr Kamal Zaman, Mr Edwin Savariraj and Ms Devaki Nair.

The first paper "Observations on the current status and potential of cockle culture in Malaysia" stimulated a lively discussion, particularly on the key questions of seed supplies needed by the industry and of natural spatfall areas.

From the next paper — a controversial one, on length frequency data analyses of cockle (analyses based on the growth patterns of cockle over time), participants learned that harvest for a given quantity of seed would be maximum if the cockles were harvested when one year old, However, when one year old, the cockle is too small to be legally harvested — Malaysian law has prescribed a minimum size of 31.8 mm on marketable cockle. (This size is intended to ensure adequate spawning by adult cockles, which in turn will lead to greater seed production).

"Shell-banding patterns" (growth lines) in cockle can be very revealing. They can tell you about the age of a shell, how fast it grows, whether it has been exposed to low salinity. The technique was presented only briefly, in the absence of the expert concerned.

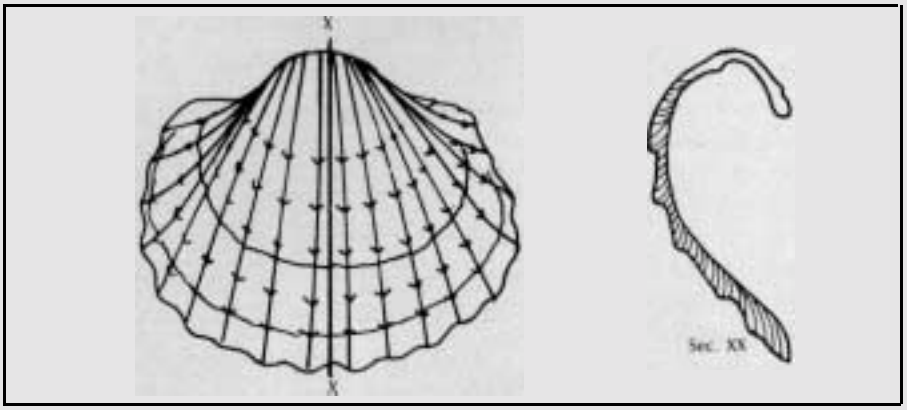
A later paper examined when, how often and from what size cockles spawn in culture beds. Successful commercial-scale hatcheries are unknown for low-priced species like cockle. But Dr. Wong of the Universiti Sains Malaysia presented with great enthusiasm, almost passion, his findings on the success of artificially induced spawning of cockles and of the mass rearing of larvae in laboratories, illustrating his talk with a video film.

The workshop studied the relationship between prices and production of cockle, on the basis of data from preliminary surveys.

The two status papers from Indonesia and Thailand raised questions about the distribution of several Anadara Sp, relations between different stocks, about cockle trade in the region and about results of reseeding programmes in Thailand. A slide show accompanied both the presentations. The Thais also presented a detailed video production.

The workshop did not come up with a list of recommendations. But there were some significant gains. We now have a good knowledge of the life cycle of the cockle — froni egg to larval settlement to adult. The harvest from one plot is the highest after one year of culture, but the cockles cannot be legally harvested at this time since they are likely to be below the statutory 31.8 mm. Phenomena concerning spatfalls — where they originate, why and where they occur, and how much, were discussed. The Department of Fisheries in Malaysia would like to pursue research on these topics, but conclusive results from such research are difficult to obtain. Some participants felt the most practical approach might be to amend regulations on the basis of current knowledge and monitor the effects. Example : Reduce minimum harvest size of cockle, observe the effect of this on the seed supply, and take appropriate action as indicated.

Growth lines in cockle shells (banding patterns) seen on a shell section (below right). Left : Diagram showing where the line is cut.



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Bay of Bengal Committee holds fourth session in Male

The Bay of Bengal Committee (Indian Ocean Fishery Commission's Committee for the Development and Management of Fisheries in the Bay of Bengal) held its fourth session in Male, capital of the Republic of Maldives, 17-22 February, 1986. All the seven member-countries of the committee — Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand — attended, besides delegates from FAO and UNDP and observers from Denmark, Norway, Sweden, U.K. and SEAFDEC (South East Asian Fisheries Development Center).

