BAY OF BENGAL NEWS

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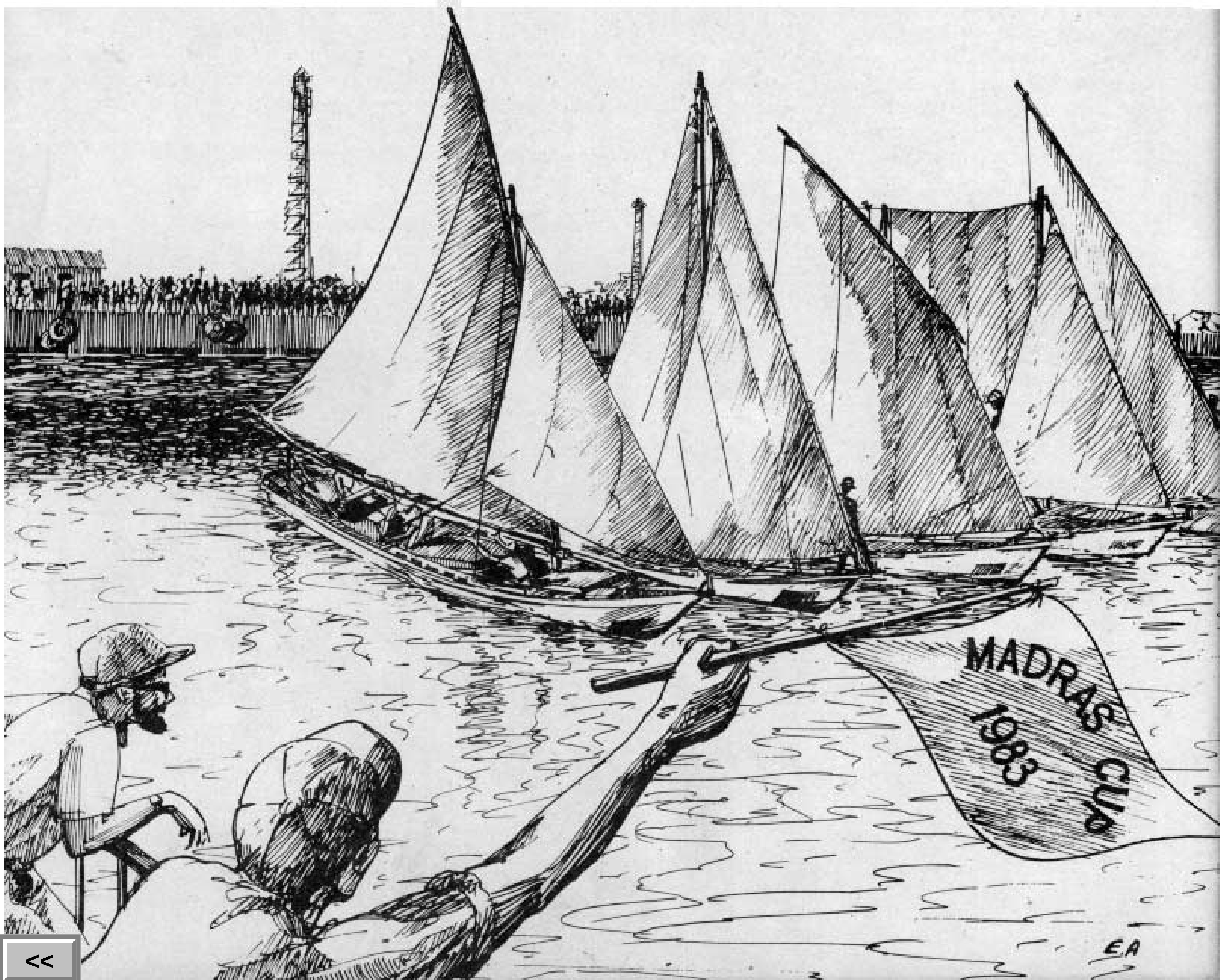
FISHERIES DEVELOPMENT

Sal/power in small-scale fisheries

Six fishing boat sail rigs, urged on by a galaxy of sail experts, battled one another for supremacy at a unique contest in Madras held in October. History will remember it as the Madras Cup, 1983. Pages that follàw describe the event.



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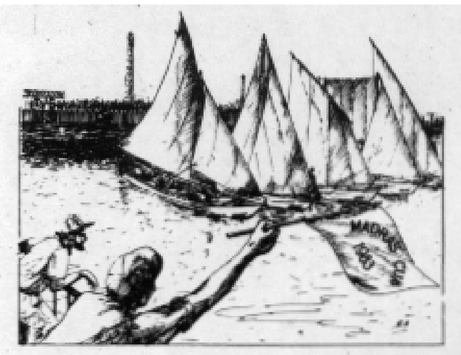

The Consultation and the Contest: A Reporter's DIary

Twenty: two sail specialists and observers from lands far and near gathered in Madras early October for a week-long consultation on sailpower in small fishing vessels. Highlight of the fast-paced meet was a four-day sail contest. It was organized by the FAO, with BOBP providing host facilities at its office in Abhiramapuram and its boatyard in Royapuram.

The. conference sought answers to basic questions that experts have been debating. Which are the most efficient sailrigs for small-scale fishing boats? What are their plus and minus points? Said one participant: "The main thrust of the trials was on identifying the right rig to supplement engine power with sail power for fuel saving, but we also tried.to improve the sail performance and sail handling of traditional craft. Consultant S. T. Akester of the U.K. pointed out : "Even in America and north Europe, fishermen are trying to reduce fuel bills by using sails, and the subject has inspired research by many institutions." In developing countries, the FAQ and the BOBP are at the forefront of sail research.

Participants in the week-long consultation were John Fyson, fishery industry officer of the FAQ, Rome; consultants Oyvind Gulbrandsen (Norway), John McKiIlop (U.K.), S.T. Akester (U.K.) and A. Boswell (U.K.); fishing craft engineer Arild Overa and naval architect R. Ravikumar (BOBP). The observers included A A Aziz, fisheries officer from Malaysia; T.K. Das, fishing technologist, Bangladesh; A.F. D de Moura, adviser on small-scale fisheries to the Brazilian National Agency (who was in Madras in the course of a tour of BOBP projects); Komes Chaorenpanich, Department of Fisheries, Thailand; Jeremy Turner and C. Palmer of the U.K.; from India, Father P. Gilet of the Center for Appropriate Technology in Muttom, Tamil Nadu; V G Joseph, fishery officer, Kerala; S B Sarma, Inspector of fisheries, and C. Bhanoji Rao, Nava skipper, Andhra Pradesh; G S P Mishra, fisheries extension officer, Orissa; E. Srinivasan, fisheries inspector, Tamil Nadu; and from the BOBP, marine engineer P A He naval architect S O Joljansen and fishing technologist 5E Akerman.

The consultation started Off October 6 with a review of past BOBP and FAQ experience with sail power, descriptions of the craft to be used, the rigs made, the test instruments to be deployed, the methodology of evaluation. Participants later visited the BOBP boatyard at Royapuram where rigs for the sail contest were fabricated with the help

(Continued on page 4)

Sail contest from Royapuram : preparations on for the next bout — between the Gunter and Bermuda rigs.

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A Letter from the Publisher

TRAINING

Bay of *Bengal News* has frequently carried reports about our training activities. In fact, almost every one of our activities has a training component; some activities, such as those for fisherwomen extension workers in Tamil Nadu and extension officers in Orissa, are entirely training-oriented; others, like the sail consultation (opposite page) also have a training component, particularly for the observers.

During 1982, the total training time added up to 750 man-weeks or about 14 man-years. The major portion (520 man-weeks) was spent on national training courses at the field level in connection with extension activities. There were also study tours, consultations, workshops and fellowships.

How useful is this training? One of our senior counterparts in the region once remarked that although he had participated in all kinds of international courseson feasibility studies and project preparation he had never had the chance of putting what he had learned to use in the course of his work in the fisheries department.

,One of our early training activities was the conduct of two courses in fish marketing. These courses were later very thoroughly evaluated; all the trainees were visited and interviewed 6-12 months after the courses. The evaluation did pinpoint some deficiencies in the curriculum, teaching method etc., but by and large there was nothing “wrong” with the course as such. More importantly, it was found that most of the trainees were either not directly concerned with fish marketing before or after the course, or were unable to utilize what they learned in the course, because of existing procedures and practices in the organ isations they worked in. This is just one example. Our experience has been that ad hoc isolated training courses have a very low benefit/ cost ratio.

As against this, our experience of in-service training schemes over a longer period of say, one to three years, has been very positive. A series of short courses, practical homework, and workshops (reviews of the homework) ensure that the trainees assimilate the content of the training and that they go onto make use of it in their daily work. The costs may be somewhat higher but the benefit more than compensates the cost.

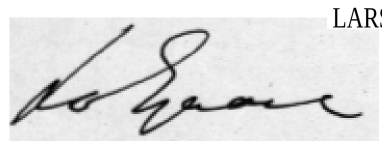
One factor that often erodes the value of training in some countries is the frequent transfer of staff between jobs which, in technical terms (subject of training), have nothing in common. Before a costly training scheme is launched, therefore, it is reasonable to ask for assurances from the receiving side about the utilization of the training. In our in-service training scheme for fisheries extension officers in the Indian state of Orissa, the state government has, on its own initiative, undertaken not to transfer the concerned officers for a period of five years. would like to see more of such commitments.

A word about regional consultations, seminars and workshops. We have organized a few of these and found them to be excellent forums for an exchange of information and experiences – provided you get the right mix of generous givers and keen and open-minded receivers; the selection of participants is crucial.

BOBP has also sponsored a large number of study tours. In general we feel that their training value is very low. To be worthwhile, they must be geared to the actual work of the trainee, who should be given specific tasks to perform and not just look around. The organisations or persons visited need to make special arrangements to facilitate the trainee’s work. All this requires some effort – which is rarely made; and is, in some cases, limited only to flight bookings!

Training is probably themost important aspect of our development work. Technology transfer is, after all, only a stop-gap solution. We need therefore to devote more time and money to training and in the first instance devise ways and means of making the training effective.

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 (FAQ) 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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Consultant S T Akester engaged in a discussion with other conference participants on the finer points of the sail rigs.

The Consultation and the Contest: A Reporter's Diary

(Continued from page 2)

of consultant John McKillop (see box on page 11). Thereafter participants viewed a 16 mm BOBP film on beachcraft sails and a 16 mm FAO film on the fitting of simple rigs to traditional canoes in Guinea Bissau.

Next day the action began. Participants drove to the Royapuram fisheries harbour for the contest between six sail rigs — Gunter, Sprit, Dipping Lug, Bermuda, Chinese Junk, Lateen. No banners proclaimed the contest; while the exotic rigs drew curious glances, they were few enough to be inconspicuous — they merged effectively into the vast Royapuram seascape.

A word about the six contest candidates. The Bermuda is a modern rig that was first used in the West Indies and is now the predominant rig in modern sailing yachts. The Lateen rig is popular with traditional craft in many parts of the world including India. The Gunter, the Dipping Lug and the Sprit Rig were very common on European fishing boats., The Chinese Junk is a traditional rig of the Far East.

The BOBP's IND-20, a 28-ft fibreglass boat designed for Andhra Pradesh, was selected as the evaluation boat for the rigs. Since there were two boats for the six competing rigs, three groups were formed for "first trials". Bermuda was raced against Gunter, Lateen against Dipping Lug, Sprit against Chinese Junk. The .winners were Gunter, Dipping Lug and Sprit.

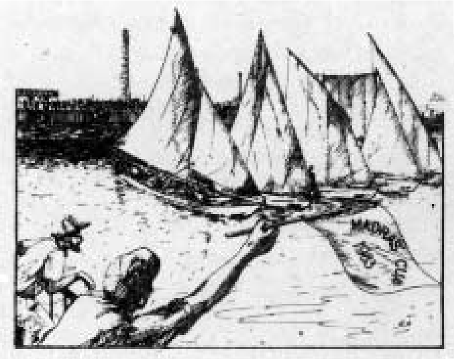
In the "semi-finals," Sprit defeated Dipping Lug and Gunter won against a modified Lateen. Followed the finals — a grand affair even without trumpets blaring and cheer-leaders rooting for their favourites. Gunter was pitted against Sprit. Gunter performed better but Sprit proved to be a worthy finalist.

How about the sails of traditional craft? The Nava was fitted by turns with the traditional Lateen rig, the Gunter and the Sprit. Fishermen were impressed by the handling and manoeuvring ease of the latter two rigs. To quote Arild Qvera : "While the Gunter and the Sprit tack against the wind, the Lateen-rigged Nava has to jibe downwind."

Asked to comment on the sail trials, consultant Qyvind Gulbrandsen said: "The findings of these trials have applications in many parts of the world." He added : "This is the first time so many different sailing rigs have been tried on two identical hulls to permit comparison of sailing performance and handling characteristics." In response to another question he said : "Traditional craft like the Nava can be fitted, at little additional expense, with sail rigs that are easier to handle and perform better. Experience shows that fishermen will readily accept a new sailing rig, if they are convinced it is better. Only proper training and long-term trials with new rigs fitted to the Nava will give the full answer."

What about the ubiquitious kattumaram? Opinion seemed unanimous that "It is very difficult to effect any low-cost improvement on the kattumaram sail, which is very efficient for its purposes."

The consultation ended with an animated discussion on the pros and cons bf various rigs. An official report will be shortly published by the FAO. But a blow-by-blow technical account of the sail contest is provided in the article that follows. **—S.R.M.**



Madras Cup 1983!

BOBP fishing craft engineer Arild Overa describes and evaluates the six sail rigs that took part in the Madras Contest.

The sailing world will speak about this year’s very exciting Americas Cup for a long time. Yet, it was just another race where boats and projects that cost unlimited millions achieve fractional improvements in performance.

In Madras, about the same time, preparations were on for a “first ever" event – elimination races for all types of rigs, traditional and modern – using one of the BOBP beach-landing fishing boat designs.

Some of us who see white sails pushing sleek boats at creaming speeds through blue waters wonder why engines were ever put into boats. The FAQ has received many suggestions from yachtsmen and sailing enthusiasts about the tremendous advantages of fitting sails to fishing boats in developing countries. This, together with the’S fact that most FAQ boatmen have considerable experience with sails while opinions vary on which rig is the best choice, led to the decision thatto really find out the facts, the various rigs had to sail against each other at the same time, fitted to the same type of boats.

Photographs of sail conference and contest by E. Amalore

By making the sails at the recently established sail loft in the BQBP’s Boat Development Centre, Royapuram, and by manufacturing the rigs there, we were able to accurately check on the costs and on what was involved in making and setting up the rigs. And contrary to the normal “around the table and blackboard” conference, the participants were hardly given time to be introduced to each other before being put on the water for several days of exciting sailing.

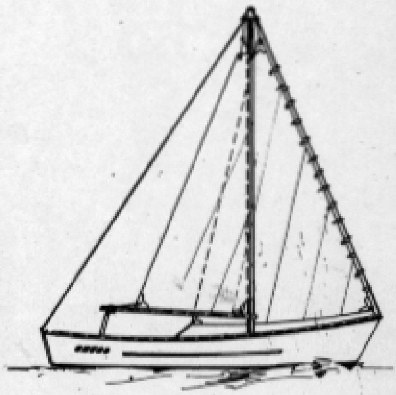
The boat: It was decided to build two identical boats in FRP, and the IND-20 design was selected : a 28 foot beachboat developed for Andhra Pradesh. It was equipped with a FRP centreboard and rudder using an aircraft wing NACA 0012 profile, both of which were fitted off centre (see drawing on page 7). Universal mast steps and chainpiates where any of the masts would be accepted, stayed or unstayed, were. fitted to the boats. For ballast, 500 kg sand-bags were used securely stowed inside the hold.

Since propeller and motoring rudder on the beach boats can be lifted out of the water, their sailing performance is very good – especially on IND-20 which inherited some of its lines from Norwegian whaling boats used in the days of the hand harpoon. Surprisingly enough, their original rig, the Gunter, also turned out to be the overall winner!