The 10th Advisory Committee meeting of BOBP's SIDA-funded small-scale fisheries project was held in conjunction with the BOBC meeting. The meeting heard with approval a report of the project's performance in 1985. During 1986 the project will focus mainly on winding up, evaluation and reporting of present activities, plus preparation of activities for the proposed successor project "Small-scale fisher-folk communities in the Bay of Bengal" due to begin in 1987. Denmark, Norway and Sweden expressed interest in funding the successor project, following positive recommendations made by the joint Scandinavian appraisal mission which studied the project during September-October 1985. The U.K. announced that funding for a project on post-harvest fish technology to function under the umbrella of the BOBP, had been approved and that the project would materialize soon.

All participating countries also expressed appreciation of activities undertaken by the project "Marine fishery resources management in the Bay of Bengal." They stressed their governments' commitment to the project and urged UNDP to continue funding it beyond 1986.

Members were full of praise for the host country, Maldives, for the excellent arrangements made for the session.

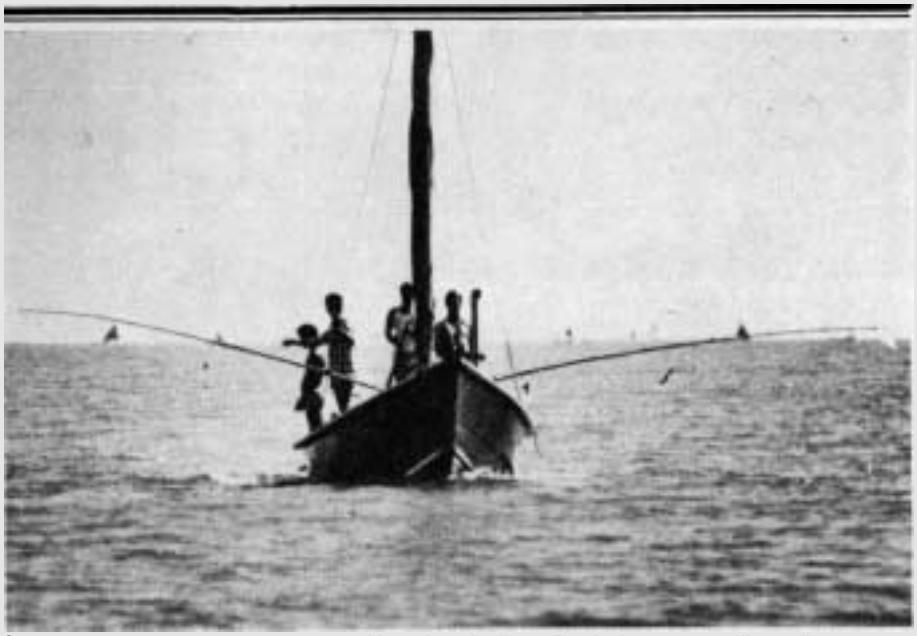
BOBP tests new fuel-efficient harbour- based boat in Sri Lanka

The BOBP has developed for Sri Lanka a harbour-based motor sailer in fibreglass meant to be an energy-efficient alternative to the island's popular 28-footers (also referred to as 3% tonners). Labelled SRL-15, the boat is fitted with a 20 hp water-cooled diesel engine (as compared to the 28-footer's 30 hp engine), and a high reduction gear box (3.65 : 1). The boat is primarily intended for large-mesh driftnetting and line fishing. Its size and carrying capacity are similar to that of the 28-footer.

Comparative technical trials of SRL-15 and the Neil Marine 28-footer were carried out in December 1985 by consultant Oyvind Gulbrandsen. The trials showed that SRL-15 is 40% more fuel-efficient than the 28-footer at a speed of 6.5 knots.

Other advantages of SRL-15 over the standard 28-footer are a long waterline with sharp entry (15°) for good speed and sailing performance; a protected sleeping area; a 1.2 cum. insulated fish hold; a wheel-house; a cooking area in the wheel-house; and a keel with ballast fixed on to it.

Fuel conservation is one of the vital needs of today in Sri Lankan fisheries. The BOBP recommends that as a fuel conservation measure, the government should provide subsidies only for engines up to 20 hp for this class of boats. Users of more powerful engines should pay the full cost themselves as they are over-using fuel. The SRL-14, which has been fishing for one and a half years off the west coast of Sri Lanka, demonstrates that an engine need not be high-powered to over-come rough monsoon conditions. (The SRL-14 has the same engine as the SRL-15 but derated from 20 hp to 15 hp.)



Crew *of the BOBP's IND-20 at* Uppada, Andhra Pradesh, use trolling lines *while going out to the fishing ground for large-mesh driftnet fishing.*

How to make money during running time : Use trolling lines

At Uppada, Andhra Pradesh, BOBP's IND-20 craft have since August '85 been engaged in trials with large-mesh driftnets.

Says Mr L Nyberg, BOBP fishing technologist (associate professional officer) : "The IND-20 crew normally spend eight to 14 hours in running time, to and from the fishing grounds. Trolling during this time can provide both pleasure and profit... I gave the fishermen a rod and a reel with artificial bait to facilitate trolling. During the very first trolling effort, a 10 kg seer-fish valued at Rs. 100 was caught. Since the fishermen were enthusiastic, I gave them two sets of bamboo outriggers plus six trolling lines angled with artificial bait. This kept the fishermen pleasantly occupied during their to-and-fro trips.

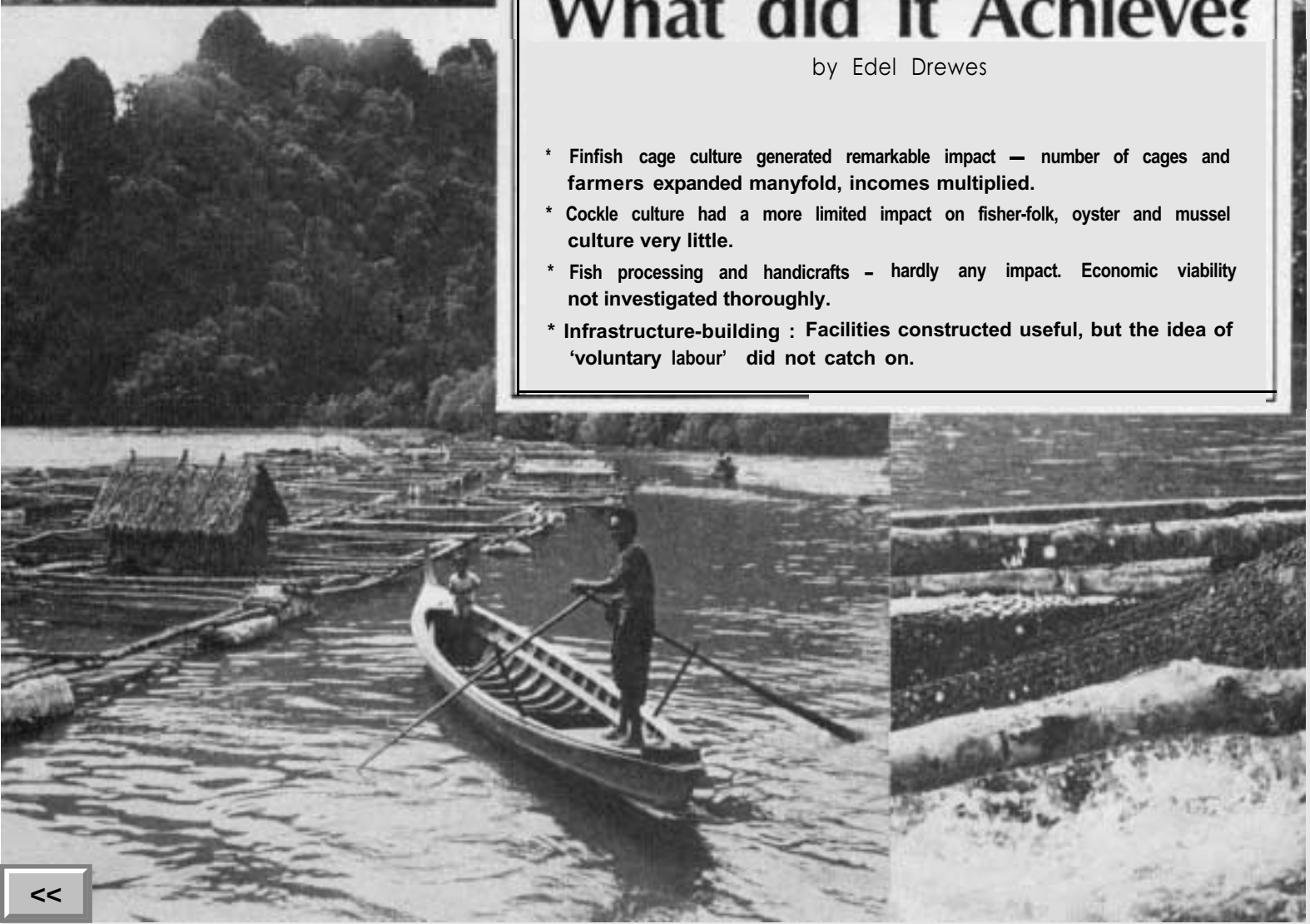
"During the 10-week period between November 19, 1985 and January 26, 1986, the boat made 36 fishing trips. Trolling operations during this period yielded a catch of 458 kg of good-species fish, ranging in weight from 6 to 12 kg each. Income from sale of the catch was Rs. 107/trip on average — which is twice the fuel cost of the craft during the period for all types of fishing trials."