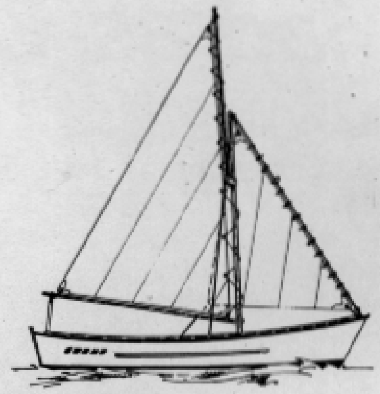
To compare the rigs, we used two methods:

1. Qbtainingsailperformancedata for a Polar Diagram on seven rigs, through the use of wind speed and direction instruments combined with a sensitive digital log. However, although wind conditions were as favourable as can be expected with only one morning without wind and never too much of it, conditions varied considerably and the Polar Diagrams obtained are therefore only a rough guide.

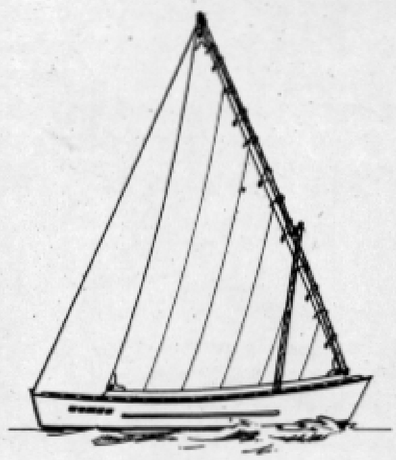
The Sprit rig is on an easy windward tack with a reefed jib.



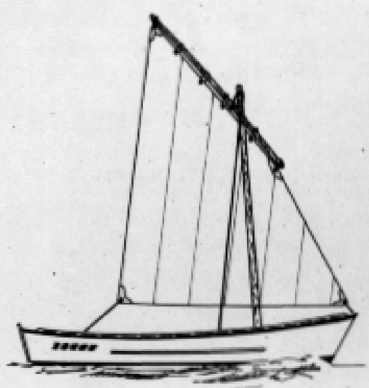
BERMUDA RIG



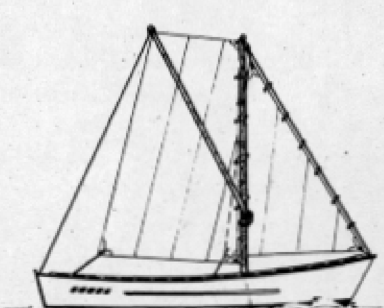
GUNTER RIG



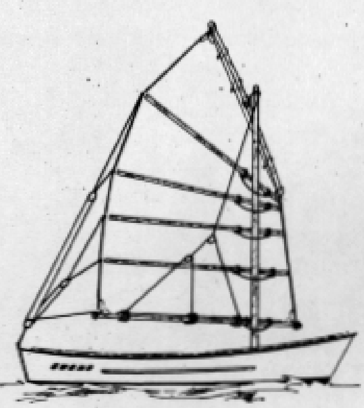
LATEEN RIG



DIPPING LUG RIG



SPRIT RIG



CHINESE JUNK RIG

2. Racing the different rigs against each other, and this was much more conclusive.

The seven rigs (used in alphabetical order to emphasjze the organisers' impartiality) were:

1. The Bermuda
2. TheChinese junk
3. The Dipping Lug
4. The Gunter
5. The Lateen
6. The Spirit Rig
7. The Swing Wing (an experimental rig; a two-ply sail of Chinese Junk configuration but with an additional swinging leach portion).

The Swing-Wing was found to be complicated and heavy, and was consequently not raced against any rig. ltMwas also ruled out by most partidpants as a possible rig on fishing boats in developing countries.

So we were left with six rigs. It is not possible here to go into all the details, but let us have a look at the main points

Some of the rigs had shortcomings in their design and handling, such as lack of yang, too weak spirit, wrong sail proportions etc.

But even allowing for that, everybody's favourite turned to be the Gunter rig. Not only did it perform the best, but it is also eminently suitable for low-cost local construction. The mast and spars are relatively short grown casuarina pieces and rope can be.used as shrouds. (In India, sawn planks suitable for masts cost fourteen times as much as casuarina trees!)

Each test rig has a total area of 27 sq. metres, and some doubts were voiced about the Gunter's suitability with a larger area. A 35 sq. metre Gunter rig will therefore be tried out on a traditional Nava in Andhra Pradesh. With a crew of seven, the mast can still be raised at sea, a necessity for beachlanding boats.

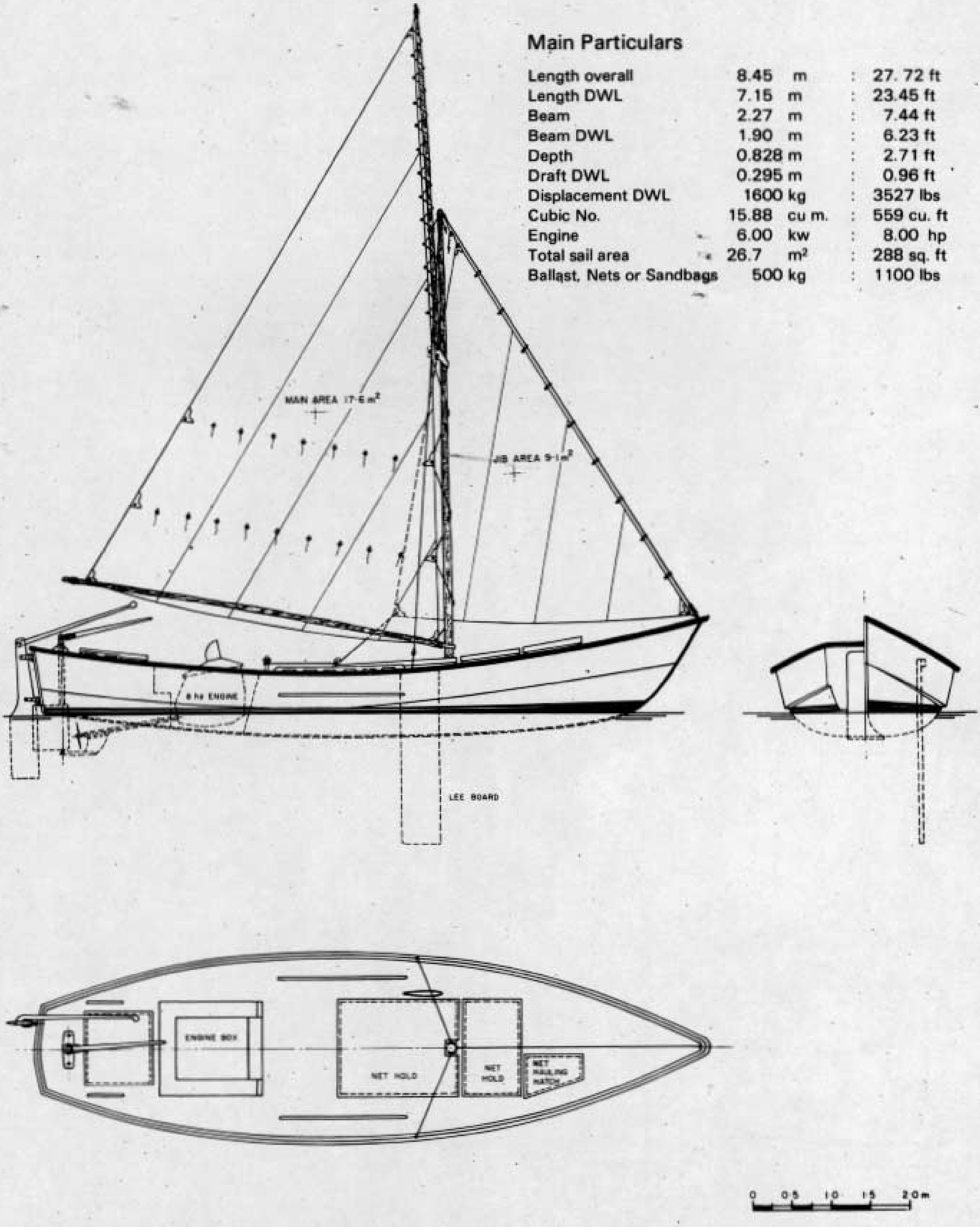
Most of the other rigs tested worked fairly well, and the following will be our guidelines for deciding on rigs in the future.

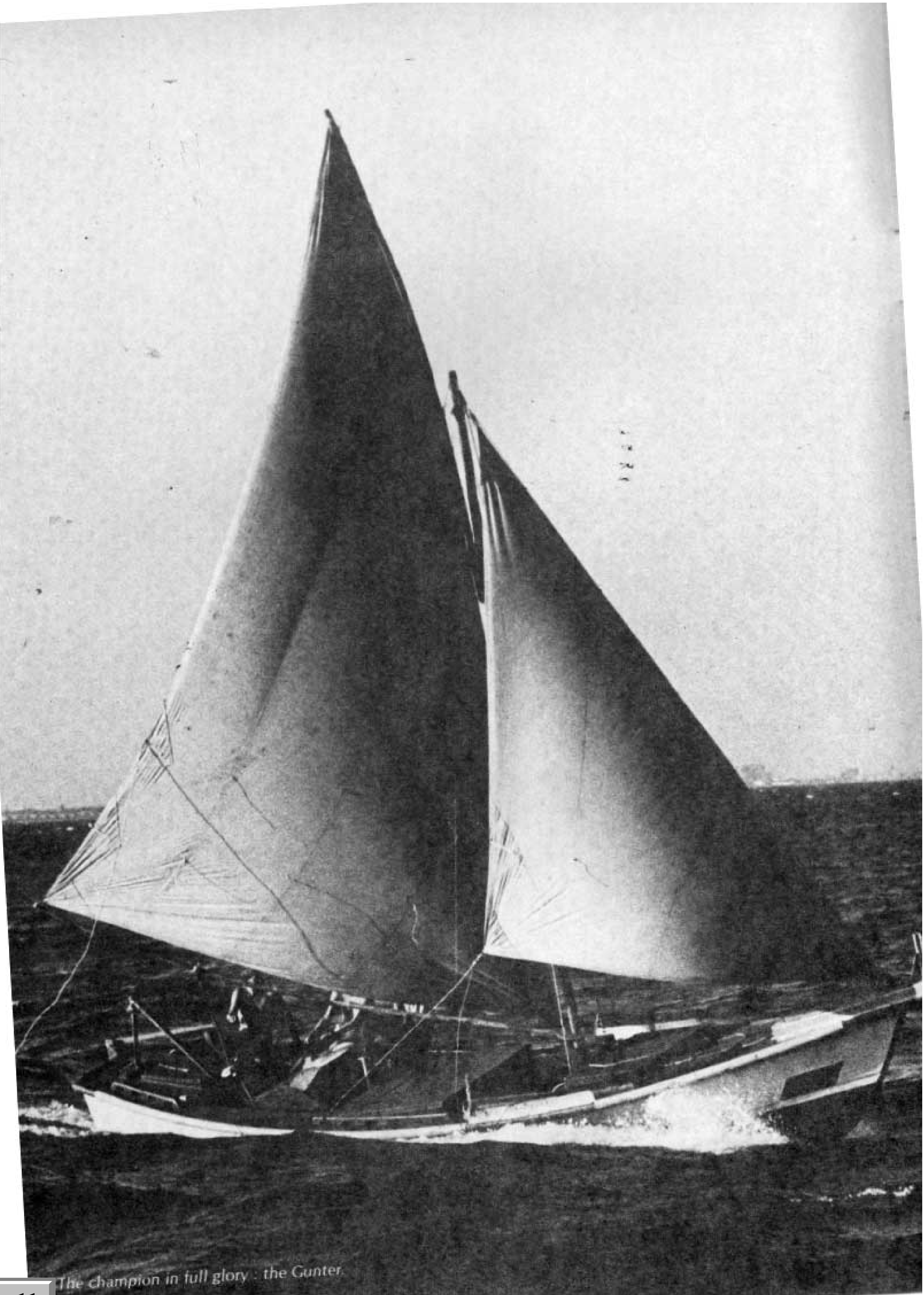
The Bermuda was beaten by the Gunter during the races. This, to some, was surprising, since the Bermuda rig is recognized as the most efficient of all rigs. Well, it is. But the rig used during the conference consisted of a high aspect (narrow)

The IND-20 design with Gunter rig.

Main Particulars

Length overall	8.45 m	:	27.72 ft
Length DWL	7.15 m	:	23.45 ft
Beam	2.27 m	:	7.44 ft
Beam DWL	1.90 m	:	6.23 ft
Depth	0.828 m	:	2.71 ft
Draft DWL	0.295 m	:	0.96 ft
Displacement DWL	1600 kg	:	3527 lbs
Cubic No.	15.88 cu m.	:	559 cu. ft
Engine	6.00 kw	:	8.00 hp
Total sail area	26.7 m²	:	288 sq. ft
Ballast, Nets or Sandbags	500 kg	:	1100 lbs





The champion in full glory : the Gunter.

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mainsail with a wide genoa, both made of light cotton. Therefore, the sails stretched out of shape while the narrow boat restrictecd the sheeting angle of the wide genoa.

After the conference, a new wider mainsail was made of heavier cloth, and the genoa cut narrower and higher. In a subsequent race, it had a slight edge on the Gunter performance-wise. It is easily handled, quick to reef but depends on a long mast which makes it an expensive rig.

The Chinese Junk : rig was a bit disappointing. With its many lines and battens, it still twisted out of shape when going to windward and close reaching. While performing well on a downwind run, it is a heavy, complicated rig set on an unstayed mast.

The Dipping Lug: performed well and is very simple. Probably the ideal emergency rig, with a shorter yard than its sister, the Lateen, it can be easily stowed out of the way when not in use. The mast is medium long and light, necessitating the use of the halyard as a mast support in anything but very light airs. This makes tacking a bit tricky, which is however not so important when used as an emergency rig or as a steadying sail.

The Lateen: performed well on all winds and was perhaps the sail working closest to the wind. It is very simple to make and is the cheapest of the rigs, which is probably why it is the only traditional rig used in this region onmonohulls. The main disadvantage of the Lateen is the length of yard required as the area increases, as much as 10.6 m for a 27 sq. m. sail. Raising and lowering it, as well as stowing it on deck out of the way, is not easy. On a smaller beach boat, the use of a 18 sq. m. lateen was demonstrated. On this size of sail the yard is easily handled and the boat performed well, including quick tacking to windward.

The Sprit: also performed well. But since it was beaten by the Gunter and costs the same, it is not likely to be used by BOBP. The Sprit itself was a bit weak for going to windward, but this is not likely to change its performance noticeably. A demonstration was given to brail the sail and sprit to the mast instead of lowering it. This was not, however, convincing since it was a complication and left some cloth flapping about up there.

Conclusion : The winners of the 'Madras Cup' were

Small boats up to 20m^2 sail area – Lateen

Medium boats: 20-30 m^2 – Gunter

Larger boats: above 30 m^2 – Gunter or Bermuda

Emergency rigs : Dipping Lug.