AQUACULTURE DEMONSTRATION PROJECT IN SOUTH THAILAND

What did it Achieve?

by Edel Drewes

* Finfish cage culture generated remarkable impact — number of cages and farmers expanded manyfold, incomes multiplied.
* Cockle culture had a more limited impact on fisher-folk, oyster and mussel culture very little.
* Fish processing and handicrafts – hardly any impact. Economic viability not investigated thoroughly.
* Infrastructure-building : Facilities constructed useful, but the idea of 'voluntary labour' did not catch on.



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Eric Tayler Johnson

In 1978, the Thailand Department of Fisheries together with BOBP and the FAO/UNDP/South China Sea Fisheries Development and Coordination Programme initiated a pilot project to test and demonstrate technologies for brackishwater aquaculture in order to increase fish production and improve the incomes of small-scale fisherfolk.

Phang Nga bay in south Thailand was identified as an area technically suitable for finfish cage culture and shellfish culture. People in the area were found to have incomes far below the national average, and their incomes – depending almost entirely on bay fisheries – seemed to be falling, because demersal resources were dwindling as a result of heavy trawling in the Andaman Sea. As employment opportunities in agriculture, tin mining and tourism were limited, and most people lived in small settlements on widely dispersed islands thick with mangrove vegetation, aquaculture was regarded as ideal for employment creation, provided it was technically feasible and economically viable.

Project planners were aware of the need for better'job opportunities and incomes, not only for fishermen but also for fisherwomen. Besides fish and shellfish culture, the project therefore had components on demonstration of fish processing (shrimp paste, fish sauce and crackers) and handicraft production as well.

The incomes of fisher-folk in Phang Nga bay were below the national average; so also their infrastructure facilities (jetties, village walkways, water supply) and their awareness of health care (hygiene and nutrition) and family planning. The project therefore included components relating to improved infrastructure, health and family care.

Project preparation and implementation

On the basis of the findings of preliminary aquaculture site surveys and a socio-economic survey, the pilot project was implemented in six selected villages during the initial phase from March 1979 to September 1981. Fisheries officers established contacts with fisherfolk who were to take part in testing and demonstrating finfish (seabass) cage culture; mussel, oyster and cockle culture; shrimp paste, fish sauce and fish cracker production; and handicrafts production. Finfish cage culture was the main project component.

Cage construction materials and seeds were purchased by the fisheries officers with funds provided by BOBP. In each of the six pilot villages, leaders were asked to form two to three production groups each of which was to operate a raft with six cages (each measuring 3m x 3m x 2m). One cockle farm of 0.3 ha was started by a group of 10 fishermen from one village. Similarly, a small oyster and mussel farm was started to test the growth of the shellfish. The number of group members was decided by the tisherfolk and their leaders, The purpose of group formation was twofold : to involve as many people as possible in the tests and demonstrations so as to avoid social conflicts; and to try out cooperative modes of production. Fisheries officers provided technical advice in cage construction, nursing of fries and cage maintenance through regular field visits to the villages.

Results

The trials indicated that cooperative production in the case of cage culture was not successful, possibly because members were not used to this mode of production and did not succeed in sharing workload and responsibilities in the right way. Care devoted to the cages was insufficient. Result : low production.

For cockle *culture,* which is much less labour intensive than cage culture and has to be carried out in the open bay away from the villages, fishermen had during the test and demonstration period found a fairly smooth-running cooperative system. Apart from nightwatch and harvesting no inputs were required. Seed was provided free of cost by the project.

While the cockle farm continued to be operated by a group of fishermen, fish cage culture demonstration was from late 1981 onwards carried out individually by farmers. Cage materials and seeds were also provided free of cost during the second project phase besides technical advice and training. Production increased with better management and improved skills. Farmers, however, still had certain problems with the growth and survival of hatchery-bred seabass fry. These were delivered by the government -

run hatchery at 1 g body weight to farmers who carried out the nursing in cages. Hydrological conditions were found to be unfavourable (salinity, water temperature) during the monsoon months, and nursing in cages should therefore have been avoided at that time of the year to improve the survival rate. Also, storage techniques during transportation of fry from the hatchery to the village nurseries, cleaning of cage nurseries and feeding practices needed improvements in order to cut production costs and increase the yield. This was taken care of by the fisheries officers through intensive technical guidance and training of cage farmers in seabass nursing.

In spite of difficulties with adequate supply and survival of hatchery-bred seabass, cage culture technology, which was unknown in the Phang Nga Bay and the entire east coast of Thailand (Andaman Sea/Bay of Bengal), had proved to be economically viable.

During the third and fourth project phases, fish cage and shellfish demonstration farms were expanded to three more provinces (Krabi, Trang and Satul), south of Phang Nga. This led to a high demand for seabass fry, which could not always be met by the hatcheries. The farmers found a solution by collecting fry and small fish – seabass as well as groupers – from nature. Groupers were however preferred as they commanded a better market price.

Oyster and mussel culture trials showed poor results and low profits when compared with the output of farms in the Gulf of Thailand, from where the spats had to be transported.

During the first project phase, fish *processing* techniques were demonstrated to groups of fisherwomen in short-term training courses by a fish utilization officer from Bangkok. The techniques were learned easily. Similarly, handicraft production required only a little more of instruction and self-training. When compared with aquaculture project components, fish processing and handicraft demonstration and training showed poor results. The main reason seems to be marketing constraints. Women trained in improved shrimp paste processing techniques did not apply these techniques as they added to production costs; no local shrimp paste merchant was prepared to pay for the value added, since higher quality did not mean higher prices in rural areas. Demand for the product is mainly in Bangkok; this, however, is sufficiently met by production centres closer to it in the Gulf of Thailand. This fact, however, was not adequately realized during project planning. While in aquaculture thorough technical studies were conducted, fish processing was started without prior investigation into its techno-economic scope.

Handicrafts training and demonstration (macrame products, paper umbrellas and articles made from fish scales) carried out during the first project phase also showed no positive results, because of limited market demand for macrame products, which were almost out of fashion in 1980.

Articles made from fish scales and small paper umbrellas, meant as souvenirs for local people, did not find a market either. As with fish processing, a prior investigation into the scope of handicrafts could have prevented the negative outcome of this project component specifically incorporated for women,

The project component on *education for women* in health care/hygiene, nutrition and family planning was included only in the fourth phase of the project. The educational programmes were implemented by the department of public health. The role of the project staff was restricted to assistance in initiating the programmes and motivating the fisherwomen to participate. The impact of such education programmes may have been more promising if they had covered men too; they were confined to women.

The infrastructure project component aimed mainly at providing a model for community development. However, it did not try to demonstrate new infrastructure techniques, except for the windmill-driven water pump. The fishing community in pilot villages was to be motivated to contribute labour to construct community facilities (jetty, walkway, community building) with project material.