FURTHER OBSERVATIONS

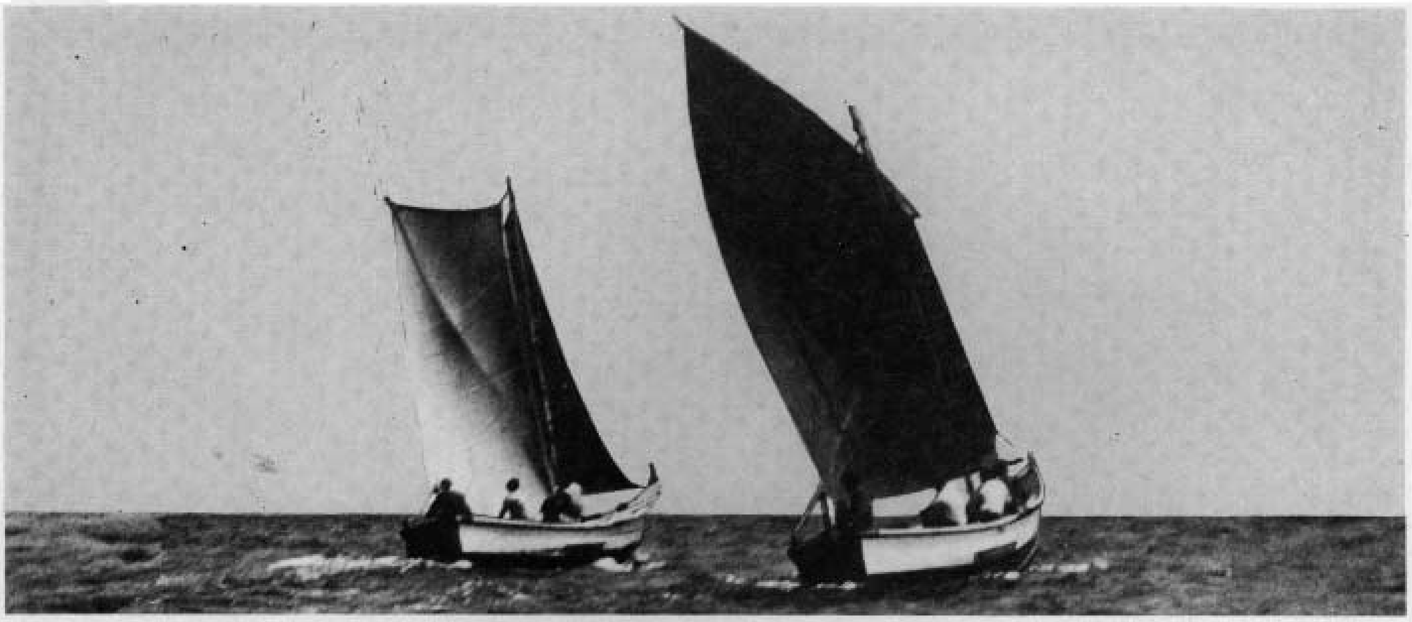
a) Rigs not tried : The Gaff rig was not tried since it was felt that it has little application on relatively small boats. The Standing Lug with jib wOuld probably perform like the Sprit Rig and although we were thinking about trying it, there was no time.

Double ply sails like Swing-Wing or Freedom sail are too expensive for use here since the cloth is the biggest expense on traditional rigs (see table).

b) Leeboard and rudder off centre: The leeboard well on the beach boats is not in centre, the reason being that the net hold is there. Likewise, the centre of the transome is cut to allow the propeller and motoring rudder to come up when landing on the beach and the extra sailing rudder is therefore attached to the transome on the side, more or less in line with the centreboard. Everybody thought that a better performance would result with the centre-board in its deepest position, i.e. the boat healing to starboard. However, with the fairly good instruments used, no difference could be detected. We will therefore continue to use this solution.

c) Motor sailing data: There was some lighthearted criticism about the boats sailing too well! With 8 HP engine, the boats made 6.2 knots while sailing speed reached 6.8 knots in a good wind.

Only on a very special wind would motorsailing be used on these boats, and we did not get data for this during the consultancy. Motorsailing is more attractive on heavier displacement boats using relatively small rigs.

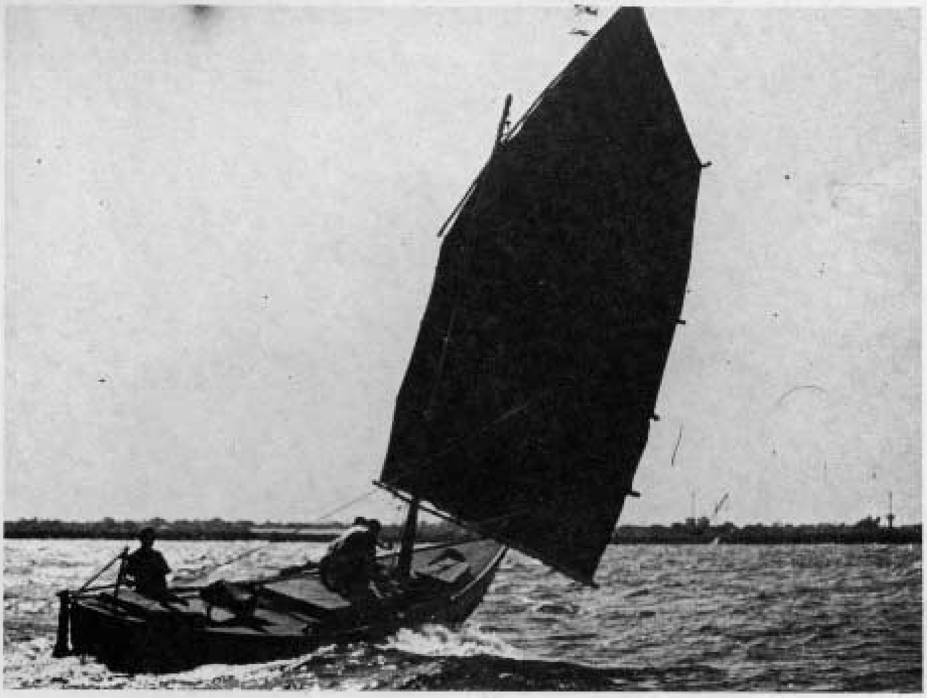


d) Other boats : A 37 ft traditional Nava from Andhra Pradesh, a 23 ft aluminium beachlanding boat, fitted with a Lateen sail, and a FRP Oru 9r outrigger canoe, developed for Sri Lanka, were also demonstrated during the trials. And although the IND-20 sailed very well, it is a different experience to sail on the 40 ft. Oru, a real sailing machine, which can even be used for fishing! But more about that in a later issue.

e) Cost/weight data : The table below, prepared by the sailmaker, gives the proportional costs and weights of the rigs used. Some conclusions can be drawn

- Since "Casuarina" trees can be used, spars on traditional rigs cost very little.
- Sailcloth is the most costly item.

The Dipping Lug (right) in competition with the Sprit Rig. The Sprit Rig emerged convincing winner. Below : The Chinese Junk in action.



Cost of 27 sq. m. rigs used in the trials

RIG	Cost of materials				Weight (Kg)			Labour manhours			Total cost in India
	Sails	Rigging	Spars	Total	Sails & Rigging	Spars	Total	Sails	Rigging	Total	$***
Bermuda	106	*50	108**	264	21	31	52	11	8	19	362**
Dipping Lug	105	6	3	114	21	47	68	9	3	12	160
Gunter	106	*25	3	134	21.5	52.5	74	12	8	20	194
Lateen	103	7	5	115	21	47	68	8	3	11	160
Junk	105	16	10	131	55	85	140	12	10	22	192
Sprit	106	*27	3	136	21.5	47.5	69	12	8	20	197

* Stainless steel wire standing rigging.

** Aluminium mast and boom.

Based on 30% overhead cost on materials, $ 1.00 per manhour for labour, including overhead.

Making the sails for the Madras trials

by John McKillop

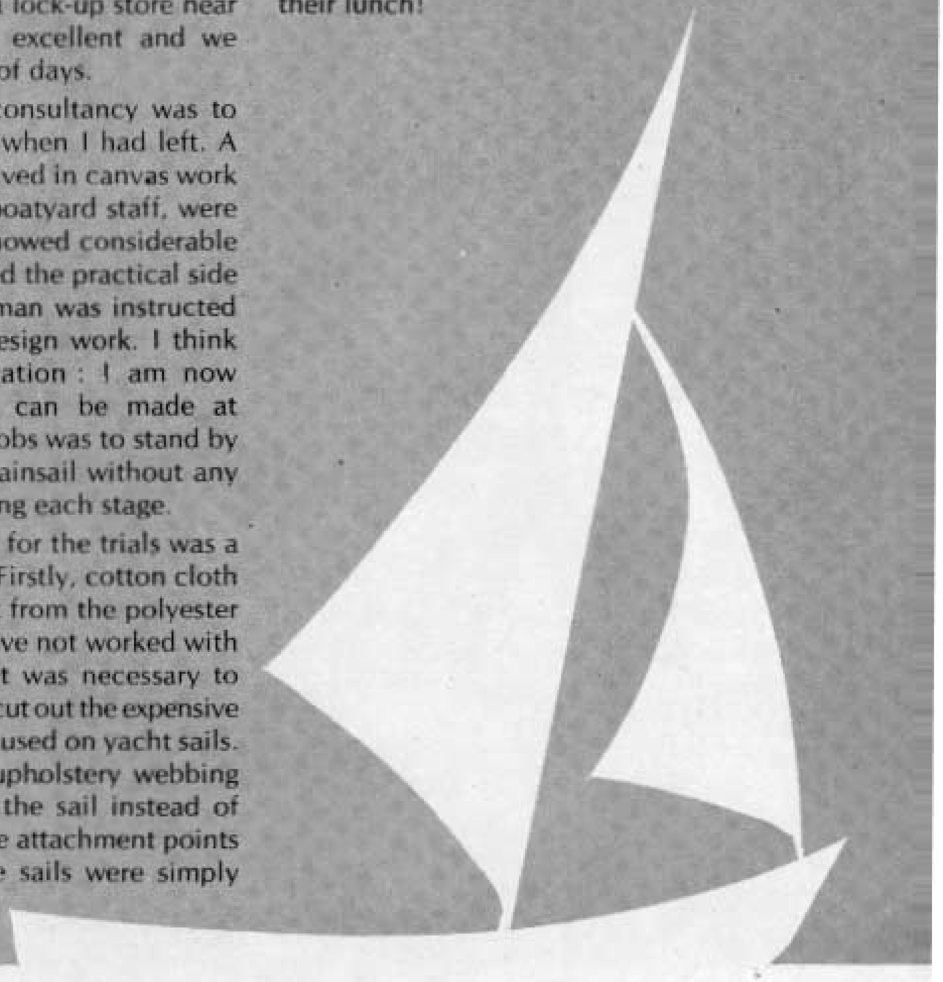
The job of getting the sails made for the Madras sail consultation started late 1982 when I was asked to obtain the equipment to set up a sail loft at the Royapuram boatyard. An industrial sewing machine, hand tools and a number of sail fittings unobtainable in India were sent from the U.K. It was important not to forget anything as there would be no time once I was in Madras to ask for any more extra parts.

Cloth, thread and rope were obtained in Madras. On September 5, I arrived to start the work. The first task was to set up the machine and sort out the stores. The moulding loft, 18 m × 5 m, was to be the cutting floor with a lock-up store near by. The arrangements were excellent and we were in business in a couple of days.

One of the objects of my consultancy was to train local staff to continue when I had left. A man from a nearby firm involved in canvas work and upholstery as also two boatyard staff, were taken on as trainees. They showed considerable aptitude and quickly mastered the practical side of sailmaking. The draughtsman was instructed in layout and general sail design work. I think this was a successful operation : I am now confident that simple sails can be made at Royapuram. One of my last jobs was to stand by while they made a gunter mainsail without any help from me beyond checking each stage.

The making of the seven rigs for the trials was a most interesting experience. Firstly, cotton cloth has properties quite different from the polyester now used in Europe, and I have not worked with cotton for about 20 years. It was necessary to develop several techniques to cut out the expensive and highly skilled hand-work used on yacht sails. We made extensive use of upholstery webbing which can be machined to the sail instead of rope and to secure rings at the attachment points of sheets, halyards, etc. The sails were simply designed and cut, suitable for semi-skilled construction and for use as samples for future manufacture.

The sewing machine was a big worry. It is a high-speed sophisticated model which can be damaged by misuse. Damage would have jeopardized the whole work programme, as spare parts are not available in India. All went well, however, and the sails were ready on time and fitted to the rigs. Nothing came to bits during the trials, which justified our unorthodox construction methods. The only repair we had to do was on the 'Nava' sail in which the crew burned a hole while cooking their lunch!



glimpses into BOBP Projects

Experts Review Non-Formal Curriculum for Tamil Nadu Fisherfolk

An interesting BOBP experiment was described in an earlier issue (July 1983) of Bay of Bengal News: the preparation of teaching material for Tamil Nadu fisherfolk.

To ensure that this material would be useful, the BOBP invited experts with long experience in non-formal education to critically examine it. Consequently 15 experts from Bangladesh and India (see list below) met at a week-long consultation in Madras in November. Placed before them was a 200-page document prepared by the BOBP with the assistance of a social worker and a freelance researcher. This was an "animator's guide" ("teacher's guide"). It contained detailed "lesson plans" covering 54 subjects in 10 areas – the family and the community; fishing; diseases and their prevention; social excesses; education; leadership and citizenship; basic needs; social practices; alternative way of life; government schemes.

The "lesson plans" discuss the methodology the animator may adopt for a particular subject, the questions he may pose, the material (charts, pictures, sketches) he may use. Their approach is "participatory" and designed to make the fisherfolk active participants in the educational process, not passive recipients.

The experts were asked to evaluate the lessons from the standpoint of relevance, content, presentation and flow; suggest improvements; and finalize a revised "animator's guide" They divided themselves into three groups for the evaluation exercise.

Criteria formulated for the lessons Did they study the problems of the fishing community? Did they contain guidelines for action? Did they capture the interest of the learners? Did they purvey important facts in an interesting way? Were they lucid enough to be handled by the animators?

The experts immediately got to grips with the assignment. Discussion was vigorous. Sample comments on the lessons: A few of them were too long; questions they posed were occasionally too obvious or simplistic; some of them did not arouse the critical attitude desired; the lesson on "our needs" was narrative rather than participatory the lesson on "social excesses" was overly moralistic – it would be preferable to get a group of learners to enact a role play on drinking; the lesson plan on "nutrition" used terms like "carbohydrates" and "proteins" which could not be meaningful to fisherfolk; the section on "progress" was too abstract: it should be renamed "dream of a good life", and the animator should ask the fisherfolk to spell out their dreams for the future.

The experts were also asked to provide guidelines for a primer to teach the fisherfolk the three R's (reading, writing, arithmetic). They suggested that the primer being developed should concentrate on the 145-'tunctional' Tamil alphabets and omrt the 100 alphabets that are not; that each lesson should stress a single concept or issue; that the primer's vocabulary should be confined to what the fisherfolk know and to words found in the lesson plans; and that arithmetical concepts should relate to the fisherfôlk's life.

The experts stressed that materials to improve literacy and promote awareness should be designed as separate entities; 'and should not be combined in the same book. The literacy materiais (primers) would be structured kits, not possible to alter; but the "awareness material" (lesson plans) needed flexible handling by the animators, who could alter the sequence of the lessons on the basis of local priorities.

The BOBP has also prepared a list of 100 topics on which "supplementary reading materials" are being prepared for the fisherfolk at three levels. Picture content is the highest in the first level (80%) and lowest in the third (20%). For an example of first-level material – on dehydration and what should be done about it – see the illustration (opppsite page). The experts commended the supplementary materials but felt that their "entertainment value" needed strengthening.

Social worker R. S. Anbarasan says: "We hope to have the entire curriculum package (revised and field.. tested) out by September 1984. The components of the package are at present at various stages of pre-

Would a fisherman understand the term 'carbohydrates'? Experts review material prepared by BOBP for Tamil Nadufisherfolk.

An example of "supplementary reading material" for fisherfolk prepared by BOBP. This strip, an extract from a longer sequence, is about a baby that has severe diarrhoea. The village health assistant tells the mother what to do to prevent, dehydration. ("Give the baby mother's milk and plenty of water

paration, revision and production." Says BOBP sociologist Patchanee Natpracha : "We are confident that fisherfolk who complete this curriculum will not only be able to read and write (be literate) but also develop awareness and acquire functionality — the other two components of the National Adult Education Programme. . . . This means they will be able to do simple calculations, express themselves, think critically,, organize action programmes to solve their problems."