The community development approach, already tried out in other countries of the Bay of Bengal area, had limited success. It was easier to get fisherfolk to contribute money to villages or community infrastructure development than labour. For example, in 1984185 villagers in Sam Chong Nua/Phang Nga province collected a large sum of money to construct a link road. Individuals who contributed Baht 2,000 to 15,000 (US $ 76 - 570) would not, however, contribute their own labour, and the road construction had to be carried out by a professional construction firm. A similar thing happened in the construction of a mosque at Pan Yi in Phang Nga province.

Besides the community/infrastructure facilities constructed with funds contributed by the village, various other public-funded infrastructure facilities have been built since the start of the project in 1979. These however cannot be seen as a direct result of the project, though the project staff and fisheries field officers assisted the technical department officers in the provinces and districts, to identify the specific infrastructure needs of the fisherfolk – mainly drinking water supply and new school buildings.

The community development approach which the project tried to demonstrate – the project providing funds for material procurement and the fisherfolk providing the labour – was not adopted outside the project villages for two reasons : the government did not have enough field extension personnel to organize and motivate fisherfolk to contribute their own labour, and the village leaders themselves found it more appropriate to ask for voluntary cash contributions rather than labour.

impact – Cage culture

Considering the fact that the cage culture demonstration project started with only 28 fish cages (252 m2) and only 28 fishermen, the expansion of the technology to over 3,000 cages (27,000 m2) and more than 1,000 farmers within six years (1979-85) attests to a remarkable impact, and the success was due to the following factors : small-scale fishermen in the project area were responsive to the new working patterns (except for the nightwatch) and to an increased working effort; the market demand for the product increased steadily; as the demand could not be sufficiently met in spite of higher production, the prices increased steadily; investment and operating capital were made available by banks; and technical advice and extension services were provided by the project and the Department of Fisheries.

It was however noted that the 3000 fish cages are not equally distributed among

Finfish cage culture, the project's main component, recorded rapid and spectacular impact.

the 1000 owners. The cage farms can be classified as follows :

- family farms without hired labour (2-4 cages)
- owner-managed farms with hired labour (5-30 cages)
- absentee owner farms with hired manager and labour (about 31-100 cages).

Most of the cage farms fall under the first two categories.

The availability of feed determines to a large extent the profitability of cage culture and the investment and cage farm ownership patterns. The amount of feed available is adequate in many locations which are suitable for fish cage culture from the hydrological standpoint; the cage farms in these locations are small in size and owned by the operators themselves. They took up cage culture as a family enterprise, collecting fry and most of the feed, instead of buying it. Consequently, the feed constraint, though it lowered the profit, appeared to help control cage farm sizes; small-scale fishing families benefited more than those employed as workers on large farms.

Cage farms with more than 10 cages are generally owned by non-fishermen. Many of them are even non-residents, with incomes from agricultural land (rubber), tin mines, charcoal factories, fish trade and schoolteaching. Cage farmers with more than 30 cages do not even manage the cages themselves; they engage managers to organize purchase of seed and feed, marketing, and supervision of labour (for feed preparation, feeding, cage maintenance and security). Compared with family farms, the benefits for small-scale fisherfolk are low.

Though most family farms are short of feed, and therefore understock and underfeed fish, they can improve their incomes substantially through cage culture. The average annual yield per cage (one crop) of small farmers (4 cages), depending on self-caught feed was 96 kg : 160 groupers of 600 g body weight. Groupers of this size command a market price of only Baht 85 per kg whereas 800 g groupers fetch upto 120 Baht per kg. In spite of the rather low yield, these small farmers make a net profit of Baht 5,776 per four cages plus 24,000 Baht earned on fry and feed collection. This makes an annual family income of 29,000 Baht which is about double the family income earned from capture fisheries in 1983 (Baht 146,000 per household with three working members).

Since fish culture does not, however, provide daily incomes but at the best only quarterly incomes if selected harvesting is done, it is difficult for small-scale fishing families to take up cage culture as an exclusive occupation. They have to continue with capture fisheries and fish processing to meet the basic daily needs of their families. This means that a family has to sell a part of its captured fish and that the entire catch cannot be used for fish feed. Small-scale fishing families with daily earnings and generally without savings and without support from close relatives have therefore taken up fish cage culture only as an additional 'occupation (two to four cages).