What did the experts think of the whole exercise? Dr. Om Srivastava of Seva Mandir, Udaipur (which runs 300 adult education centres in an area heavily populated by tribals) describes the consultation as "a very honest effort". He adds: "One of the problems with any educational material is that the implementation has to be closely watched. The riiethodology for delivering the material should be continuous and discovery-oriented. By that I mean it should be tested, revised, adapted to the location and the.audience, redesigned.... It is not a one-shot effort."

Dr. Sharada Jam of Rajasthan said she was quite amazed at the effort that had gone into the preparation of material. "A lot of authentic ground-floor work has been done... I didn't think an international organization could produce this." (Her exposition of th.e relevance of a curriculum for fisherfolk is set out on page 14).

How will the material prepared by BOBP reach the 400,000 Tamil fisherfolk who live in 400 coastal villages? Leading Tamil Nadu officials met with BOBP in November to discuss implementation of the curriculum. It was agreed that once the curriculum was ready, it could be tried out in 30 centres on a pilot basis. The Directorate of Fisheries, will identify and recruit animators from the respective villages (minimum qualifications being standard VIII);' they will be supervised by sub-inspectors of fisheries. Salaries and allowances for the animators, besides equipment and training, will be provided by the Directorate of Non-formal and Adult Education.

After the pilot testing of material and any necessary changes, the curriculum will be introduced in phases in Tamil Nadu fishing villages. It is hoped that all the 400 coastal villages will becovered in four or five years. Adult, education and fisheries officers will'meet periodically at the district level to ensure coordination in implementing the programme:

All this is good news for Tamil Nadu fisherfolk. Much ingenuity, labour and skill have gone into devising educational material for them. A curriculum that they find useful can also perhaps be adapted for other locations in the Bay of Bengal region.

Participants to the consultation on non-formal education

Ms. Anita Dighe of' the Council for Social Development, New Delhi; Dr. Sharada Jam of Rajasthan; Mr. S A Karim of CONCERN, Bangladesh; Dr. A. Pitchai of the Tamil Nadu State Resource Center; Mr. K. Ramakrishnan of the Madras Institute of Development Studies; Dr. Om Srivasava of Seva Mandir, Udaipur; Dr. L S Saraswathi, researcher in rural development, Madras; Mr. S H Talukder, chief of the training 'unit from BRAC, Bangladesh; Mr R. Venkatachari of the Directorate of Non-formal and Adult Education, Madras; Mrs. Freda Chandrasekharan, Deputy Director of Fisheries, Tamil Nadu; and, from the BOBP, Development Adviser V.L.C. Pietersz, sociologist Patchanee Natpracha, documentalist V. Bhavani and social worker R. S. Anbarasan.

Development:. What is the Role of Outsiders?

by Sharada Jam

How shall we assist development? Must we?

The dilemma expressed here rests on a sensitive perception of the reality in the fishermen's community. If we have learnt to distinguish between relief and development, we know that the latter is an "internalised" process. *It may be slow, it may be sporadic, but it certainly is not an activity of "outsiders" or "well-meaning" people.*

Relief operatiQns definitely call for external "help" of a temporary nature necessitated and justified by calamities or "unforeseen" circumstances. Development, as distinguished from relief operations, must "happen" rather than get "done".

However, there is another side to the story. One cannot wish away the fact that conditions of deprivation and stagnation do exist; that they spring from neglect and — more often than not — from human selfishness, vested interests, and greed. They are non-natural' conditions and therefore call for intervention so that the natural process governing human conditions may be restored. It does point to the responsibility of the privileged group to intervene. The sharpness of the dilemma is felt when posed in the following manner : "Intervention" may mean dependency or manipulation; but absence of intervention may mean maintenance of a status quo that supports the vested interests at the expense of the poor.

If we analyse this situation, two facts emerge clearly. Whatever the specific nature of growth may be in a community, if it is not internalised, natural, spontaneous, it is not development. Again, it can be internal ised or spontaneous only when the following features manifest themselves.

1. A sense of belonging. The members of the group must identify themselves with each other and their environment, i.e. they should talk in terms of "our people, our children, our work."
2. A minimal rejection of the present. They must perceive the reality around them and feel that it is not what they really and ultimately want. Things should be better.
3. A sense of confidence. ("We *can* be better. We *can* improve our lot.")
4. A visualization of alternatives. What shall we do? (Either we can do X or do Y etc.)

If we grant the aboveanalysis, then the development dilemma resolves itself. It is true that we must not interfere and'manipulate; it is also true that we cannot be complacent about a condition of deprivation.

Our activities must focus on removing all obstacles which hamper development. This, in effect, would mean

(a) Identifying those conditions which hinder a sense of involvement, awareness of surroundings, confidence, sense of alternatives and emergence of leadership.

(b) Creating an environment that helps eliminate the hindrances.

What non-formal education can do

This perspective, therefore, crystallizes in formulating an educational programme that would enable members of the community to discover themselves and gain confidence in relation to their environment; make existing patterns appear as changeable; ensure that *sense of hopelessness ceases to cripple their mind and sap their energies. In short, it should help them to start "seeking" and "finding".

Such an educational programme helps members of the community to become genuine participants in the process of growth. It may entail learning of skills; information dissemination; a perception of alternatives

Theseare the assumptions behind the attempt to devise a curriculum for the education of marine fisherfolk in Tamil Nadu.

The approach is that the learner should get assistance in discovering himself as a member of a community, and in entering upon a more alive, enthusiastic relationship with the environment. The entire series of lessons focusses on the need for cooperative, just and healthy living which in turn can shape things closer to the heart's desire.

This entire approach rests on a threefold acceptance by

1. The community, which is the main focus of the programme.
2. The implementers, i.e. the educators
3. The Government functionaries.

The importance of the first two factors is generally well recognized, but the third factor is not often seen as a crucial and critical input. The administration provides a final support structure within which a non-formal education programme is implemented. Energies can be dissipated and cynicism may ensue if a conflict erupts between any two elements or an attitude of indifference crops up. If there is agreement on the approach and the strategy, the programme becomes more acceptable; if a dialogue transpires, it can be made appropriate and relevant.

India and Sri Lanka

Engine Training for Beachcraft

One of the main obstacles to introducing mechanized boats at the village level is the maintenance and repair of engines. If the engine does not function, the mechanized boat stays ashore, loans remain unpaid and the project fails.

The engine to be installed has to be of a high quality since the job it has to perform in the fishing boat is very demanding. It has to endure long hours at full throttle, and go far out to sea, often against heavy weather, causing a lot of spray and salt-laden air to be sucked into the engine.

Preventive maintenance is perhaps most important. If properly looked after, a good engine will be capable of long life with good performance and fuel consumption will be kept down to a minimum. One must remember that if the boat is shore-bound for three days for engine repair, the repair may only cost Rs. 200 to Rs. 300, but the loss in income from fishing may amount to three or four times that.

The preventive maintenance that fishermen must do is to check the oil level and to change the oil at the right intervals. This work includes replacing the oil filter. Care should be taken in construction, design and operation to ensure that the air intake is protected from sea spray – since sea water, coming in with the combustion air, even in small quantities, causes heavy corrosion inside the cylinder and on the valves.

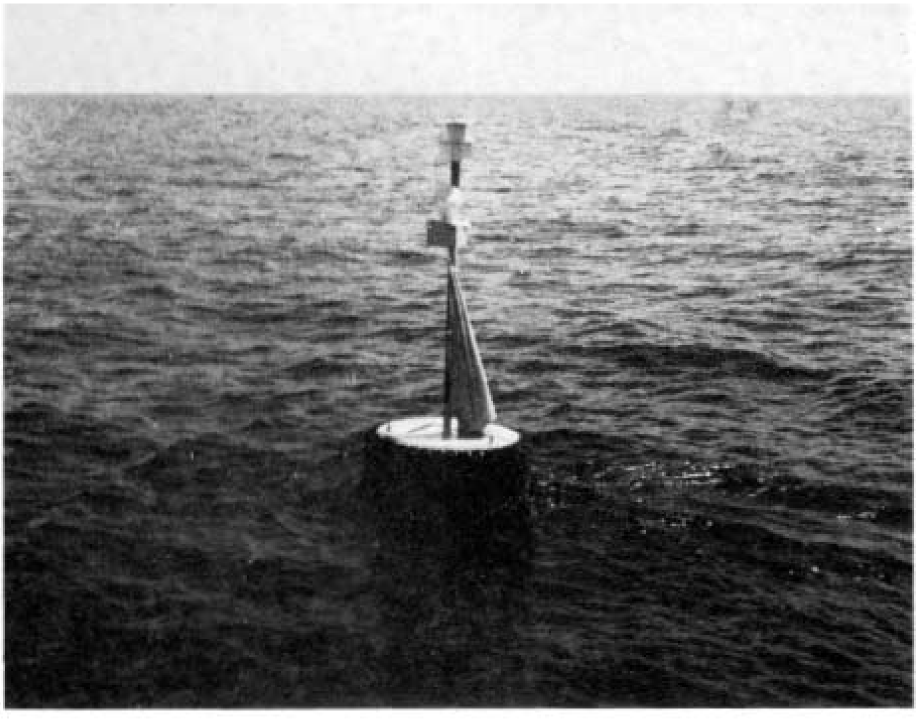
Wherever the BOBP seeks to introduce beachlanding boats, it sends two to four people from the fishing village to the factory in Bangalore for an engine repair course lasting six to ten days. The trainees are shown how the engine is dismantled, how to use special tools, how to adjust valves or test nozzles, replace bearings, crank shafts, oil seals, etc. – in other words how to carry out a full surgery!

"Engine trainees" so far include an Inspector of Fisheries each from Tamil Nadu and Andhra Pradesh, two fisheries counterparts each from Andhra Pradesh and Orissa, two fishermen from lnjambakkam and four from Reddikuppam, and one mechanic from the Royapuram boatyard. However, none of the fishermen trained so far has carried out any engine repair in their village they do not feel confident enough and prefer to call in the factory mechanic. In future, only experienced mechanics will be given factory training on this engine'.

The main objective of the engine training must therefore be to get fishermen into the habit of checking the oil level before each start up, and to carry oil with them for topping up during the trip. At the same time, they should also lubricate the stern bearing, since it is grease-filled to prevent sand entering the bearings. Without a regular supply of grease, the stern bearing will wear out quickly and also damage the propeller shaft.

Training should also be given in general installation maintenance, in tightening bolts and stern, and in cleaning the fuel tank, water separator, filter etc. Fishermen taking part in BOBP experiments from now on will be trained at the Boat Development Centre in Royapuram.

In Sri Lanka, engine maintenance has not been a prQblem so far. Mechanization has been on for a long time at the village level. The only assistance BOBP has to provide is with spare parts and with co-ordination.' For bigger jobs a number of qualified workshops are available no engine has suffered for lack of oil.



Sri Lanka

FADs: Where are They Now?

How effective are fish aggregating devices (FADs) in boosting the catch of pelagic fish in Sri Lanka? An experiment was launched by BOBP in 1982. The results were disappointing. The catches around the FADs were below' expectations; further, the FADs were not durable: all of them disappeared in nine months.

The FADs were constructed from old truck tyres belted together with a steel mast to form a buoy. The tyres were filled with polyurethane foam for buoyancy and the mast was equipped with a flag, light and radar reflector for safety and high visibility. Scrap nylon fish netting was attached to the mooring line to attract the small fish that first aggregate around the FAD. The mooring line was constructed of chain and polypropylene rope, secured to anchors of concrete and steel.

Consultant Charles Peters says that Sri Lankan fishermen expressed conflicting opinions on where the FADs would be placed. The larger '3½ tonners wanted the FADs about 20 to 25 miles off the coast, but smaller boats wanted them closer. The FADs were finally, deployed between November '82 and February '83 — 6 to 13 miles from the coast off Ambalangoda, Galle, Welligama, Tangalle, Wedduwa, Panadura and Negombo.

To monitor catch data, counterpart staff visited the FADs and landing sites once or twice a month and interviewed fishermen operating around the FADs. Some observations : The aggregation seemed to start immediately after deployment; shoals of baitfish were found round all the FADs; shoals of pomfret were also found close to the first FAD but no pomfret was caught because of lack of suitable fishing gear; the fishermen. hesitated to use gillnets too close to the FADs because of risk 'of entanglement with the FAD. Catch? Between December 21, 1982 and June 1, 1983, some 7000 lbs of fish — mainly dolphinfish and frigate mackerel, but also some tunny, rainbow runners, yellowfish, tuna and seer fish — were captured in the immediate vicinity of the FADs.

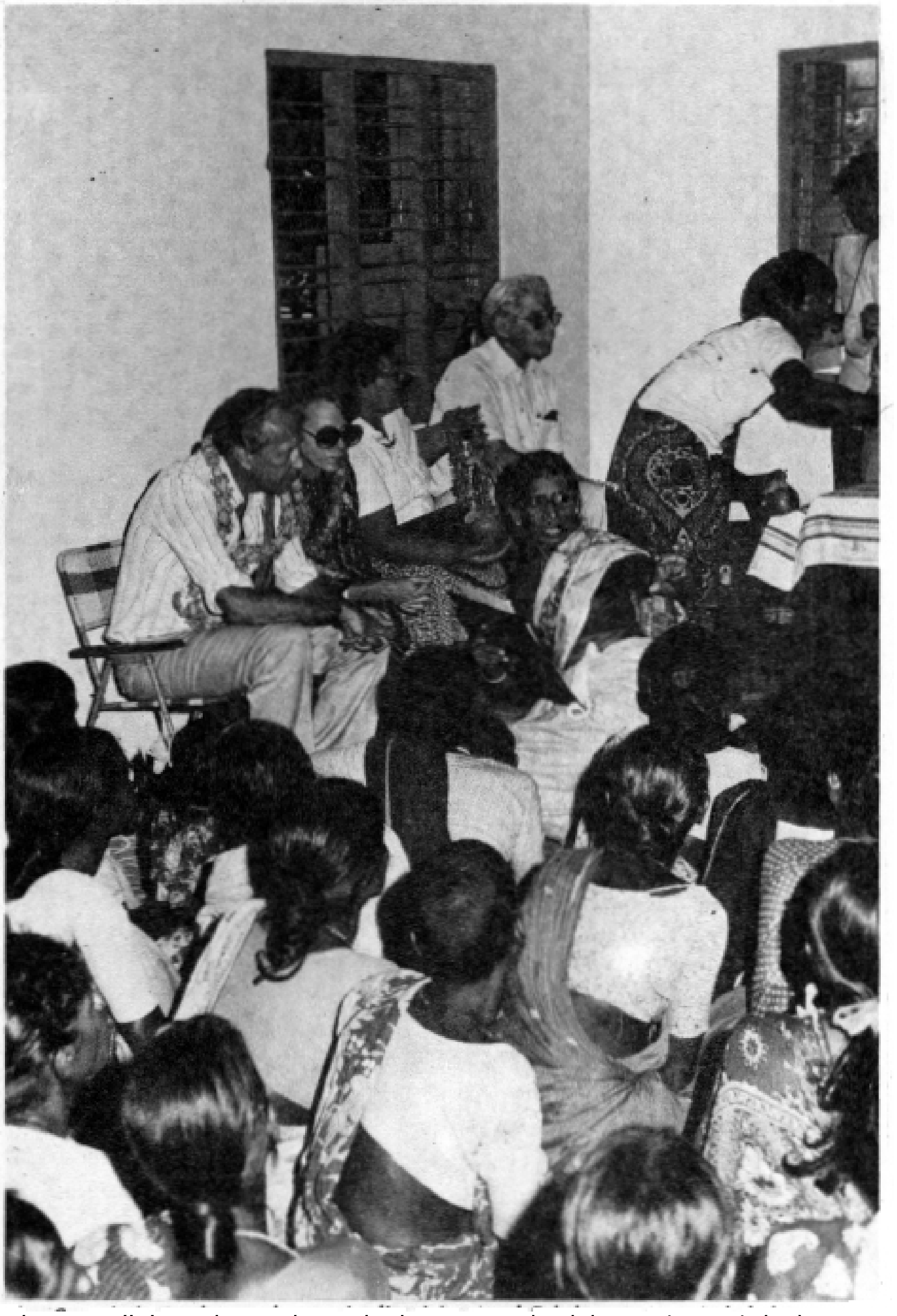
The hope that the FADS would aggregate larger migrating species, such as yellow fish and skipjack tunas, did not fructify. Possible explanations, according to S.L. Suraweera and D.T. Mendis of the cooperating agency, NARA, were that the FADs were deployed in waters that were too shallow, too far from the migration routes of the larger species; and that the species were not abundant during this particular season.