Whether operated as family farms or large-scale farms, fish cage culture depends to a great extent on female labour. Initially the technical training and demonstration was directed towards men, but women picked up the required techniques on their own by observation. Men provide most of the labour for seed collection and feed collection but women also contribute. Further, the tasks of feed preparation and feeding are carried out mainly by women. Checking and cleaning of the cages is generally done by men. Changing of fish into the larger mesh cages and harvesting are done by both men and women. Safeguarding of the cage farm at night is done exclusively by men.

Although women have not been excluded from access to the new technology, they should have been included in the technical training on cage management and nursery rearing of fry provided by the fisheries extension officers in all demonstration villages. This might possibly have improved cage maintenance and management; the mortality of fish could perhaps have been reduced and the profit increased.

Impact - Cockle culture

Cockle culture in the project area is economically viable only if spats are procured in large quantities from distant places and if the product is sold in large quantities. There is no scope for small-scale farms. Therefore large single-owner farms or fairly large group-owned farms were set up.

The latter mode of ownership (group ownership) is however an exception, and large single-owned farms predominate. The owners are non-fishermen and most of them even non-residents of fishing villages. Many of them are business people from the southern border towns having links with cockle seed/spat suppliers from outside the country. Procuring cockle seeds for farms in the project area requires tremendous effort and entails high risk.

There is only one group-owned cockle farm (Pan Yee). The government and banks provided financial assistance and helped fishermen to form a production cooperative in which all the 16 members had shares. The minimum holding is one share. The 16 members have appointed one of themselves as manager to look after seed procurement, marketing, supervision of harvesting and safeguarding. The cockle farm profit is shared among the members according to the shares bought. The manager who receives a monthly salary has a second occupation as manager of a large farm whose owner has close links with seed sellers abroad. Without this connection the cooperative-owned farm could not have been set up.

As farms must be licensed under authority of the Department of Fisheries and the area alloted to individuals is restricted, large-scale cockle farmers (mussel and oyster farming being still too limited to have caused similar problems) have to find "partners" in whose names their cockle farm area is licensed. As small-scale fishermen with low incomes are rather open to such a "partnership" and do not have the power to demand high shares, cockle farm investors generally choose small-scale fishermen as their "partners" and pay them about 5% of the net earnings. In addition the "partners" are given priority when workers are recruited for harvesting and safeguarding.

Training of fish farmers at a community hall funded *by* BOBP.

Cockle culture has therefore benefited the target group of small-scale fisherfolk much less than cage culture. Moreover it offers few job opportunities, particularly for women. For farm management as also for safeguarding, only men have been employed. Women are occasionally hired for harvesting work.

Of further importance is that small-scale fisherfolk with low incomes earned on a daily basis cannot afford to become full-time or exclusive cockle farmers, as the culture period is extremely long and income does not flow in at short intervals. Small-scale fisher-folk would therefore be able to take up shellfish culture only as paid farm managers, as watchmen or as daily wage labourers during harvests or sometimes as false partners.

To conclude, not all components of the aquaculture demonstration project have reached the target group of small-scale fishermen/women to the same extent. The above discussions show that of all project components, the one relating to aquaculture – and in particular, cage culture – has produced the best impact. The factors behind this have been discussed. One more factor is perhaps the thorough preparation and detailed planning of it compared with all other components. This is reflected in the operational targets, which mainly refer to aquaculture. Since much less preparation went into the fish processing, handicrafts and infrastructure project components, operational targets were hardly outlined. The components on handicrafts and education for women were not even mentioned under operational targets, indicating that these components were added without adequate appraisal. A thorough project identification study – as with finfish cage culture – could have led to more specific operational targets and more positive results. This refers mainly to the handicrafts components, but is also true of fish processing.

Since finfish cage culture has proved to be a viable supplementary or even alternative source of income for small-scale fisherfolk, with potential for both men and women, this component should be seen as crucial in future development efforts for the benefit of small-scale fisherfolk.

it needs to be realized, however, that a massive technical-financial extension effort will be meaningful only if sufficient seeds and pelleted feed can be supplied to farmers. As both requirements cannot be sufficiently met at present, the development effort should concentrate on improvement of hatchery seed and pelleted fish production.

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