Equally serious was the mortality rate of the FADs. By July 1983 only one FAD was intact. (One FAD disappeared soon after deployment; one was towed ashore after being adrift; three others were in working condition but difficult to locate because the signal mast had been removed.) October, none of the FADs was traceable.

"The construction of the FADs has obviously to be improved", says G. Pajot, fishing technologist, now back with the BOBP after a two-year stint in Rome.

Tamil Nadu, India

Swedish Ambassador Visits BOBP



The ,wedish Ambassador to inaia, Mr. Axel Ldelstam (seated, lett), meets the fisherwomen of Pattipulam village south of Madras.

The Swedish Ambassador, Mr. Axel Edelstam, visited the BOBP early December during the course of a tour of 5 IDA-assisted projects. He viewed a surf-crossing demonstration of BOBP beachcraft at Reddikuppam village south of Madras, and toured Pattipulam village, where a community hall has been built by the Tamil Nadu Fisherwomen's Extension Service with funds from the BOBP. Fisherwomen will hold group meetings in the hall and run a "balwadi" (day-care centre for children), besides renting it out for weddings and community functions. The Ambassador expressed delight that the fisherwomen of Pattipulam had got together in a cooperative spirit under the Fisherwomen's Extension Service to organize development activities. (The Pattipulam community hall is one of three halls funded by BOBP as part of its pilot projects in cooperation with the Fisherwomen's Extension Service. The other two halls are in Panaiyurkuppam arid Devanerikuppam)

In a nutshell

Bay of Bengal News covers the BOBP's work only selectively. Since more than 50 BOBP pilot activities are in progress at any time in member countries; only a few of them are reported in a single issue. Here's a sampling of interesting experiments! studies which will be reported in detail in future issues.

Introduction of high-opening bottom trawling in Sri Lanka

Following an'exploratory survey in March 1983, high-opening bottom trawling experiments have been initiated off Pesalai in the Mannar district of Sri Lanka.

Motorization of canoes in Adirampattinam

In Adirampattinam, Tamil Nadu, a motorized canoe engaged in comparative fishing trials with a local canoe for four months from July 1983. The results of motorization are promising.

Motorization of Chandi in Bangladesh

Following a successful BOBP experiment, an investment proposal is under consideration for motorizing 250 Chandis, with funding from the UNCDF (United Nations Capital Development Fund).

Resources *Study*

As consultant for the UNDP-funded' project "Marine Fisheries Resources Management in the Bay of Bengal" Dr. B I Antony Raja has toured Bangladesh and Orissa, India to study the hilsa resource.

Fishing gear improvement — Bangladesh

Several experiments to improve the traditional gears of Bangladesh have been in progress — particularly set bagnets and large mesh driftnets.

Resources *workshops — Maldives and Malaysia*

Two courses/workshops have been conducted recently by BOBP — a training course in fisheries statistics and biology in the Maldives, and a workshop on the small pelagics of Malacca strait in Penang.

Credit for fisherfolk, Orissa:

This important project has brought banks and extension officers together in the service of fisherfolk. Disbursement of credit has begun.

A Letter from the Field

Here's *a letter from our shrimp culture demonstration project at Polekurru, Andhra Pradesh, launched in 1982. The project attracts both welcome and not- so-welcome visitors .... More in the* **next** *issue.*

Sir,

As discussed by us on 19.11.83 I have discussed with other two scientists on making night halts to watch the shrimp at project site. They also agreed for the proposal.

On 21.11.83 and 22.11.83, my-self and Raghavulu made night halts. On our two days watch we observed two groups of animals (foxes and otters) are entering to our ponds at an interval of 3 to 4 hours and walking on the margins of our ponds. It indicates loss of some shrimp. On first day we have frieghtened them with making noice on zinc tins and chasing with sticks. Second day also followed the same procedure. Today we are taking some lights to put alround the farm and to use some crackers. Today I also issued a telegram for supply of one fog horn from Madras. I came to know that it gives big frieghtened sound which can be used during night to sound in half an hourly intervals. It also useful to frieghten crane and other birds picking prawn at early hours and late evening of day.

with regards,

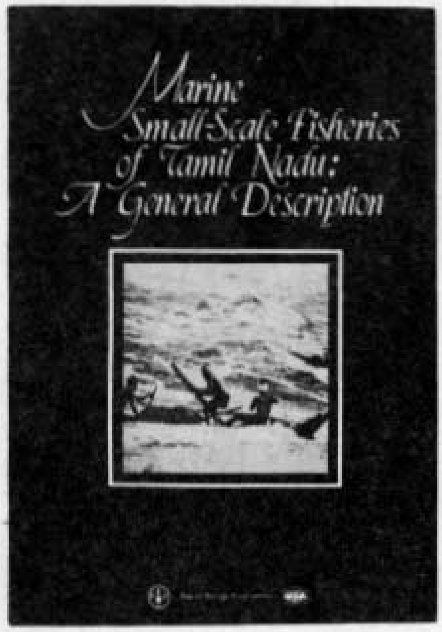
Yours sincerely,

23/11/83

Asst.Director of Fisheries,
(Shrimp Culture Project),
Polekurru at Tallarevu.

Abstracts of BOBP publications

Two technical papers out during the last quarter are abstracted below.



BOBP/INF/5 : *Marine Small-Scale Fisheries of Tamil Nadu, a General Description. Madras, India, December 1983.*

Part of the BOBP "general description" series, this paper revises and updates a 1977 paper. It is a concise factual and statistical summary of the existing infrastructure, the resources, the government set-up and development plans concerning marine small-scale fisheries, and of the socio-economic conditions and production and post-harvest practices of the fisherfolk. The paper may serve as an introduction to the subject or as a background document.

BOB P/WP/23 : Review *of* experiences *with and present knowledge about fish aggregating devices by M. Bergstrom. Madras, India,* November *1983.*

This paper reviews worldwide experience and current knowledge on fish aggregating devices. Nearly 150 institutions and experts were asked to contribute; the paper draws on their experience, as also on other published material.

The paper describes a spectrum of FADs ranging from simple and cheap applications for near-shore waters to modern, highly sophisticated devices for tuna and tuna-like fishes. It is profusely illustrated with sketches and diagrams.

Seaweeds: the underwater treasure

Seaweeds belong to the simplest group of sea plants, the algae. They have no distinguishable roots, stems or leaves, all parts of the plant body looking very much alike.

Thousands of seaweed species grow in marine waters. They are generally classified, on the basis of pigmentation, as red, brown; green or blue-green. Most of the economically significant marine seaweeds belong to the first three groups. Prominent among them are *Eucheuma* and *Gracilaria* (red algae), *Sargassum* (brown algae) and *Chaetomorpha, Cladophora* and *Enteromorpha* (green algae).

Developing countries of Asia are the main sources of some economically significant seaweed species. It is estimated that some 100,000 tons of dried raw seaweed worth about US $ 30 million are produced in Asia every year. The principal seaweed-producing countries are Burma, China, Indonesia, Malaysia, Philippines, Thailand and Vietnam.

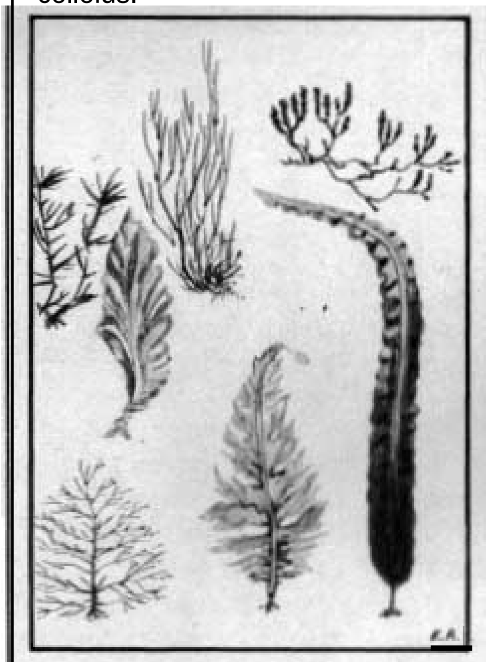
Seaweeds have manifold uses in man's everyday life: as food, fodder, medicine and fertilizer.

Coastal inhabitants in many Asian countries, especially Japan, eat seaweeds. These "sea vegetables" are said to be rich in minerals and vitamins, but their protein content is low and their carbohydrates are hard to digest. Therefore seaweeds. can supplement but cannot replace staple foods such as rice, fish and other cereals. As fodder, seaweeds help feed goats, cows, sheep, horses, poultry and hogs.

Medicine? Most seaweed species have some pharmaceutical properties. They have long been known as an efficacious remedy for goitre, a disease that afflicts more than 300 million people round the world. They can also be used to treat diarrhoea and other stomach or urinary disorders.

Industrial interest in seaweeds is largely for the colloids, gels and gums that can be extracted from them. Such extractions form the basis of multimillion dollar industries in Europe, Japan and the United States. As far back as 1972, the total output of seaweed products in the United States was $ 22,400 million.

Colloids such as agar, carrageenan, alginate and furcellaran are used as thickening, suspending, stabilizing, emulsifying, gel-forming and film-forming agents in many food industries as also in cosmetics, drugs, textiles, paints, leather and explosives. Cheese, frozen foods, pastries, ice cream, desert jellies, fruit juices, milk shakes, salad dressings, meat and flavour sauces, beer, photographic films, shoe polish, dental impression moulds, shaving soaps, hand lotions, air fresheners, cosmetics and tooth paste are some of the substances made from seaweed colloids.



Agar is a gelatinous substance obtained from red algae. Its most unique application is as a culture medium in bacteriology. It is also a food adjunct, and has numerous industrial applications.

Carrageenan (made from red algae) is used mainly as a stabilising and gelatinising agent in food.

Alginates are present in most species of brown seaweeds. They find use in several food products, and are also used in the textile printing industry.

Contrary to the supply of seaweeds, the seaweed colloid manufacturing industry remains concentrated in a few developed nations : Denmark, France, Japan, Norway, Spain, the United Kingdom and the United States. Of the more than 41,000 tons of seaweed colloids produced worldwide during 1980, valued at about U.S. $ 300 million, only about 8% was manufactured by developing countries, particularly the Republic of Korea.

Farming of seaweed

The bulk of Asia's seaweed production is from wild crop. This is an unreliable source. In contrast, production of species through farming is reliable, and highly labour-intensive as well.

Many of the economically important seaweeds can be successfully cultured. The culture of *Eucheuma, Gracilaria* and *Porphyra* species (red algae) and *Caulerpa, Chaetomorpha, C/adophora, Enteromorpha* and *U/va* species (green algae) have been successfully demonstrated.

The twcrculture methods used at present are:

(i) management of natural areas
(ii) vegetative seeding (planting a cutting of the weed) of the selected species.

For the first method, one merely makes good use of seaweed growth already occurring naturally, guards it from poachers, removes unwanted species, and carefully regulates harvesting. Such a "managed" method produces better and more abundant crops than what results from wild growth.

The second method involves a more intensive type of cultivation in enclosed areas such as ponds *(Gracilana* culture in Taiwan is an example) or in open waters with marked boundaries. In the latter case, sites are selected and cleared and boundaries marked. Nylon lines are tied to stakes at equal distances apart. These are seeded by stringing to them cuttings (100 to 150 kg) of seaweed species such as *Eucheuma.* Culture by this method has been very successful in the Phillippines, where up to 15,000 tons of dried *Eucheuma* was produced in 1979.

More and more countries have taken to seaweed farming in recent years. The article that follows describes a pilot project in western Malaysia, for the farming of *Gracilaria* seaweed. The culture methodology, based on the principle of "spore seeding," is different from the methodologies described above.

How to farm seaweeds: Lessons from a pilot prolect in western Malaysia

by S. R. Madhu

At the project's pilot farm in the Middle Bank, two staffers tend lines on which gracilaria are growing.

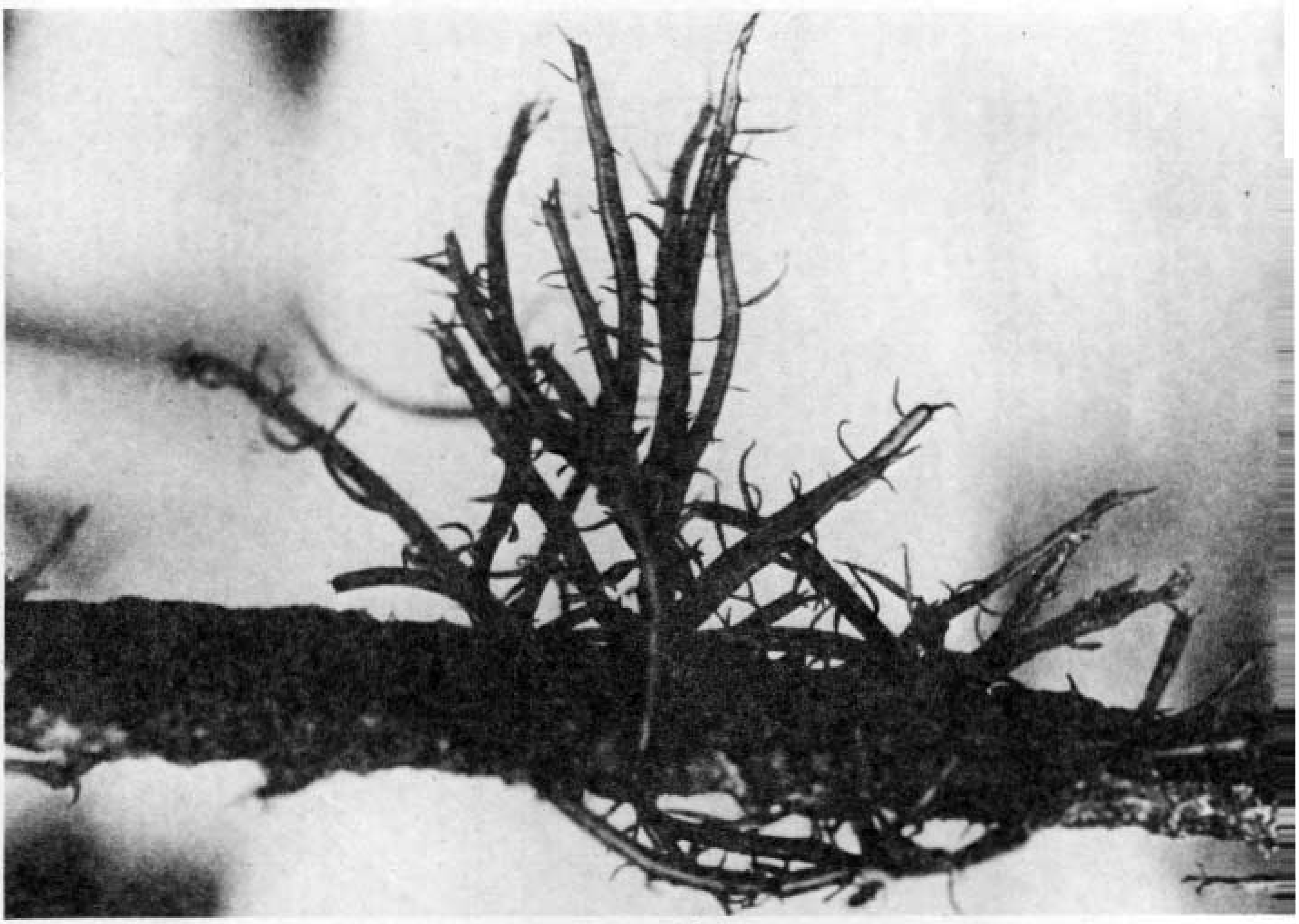
Is' commercial development of seaweed culture possible in Malaysia? Reasonable promise is held out by a one-year-old project around Penang, executed by Malaysian researcheFs in cooperation with experts from Hawaii.

The project marks the first systematic attempt to farm seaweeds in Malaysia. It is also the first time that the *Gnacilaria cylindnica* species of seaweed is being farmed anywhere. The project has naturally posed formidable problems and challenges, many of which have been overcome.

Says Mr. Jack Fisher, senior seaweed technician from Hawaii, "There is still a long way to go. But we have made a good beginning." Mr. Shaari bin Sam Abdul Latif, Director of the Fisheries Research Institute, Glugor, Penang, and Mr. Slow Kuan Tow, head of the aquaculture section in the Malaysian Fisheries Department, express satisfaction at the progress of the project and the potential it underscores.

Fisher represents ARDP (Agronomic Research Development and Production) Incorporated of Honolulu, Hawaii, founded by Dr. Maxwell Doty, "grandfather of the seaweed industry." ARDP supplies the expertise, BOBP offers a part of the funding (US $ 50,000), while staff, research facilities and other counterpart support are provided by the Glugor Institute. Chief coordinator of the project is a young lady scientist from Glugor, Ms. Faazaz Latif.

Malaysia's seaweed potential was studied as far back as 1977 by Dr. Maxwell Doty, who had observed that seaweed farming supporting a thousand families could be introduced



Pond culture of seaweed : Gracilaria cylindrica seaweed grows on rafia line in a pond at Ban Merbok.

and developed over a four-year period. The pilot project is the first step toward such a development. Its main goals are to identify a commercially valuable seaweed species suitable for culture in the Penang area, select viable production sites, determine feasible methods of culture, and impart training to local staff. Some glimpses into the project's activities

In the muddy'shores of the Middle Bank (that lies between Penang and Kedah States) young scientists look for seaweed specimens, often in knee-deep mud and neck-deep water, frequently confronting jellyfish stings.

* In fibreglass tanks in Glugor, seaweed thalli (branches) collected from the Middle Bank deposit "spores" or seeds on a variety, of surfaces ("substrata") — cockle shells, rubber strips, nylon lines, plastic sheets
* At a pilot seaweed "farm" in the Middle Bank, strings of nylon filament connect rows of stakes driven into the mud. The strings bear seaweed "sporelings", which will grow in a few weeks into adult seaweeds.
* At the University of Hawaii in Honolulu, Dr. Maxwell Doty examines the gel content of seaweed farmed by the project.

Fisher describes the methodology of the pilot project thus : "It's a long and time-consuming series of trials. You collect seedstock or specimens of the required seaweed species from the wild, find out how and on what surface it generates the best seed' yield, monitor its growth to a juvenile stage, then .to adult size. You experiment 'with different substrata — in the lab, in the'field, in ponds. The idea is to find out an economic method of seeding in viable and large quantities. You later confine your attention to one substratum and one or two sites and convert seed into juvenile material for a pilot farm. Success in a pilot farm is essential for mass production of valuable seaweed."

Fisher and Faazaz answer questions concerning the project.

Q: *How and where do you look for sea weed seedstock?*

A : We are concentrating in this project on two seaweed species — *Gracilania cylindnica* and a "red" species of Gracilaria, as yet un-named. When it's low tide, we take up a boat and explore the selected area. When we suspect there's seaweed at a particular place, we jump out, grope around, and fix a marker pole, so that we can locate the place again. We carefully remove "thalli" of the seaweed, leaving the root. We have selected some areas for experimental field work. These are located in endemic gracilaria zones; each has its distinct characteristics. (See diagram on page 23).

Station 1 is in a narrow sub-tidal area on the west side of the Middle' Bank. It is soft mud here. There are good "stands" of both Gracilaria cylindricà and of the red species of Gracilaria. Station 2, located in a wide sub-tidal area,.has disappeared — may be fishermen wrecked it.

Station 3 is on the privately owned Jelutong fish-cage raft culture system on the Penang side of the channel that separates Penang from the Middle. Bank. Station 4 is on the east intertidal side of the Middle Bank, a short distance away from Station 1. Here the substratum is a firm coarse sand-mud mixture. Both *Gracilania* species occur but C. *cylindrica* predominates. The extent of Gracilaria growth on the Middle Bank has not been mapped yet.

Q: *What problems did you encounter during your exploratory trips?*

A: On a 'few occasions, we ran into jellyfish. Some species are very dangerous and 'recently caused the death of a swimmer near Penang. And one of the staff was badly stung across the thighs once, raising weals accompanied by severe pain. Fortunately, it was nota killer jellyfish but another kind.

Now and then we got caught in a storm, there were anxious moments. But nothing serious occurred.

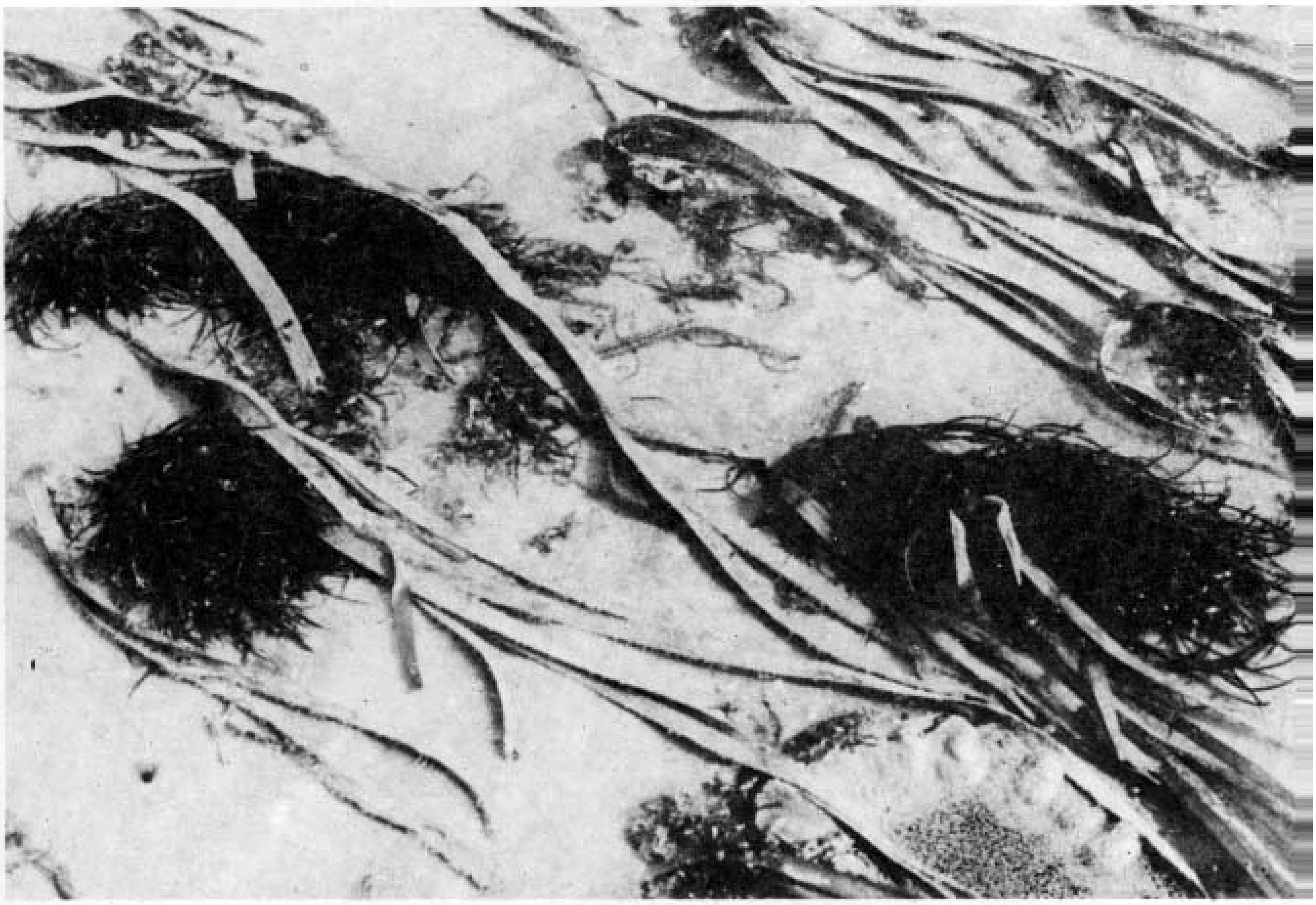
Q: *After collecting specimens, you took them to the Giugor lab for seed or. spore generation. Please describe the process.*

A : As soon as possible after cpollec lion, the seaweed "thalli" were transferred to a seeding tank at the Fisheries Research Institute, Glugor,

Field trip to the Middle Bank. From left: &Glugor researcher; Prof. Ma Doty of the University of Hawaii; Mr. Sha-ari bin Sam Abdul Latif, Dil **of** *the Giugor Institute; and Mr. V L C Pietersz of the BOBP.*

so that we could study its spore or seed discharge pattern on a variety of surfaces or substrata – cockle shells, rubber tyres, nylon nets, plastic sheets, raf la line, monofilament line, coconut shells, mangrove 'branches, fibreglass, tetron mesh, nipah palm fronds. The idea was to find out the best stratum. We sel these trial substrata on the ba what was cheap and locally avai and what we observed in the M Bank. The seeding tanks mean 0.9 x 0.6 x 0.6 metres. The sub was placed at the bottom, Gracilaria thalli were evenly

Gracilaria occurs in abundance in nature in certain portions of the Middle Bank. Here it is seen attach Enhalus (a seagrass species). (All the Middle Bank pictures were taken by Jack Fisher.)



buted on nylon nets stretched about 20 cm above. Seawater for the tank was obtained from the institute's regular supplies of sea water. After the thalli were placed in the tank, the tanks were covered to exclude light for two to five days.

The "seeded substrata" – cockle shells, for example, with spore deposits on them – were later transferred to a 3 x 1.2 x 0.6 metre fibreglass holding tank for development of sporelings.

The advantage of producing seed-stock in the lab is that you can control the conditions, keep predators out, reduce juvenile mortality.

Q: *What substratum did you finally choose for project work? What were your findings about spore discharge?*

A: As we said earlier, we tried out more than a dozen substrata. We found that spores stuck to most things that are not toxic. We finally selected – for growth of juveniles to adults on a pilot farm— rafia line and nylon monofilament line. (Rafia is a form of plastic line used mainly for packaging.)

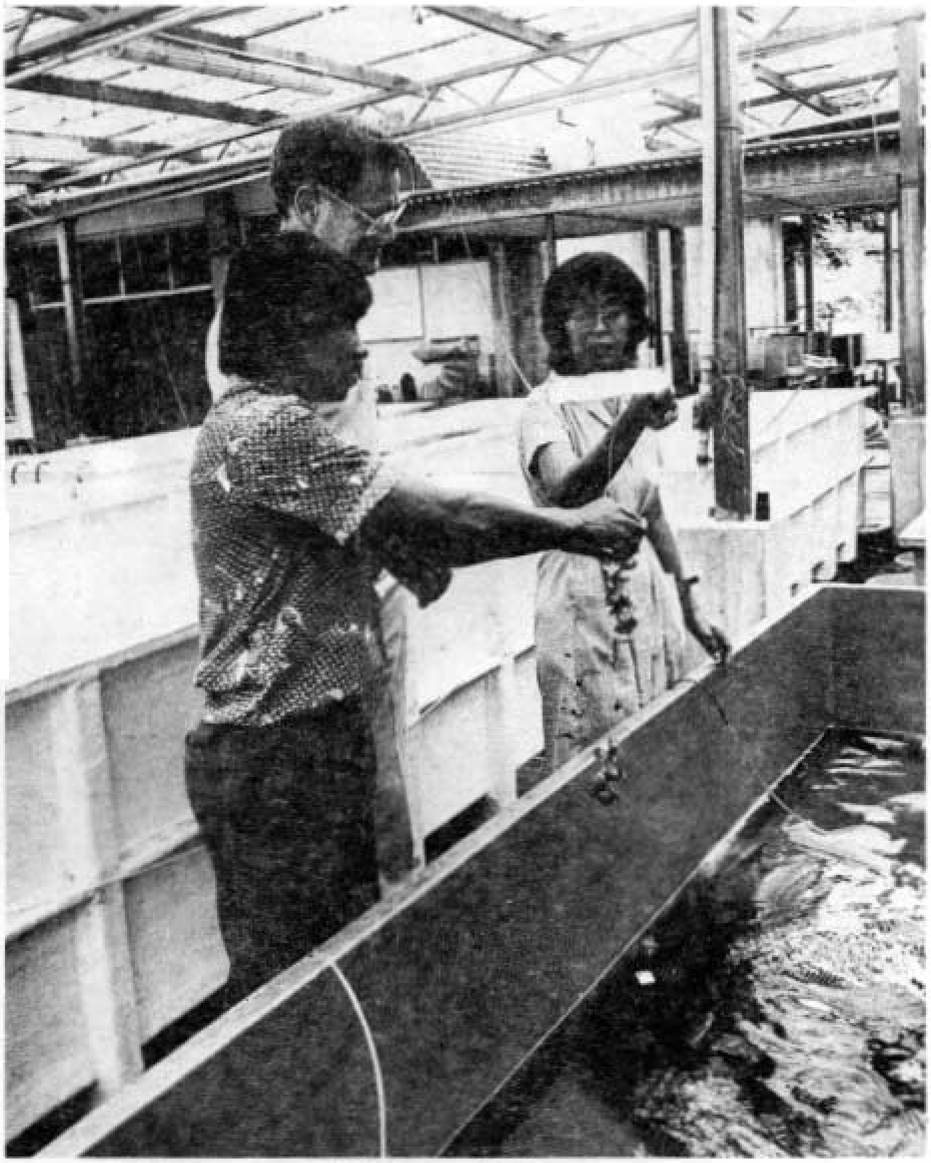
There were some interesting findings concerning spore discharge. Let me cite just a few.

- The use of "aged" seawater accelerated spore development.
- The bulk of the spores got discharged during the first night of the thalli in the lab.
- Thalli subjected to stress discharged spores more readily than those without stress. The mere act of removing the thalli from the field is a form of stress, so is its transport to the lab, the cleaning process and the eventual placement in a different environment.

The seawater at Glugor has a low fertilizer content and other algae in the tank compete for the fertilizer. Th.is affects spore survival.

Q: *Besides lab production of juvenile seaweeds, did you also take up juvenile seaweed production in the field?*

A: Yes. 'We need fairly large quantities of sporelings or juveniles for a pilot farm. Such quantities can not be produced quickly at the Glugor lab, so we also did natural, seeding. We chose the natural



Consultant Jack Fisher and Ms. Faazaz Latif, project's team leader, examine spore seeding on cockle shells at a tank in the Glugor Institute along with a research assistant (left).

Gracilaria grounds on the east side of the Middle Bank for "in-field seeding." Monofilament line, ratia line and plastic sheets were used as substrata, and these were strung between stakes on the gracilaria grounds. There were impressive spore deposits, which in turn produced dense outgrowth of seaweed. Growth rate in the f'ield was estimated at 3.5% per day. In other words, the juvenile would double itself in weight in about a month.

One disadvantage of seeding on natural Gracilaria grounds was that of mixed spore deposit from both Gracilaria species. (In the lab, you can seed different species in different tanks and thus keep the species separate.) Mixed farming gives rise to problems at the post-harvest stage.

Q: *After the spore settlement and outgrowth work, what steps are taken to establish a pilot farm? What has been your experience with the pilot farm?*

A: Before going into the expense and effort of setting up any large-scale experimental farm, we first have to test the suitability of a given site : in other words, can the juvenile gracilaria species survive in that environment? So we set up a small test unit consisting of nothing more than four lines – two'of which carry gracilari,a sporelings, and two carry gracilaria spores. The latter will establish whether in-field seeding is possible at the site: Once the survival factor is established, work can commence on setting up a pilot farm which should be large enough' to produce some useful data that can be extrapolated to commercial levels either ,as hectarage or acreage. For the present project, we decided ona30m x 30mpilotfarm holding

240 10 metre-lines, largely because this is a practical size in view of limited staff strength and limited work time which is governed by the low tide durations. At present, we have one completed 'pilot farm established on the Middle Bank, which, though still in its infant stage, is beginning to show good results. In addition to 'standard' farm lines of rafia, this pilot farm is also being used to conduct further experiments on farming methodology, which will include increasing the farming density, in-field seeding and variations of the basic farming system. Test units have been established at some of the bays on the south coast of Penang and also one on the sandbank near Batu Maung. If and when these produce positive data, the establishment of pilot farms here as well could be considered though we also have to bear in mind the current fishing activities conducted by residents in these areas, which may call for a totally different method of farming.

Fortunately, one thing we did foresee at the Middle Bank pilot farm was the problem of drift material, notably the green algae *u/va.* Had the lines been set cross current, the volume of drift material carried across the farm and getting entangled in the lines would soon have uprooted the stakes and even snapped the lines. By orienting the lines parallel to the current flow, this problem has been largely overcome.

Spore discharge experiment at the Glugor Institute.

Q: *You commented earlier that the choice of substrata for spore deposit depended on cost and local availability of material. Would you like to elaborate and also discuss the costs and earnings of a full-scale commercial seaweed farm?*

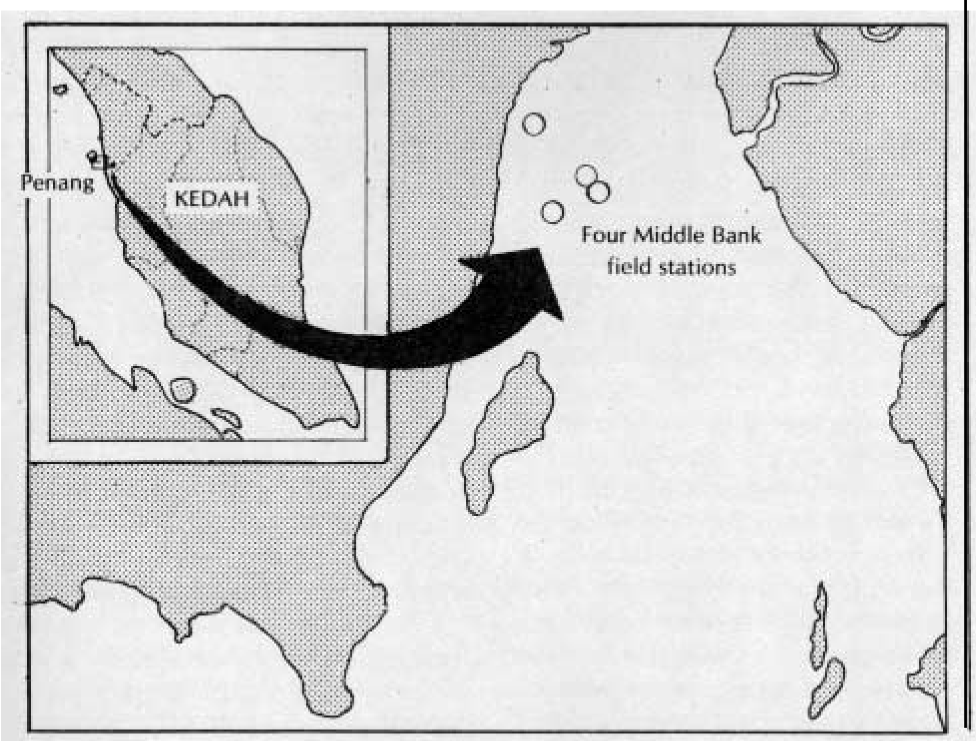
A : To answer the second part first, it would be unwise at this point, to guess the potential income of a farmer on say, a one-hectare farm, as we have still to establish the productivity of the present farming system in terms of kilos of seaweed in a given area.

Also, potential buyers for the raw material have to be approached with samples in order to establish the selling price. The pilot farm will itself ultimately produce reasonably accurate productivity information which will later include the number of harvests that can be conducted per year. These harvests will, of course, provide the raw material that can be sold to prospective buyers.

As for the farming itself, we have looked at many types. of locally available substratum. They vary in cost, but many of them are basically free. After the earlier seeding experiment, it seems obvious that the most successful substratum in terms of actual outgrowth is the rafia line, which costs U.S. $ 8 per roll of 2000 metres. In commercial farming it is hoped that the villagers will acquire their own stakes without cost. For if these have to be purchased, the farming expenses would increase

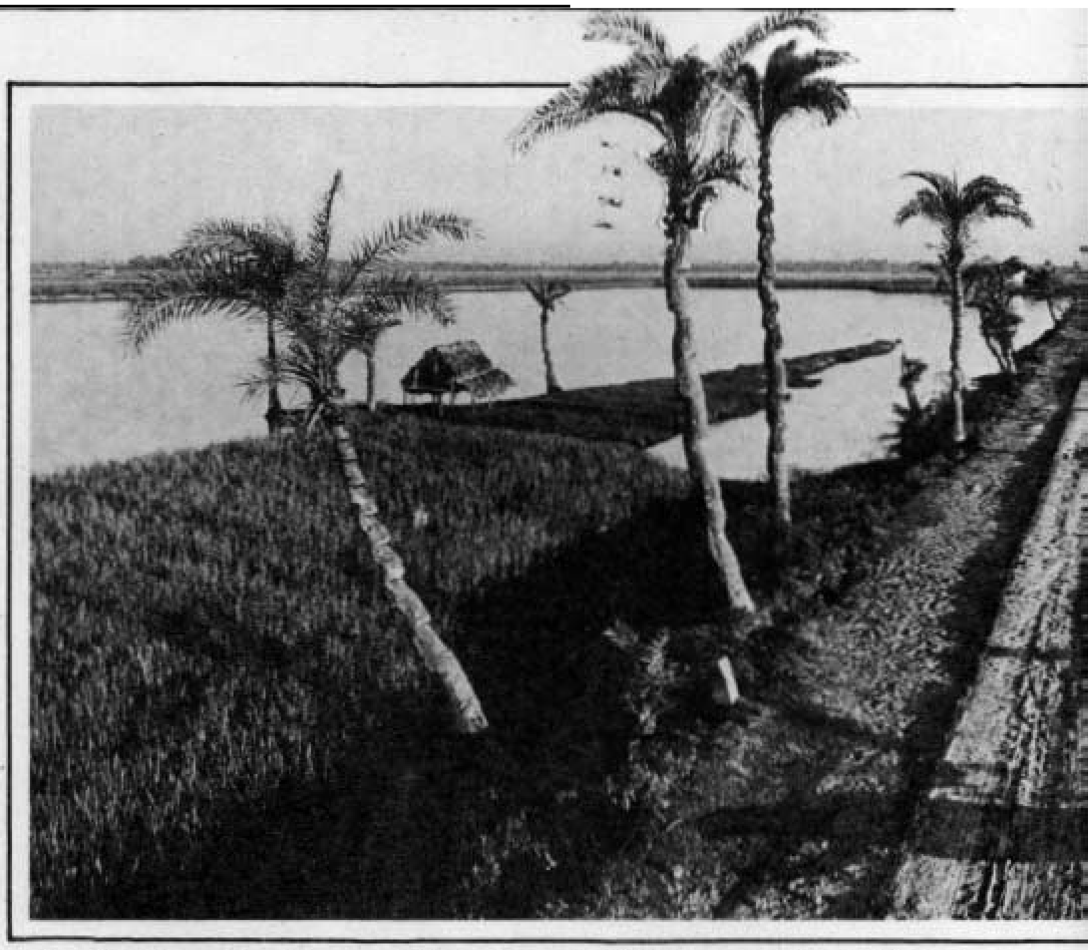
(Continued on page 32)

This map of the project site shows the location of four field stations in the Middle Bank which is located between Penang and the mainland.
Inset: Location of Penang with respect to the mainland.



Creating a. model for shrimp farmers: A profile of the Satkhfra project, Bangladesh

Shrimp farming is spreading fast in Satkhira, a quiet little farm town south-west of bhaka. One of the reasons is a demonstration project assisted by BOBP that has buoyed shrimp farmers and drawn scores of visitors. Dr. M Youssouf Ali, Secretary of Fisheries, Bangladesh, has described the setting up of the project as "a dream come true". BOBP's S. R. Madhu visited the project in October and interviewed staff, consultants and fish farmers. Here's a report.



This is Satkhira. The village road lies between the BOBP-assisted demonstration project (left) and a private paddy farm. (Picture by S.R.M.)

To reach Satkhira, you fly south from Dhaka to Jessore, then drive down 75 km of bumpy road. You go past paddy fields and palm trees, numerous ponds and canals, and hole-in-the-wall shops at little village bazars.

Agriculture is the mainstay of Satkhira, but many people culture shrimp in paddy fields during the January-July season. They let in tidal water, trap the fish, let them grow and harvest them in course of time. They make a profit.

No wonder a two-man mission from BOBP (J.G: Broom, consultant, and M. Karim,aquaculturist) that explored several possible sites for a shrimp culture demonstration project in 1981, selected Satkhira. Why? As mission members put it: "The land is here. Shrimp seed can be got easily. The salinity table is favourable, the tidal flow is moderate. With a scientific approach, shrimp farming can be highly lucrative."

Following the mission's report, a three-year demonstration project was launched in 1982 by the Bangladesh Government with BOBP technical support. Its goals are to demonstrate scientific techniques to local farmers and to help them boost production and incomes. The widespread use of such techniques, it is hoped, will trigger a myriad job opportunities — for constructing ponds, maintaining dykes, collecting fry, controlling predators, harvesting the catch, transporting, processing and marketing it. Such a boom will provide a fillip to development in Satkhira.

The demonstration project got off the ground quickly. A site survey was carried out early 1982, detailed engineering plans, including pond layout and design, were drawn up, land was acquired, scientific equipment was ordered and bought. Bangladesh scientists attached to the project went on study tours of shrimp farms in .India; so did consultants engaged to construct the ponds. A socio-economic survey was initiated of the population near the project site. Pond construction was taken up and completed in three months, with a 300-strong work force executing a variety of excavation, masonry and carpentry jobs. An experienced consultant (A.N. Ghosh of West Bengal, India) was engaged for culture trials. A laboratory-cum-office was set up.

Seen from the road, the project complex is a 20-hectare expanse of green, brown and blue lit up by a fierce sun. It consists of a four-hectare "agro-aquatic paddy basin" where shrimp happily co-exist with paddy during the wet-season; 10 ponds of 0.8 hectare area each; a 2.2 hectare "catch basin"; a small two-room building that serves as a laboratory and office; four thatched huts where guards sit; sluice gates and canals. (See diagram on page 26). The project's neighbours include both paddy and shrimp farms.

Culture trials began early '83. Between March and May, nine ponds were stocked with *Penaeus monodon* seed. The first harvest was recorded in August. Paddy-cum-fish culture in the agro-aquatic basin was taken 'up after the onset of the monsoon. Paddy was planted in the shallow areas, fresh water shrimp and carp in the deeper areas, as also in two ponds. The second stocking of *Penaeus monodon* seed is due end-December, the second harvest end-March.

the cultured shrimp in these nets. Habibur Rahman and Giasuddin sit by a pond, fiddling with esoteric instruments. They are recording the "physico-chemical parameters" — such data as pH, salinity, temperature. We also see pond-clearing operations with a nylon dragnet : several project assistants wade through a pond, dragging a net forward. As they reach the other. end of the pond they converge, and the net convulses with catch : seabass, some white prawn and some *P. monodon.*

Why are the ponds.being cleared? It is late October : One harvest has been completed and before the

ponds are stocked again, they have to be cleared, emptied and dried, and tidal water (from the Morichop river) let in to strengthen benthic organisms. Eight ponds are in the process of being drained.

We observe one pond being drained as a pumpset emits a continuous raucous drone, water gushes out with great force into the catch basin. It will take a full two days for the pond to empty.

We hold several sessions with consultant Ghosh, project staff and associates to learn more about the project. Here's a gist

Running the project complex are two young scientists, Kibria and Rahman; a clerk who assists in field work, Giasuddin; Jalaluddin, driver of a hard-worked Toyota land cruiser (whose tyres puncture frequentlyon the bumpy road); and about a dozen subordinate staff. The scientists live in a three-room house rented by the project about 4 km from it.

We go on a quick tour of the project complex. In one pond, project staff hurl five cast nets simultaneously. A picturesque sight — part of the process of "biological sampling." Growth data will be recorded for

Q: Please describe the technology package the project is trying to introduce into Satkhira.

Ghosh : Traditional shrimp culture practices here can be vastly improved by simple innovations. Selective stocking 'is one of them. We stock ponds with the seed we choose, rather than with what the tide brings in. Eliminating predators that prey on the shrimp is another. We keep out the predators by screening the tidal water. These two practices alone can pay rich dividends. Many shrimp farmers of Satkhira, who want to earn more without spending more, have already taken these up.

We are also trying out different eombinations of stock and species. O'he aim is to determine the best stocking density and advise farmers to limit stocking to that level. Right now private farmers resort to excessive stocking — this pushes up cost without increasing revenue. So it is wasteful. It is also our aim to identify the best species suitable for culture given the natural food in the ponds.

Another technique is nursery management. We impress on shrimp farmers that this will increase the survival rate of shrimp fry. We set up nurseries in the ponds, feed very young shrimp with a mixture of rice bran or oil cake and mysid. Excessive feeding can lead to organic pollution of which shrimp may be the first victim.

Regular water exchange is essential. We ensure this by draining the ponds and letting in fresh tidal water. Water exchange controls salinity, improves oxygen formation, brings in additional food material and encourages productivity. In fact coastal aquaculture in this part of the world depends mainly on the amount of tidal water available during each tidal cycle. And to be effective, an aquaculturist has to be a combination of a physicist, a chemist, an engineer and a biologist with knowledge of hydro-dynamics!

Q: *How do you obtain prawn seed for the ponds?*

Habibur Rahman, project scientist: For the first stocking, prawn seed was bought from a number of traders — as far as 30 km downstream. The

A harvesting operation in progress — project staff haul in a bagnet.

stocking had to be staggered from March to May as prawn seed was insufficient.

Till October end, 150,000 prawn seed had been bought from private traders at a cost of 250 taka per thousand. This cost can be brought down by organizing seed collection ourselves. A boat is soon to be made available to us by the government. It will help us demonstrate to the Satkhira fishing community how they can augment incomes by collecting prawn seed.

Q: *Any example of a private shrimp farmer who has effectively applied the project's techniques?*

Emdal-ul-Hoque (landlord, engineering contractor and private fish farmer) : In the matter of shrimp culture, I was a sceptic — until I observed the work of this project. In February 1983, I took on 4-year lease some land that all along has remained idle. I 'did selective stocking as advised by the project — put in 700 to 800,000 post-larval shrimp and fed them at an early stage mysid meat and wheat bran. Results have been good. My shrimp production was certainly better than that of other private fish farmers. I also cultivate paddy in the farm during the wet season.

Q: What do the agriculturists of Satkhira feel about the project?

Mr. Mohammed Abdul Sukur (Sub-divisional officer, Satkhira) : Well, some people do not like farming and fish farming being carried out in the same land. They are against farmland being inundated with saline tidal water. Our stand is : if fish. farming brings in more money for everyone, why should they object to it? Last year many top Bangladesh officials held a public meeting in Satkhira to exchange views with citizens here. They said shrimp culture should be encouraged because it was lucrative.

Q: *What is the paddy-shrimp concept at Satkhira? Is it different from what is being tried elsewhere?*

Ghosh : Farms that "host" paddy in the wet season and shrimp in the dry season are fairly common. Our project alternates polyculture of fresh water shrimp, fresh water fish' and paddy (during the wet season) with monoculture of marine shrimp (during the dry season). This combination has not to my knowledge been tried before. The aim is to maximize the return.

Rotating the aquatic crop with the land crop enhances soil fertility and expands job opportunities besides multiplying the return.

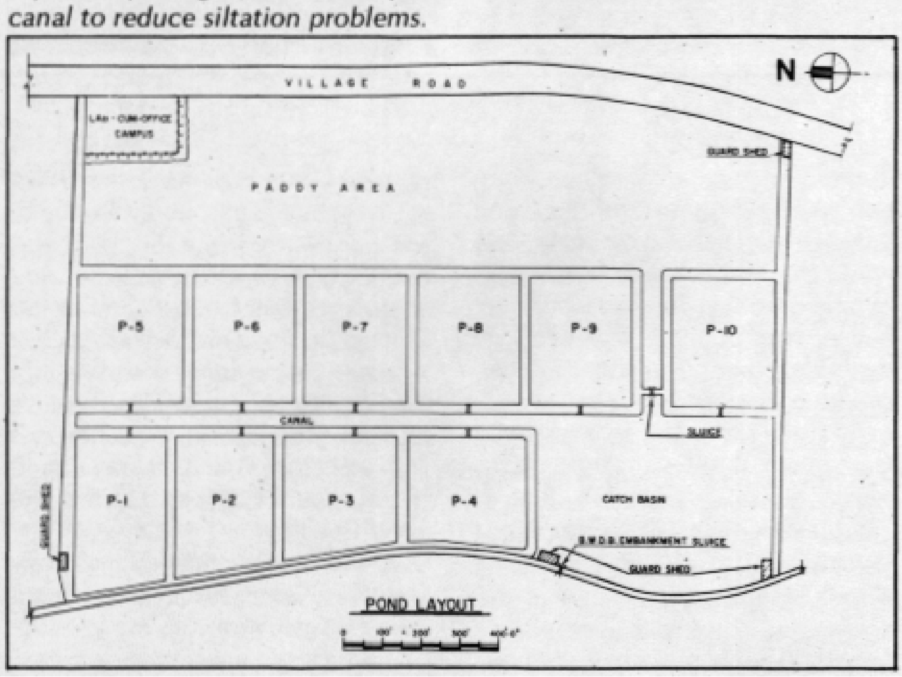
Q : *Doesn't paddy cultivation require agricultural expertise? Do you have it in this project?*

Ghosh: No, we do not; we engaged contract assistance this season. The idea of including paddy area in our project'was simply to convince farmers salinity of a certain magnitude can be tolerated by paddy. We hope the paddy harvest Will bear out this fact.

Q: What problems have you faced so far?

Ghosh : The most serious problem was a fungus attack on prawn in some ponds. It occurred last May, a result of "dead spaces" in th.e ponds. We tackled the dead spaces by removing bamboo screens from the ponds, letting in fresh tidal water and treating the ponds with lime. But to save the afflicted prawn, we had to release them, either into the

A layout of the 20-hectare Satkhira project. The catch basin (bottom right) is presently being remodelled to provide for a narrower supply-cum-drainage canal to reduce siltation problems.



feeder canal or into the agro-aquatic field.

Another problem we encountered was rain : pre-monsoon showers reduced salinity in the feeder canal; and torrential monsoon rains threatened the pond dykes. Fortunately the project got the better of both problems.

Q: How good was the first harvest of P. monodon in August? And the harvest of freshwater shrimp (Macrobrachium)? And of paddy?

Ghosh : Considering the problems just mentioned and the fact that this was the first cycle, the harvest was'nt bad. We obtained a total production of 1264.6 kg of which 986.0 kg was shrimp, from a culture area of 8 ha. This compares very well with the harvest that private shrimp farmers have been able to get.

Fresh water shrimp *(Macrobrachium* sp), had not been harvested as of early December. Paddy has been harvested and a sample production survey reveals a production 'of approximately 380 kg per hectare. (rn paddy farms which do not culture shrimp, production varies from 360 to 400 kg per hectare.)

Q : Is'nt the project's emphasis totally technological? Is there an effort to find out how it will be absorbed by the fisherfolk?

Traders bring in prawn seed from places far and near.

S.K. Chakraborty (economist from Development Consultants, a contract firm engaged by the project): We are carrying out a socio-economic survey of the population within a two-mile radius of the project. The idea is to compare their living conditions before and after the project and thus assess its impact. Through a detailed survey of 32 households data is being obtained on population characteristics, employment patterns, land ownership, tenurial pattern, cropping pattern, production, disposal of crop, cost of cultivation, livestock position and return from livestock, shrimp culture, cost of shrimp production, household consumption expenditure, investment etc.

Q: Did people cooperate in the socio-economic survey? How do you know that the information you obtained was accurate?

Chakraborty : Those who wish to acquire the project's modern technology readily parted with information. There are also people who don't want shrimp farming to spread. They believe that swamping tidal water into farms is not a good thing. They cooperate with us hoping that our conclusions will help them.

We cross-checked some of the data we obtained with available land records. There have been nO serious discrepancies. A certain margin of error is inevitable.

Q : What has been the experience of the Satkhira project staff? What problems have they faced?

Habibur Rahman, scientist: My experience at Satkhira has been exciting. I have had some tough moments, some anxious moments. The first time I had to conduct water exchange I was tense. A mistake could lead to flooding. For the first stocking operation during March-May, we had tO collect prawn seed from far and near, it was not easily available. Sometimes we returned late in the evening, then sorted all

Project staff supervise maintenance work on the main sluice.

the seed, and worked in torchlight and kerosene light to' stock the shrimp. The fungus attack on the shrimp had us worried for a few weeks. The heavy pre-monsoon and monsoon showers were critical times. They hit the culture operation, they also made the project site and its access road very slushy. "I feel like skating here!" remarked Mr. Engvall, BOBP director, when he visited us during monsoon time.

It is arduous work. We do not observe Sundays or holidays. Night duty is frequent. Entertainment? Only the radio. And group music — some of the project assistants have a flair for it.' But despite all this, I have enjoyed working here, and am proud that the project is doing well;

Dr. M. Youssóuf Ali, Secretary of Fisheries, Bangladesh remarked after a recent visit to the project : "I feel happy to see my dream come true. I would like Satkhira to develop as a lead centre for the development of *Penaeus monodon* in the region." He added : "Aquaculture has tremendous potential here. A shallow low-production area can be made to produce a substantial quantity of shrimp. . . I hope demonstration projects like Satkhira can come up with FAO assistance in other coastal districts of Bangladesh too."

Above: Shrimp culture on a paddy farm. Project consultant A N Ghosh (left) and scientist Habibur Rahman study the health of the shrimp. Below: Project staff trek homewards after the day's chores.

The Satkhira Challenge

"Satkhira offers a unique opportunity for the development of coastal aquaculture," says consultant A. N. Ghosh. He analyses this opportunity, and the technology package introduced by the BOBP to tap it. He cautions : 'We have a long way to go to realize the objective of optimal production."

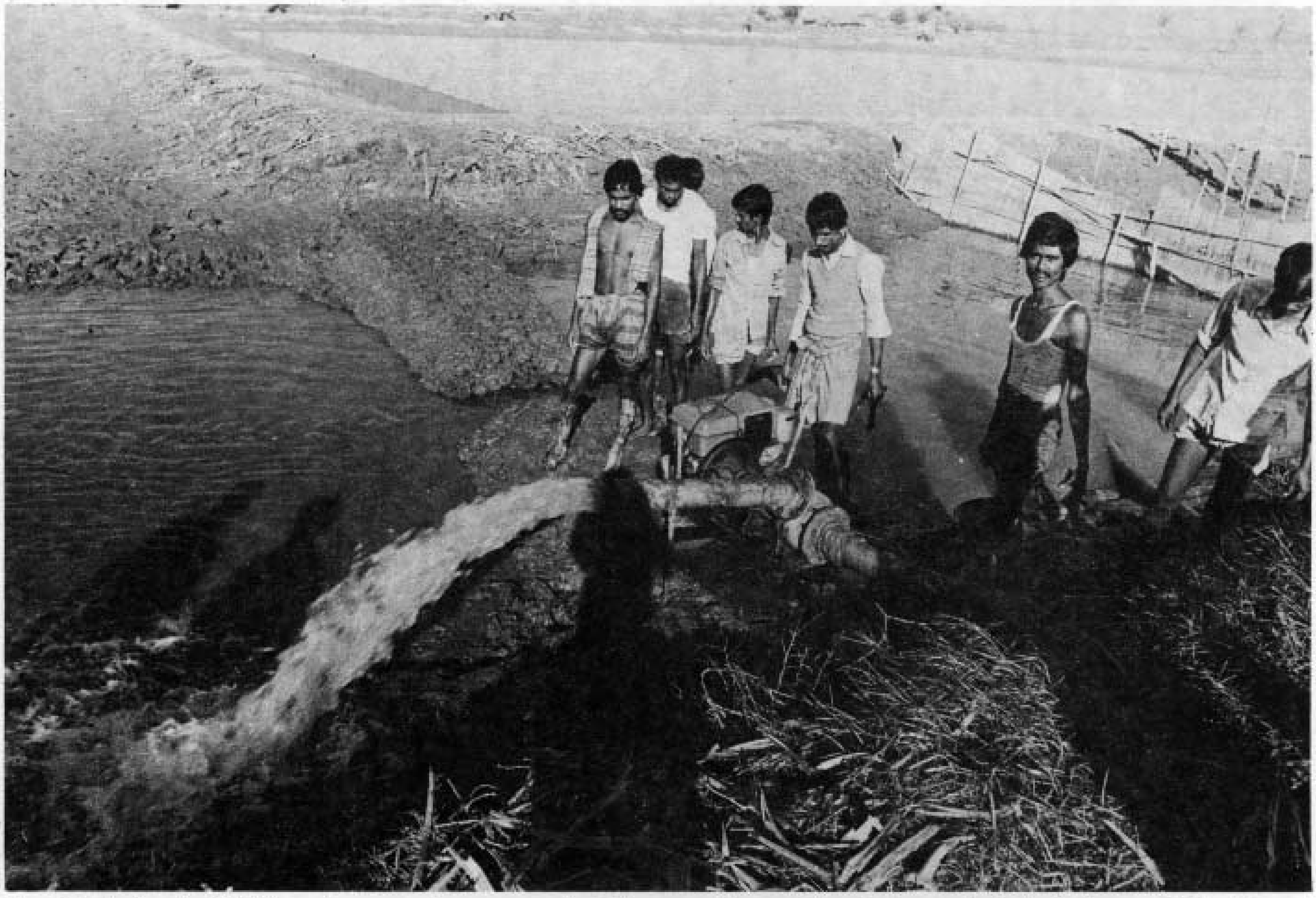
Satkhira sub-division in the Khulna district of Bangladesh about 75 km. south west of Jessore, flanked by the tidal Morichop river and the Satkhira Khal, offers a unique opportunity for the development of coastal aquaculture. This uniqueness may be attributed to several factors — its location in the reclaimed Sundarbans, a low-elevation area; a moderate tidal range that makes possible the building of embankments with narrow low-cost dykes and easy but efficient water management; and a low-to-moderate salinity range offering opportunities for the culture of both brackishwater (marine) penaeid prawns and freshwater palaemonid prawns by rotation along with paddy during wet months,

In fact, discouraged by the uncertain returns from paddy cultivation, which depends mainly on the quantum of rainfall, a large number of farmers had in recent years started trapping and growing shrimps in large impoundments during the dry seasons to supplement their income. Encouraged by the success of such culture, some of them had started perennial fishery in the lands adjoining the tidal systems. Today, out of 18,632 ha. of such tidal impoundments in the district of Khulna, more than 7,905 ha. belong to Satkhira sub-division alone! That is why BOBP considered it desirable to provide 'the farmers with easily transferable technology which will improve their yield per unit area on one hand and'ensure better utilisation of available land resource through agro-aquaculture on the other.

The technology being adopted centred on the selective stocking of candidate species of high market value, predator and competitor control, stock manipulation for size and species, water management, and crop rotation between dry and wet months. In wet months the aquaculture was proposed to be carried out in association with paddy cultivation. The basic concept behind this culture technique is to introduce aquaculture without changing the ecology of the paddy fields. It is universally known that reclaimed Sundarbans is a monocrop area where cultivation of paddy is only pOssible during monsoon months. DTh-ing non-monsoon months, agriculture is not possible on account of high sub-soil salinity and lack of rainfall.

Whenever the land is allowed to remain fallow in dry months, the sub-soil salinity is transferred to the top soil (through capillary action resulting from high temperature and rapid evaporation). With population pressures increasing the demand for

Repair of pond dyke by women construction workers at Satkhira.



Pond-draining in full flow by use of a pumpset. After one harvest has been completed, the pond is cleared, emptied and dried, and tidal water let in to strengthen benthic organisms.

land, the possibility of multi-purpose use of agricultural land will have to be considered. Hence th,e practice of both alternating and coupling aquaculture with agriculture was considered to get a better return from the same unit area.

This system of fish culture helps beneficial use of the soil. Reason The shell of prawn, shed with every moulting, and the excreta produced by fish, enrich the soil with organic content through mineralisation. This naturally benefits subsequent agriculture. It also helps restore the calcium in the soil (through the breaking down of the prawns' calcareous shells). Furthermore, if the soil is waterlogged immediately after paddy harvest when it is still wet, the transfer of salt from the deeper layer to the surface during dry seasons due to evaporation can be checked, and the soil will further improve for better agriculture.

At present, agriculture in Satkhira provides employment only during the kharif season : for sowing and harvesting paddy. For the rest of the year the rural poor are largely unemployed. If aquaculture is alternated with agriculture and a new thrust is given to prawn culture, almost all rural labourers will get job opportunities for the rest of the year beyond the agriculture season — either in the fishery, or in collection and transportation of seed to the fishery, or for handling raw material for marketing, (grading of prawns, deheading, packing and despatch). Similarly, some people will be engaged to prepare baskets for transporting prawn, and to supply and transport ice to urban processing plants.

It may be stated that the net per-hectare return of paddy alternated with fishery will be at least 10 times more than that from agriculture alone. To demonstrate the, basic tenets of the proposed technology, the salinity regime during different months of the year, as could be ascertained from previous records, was taken into consideration for' planning the work schedule. The rising salinity from January to July was considered for the growth 'of brackishwater organisms while the comparatively low salinity period from August to December was reserved for freshwater organisms with euryhaline species of brackish-water forms. In the selection of candidate species, emphasis was given to available local varieties of high-valued peneaid and palaemonid prawns which have ready market acceptability. Thus, *P monodon, P indicus,* and *M. monoceros* amongst penaeid prawn and *Macrobrachium rosenbergii* amongst palaemonid prawn were selected. Among finfish, mullets *(Liza parsia* and *Liza tade)* and carps *(Labeo rohita and Cat/a cat/a)* were chosen. In addition, some species — seabass *(Lates calcarifer)* and threadfin *(Eleutheronema tetradactylum)* — were contemplated for culture in the feeder, channels in view of their predatory nature.

The first step in management was to screen the inflowing tidal water at the entrance to each compartment and the adjoining agro-aquaculture field to prevent the entry of predators and competitors; and to stock these impoundments with a known density of candidate species after rearing them in specially constructed nurseries till they had ,attained a particular size suitable for stocking.

These nurseries were set up within individual compartments by enclosing a small area with closely knit split-bamboo screens and providing these' enclosures with false substratum. These would serve a dual purpose: they would enable the young ones of prawn to remain near the surface and also provide additional food in the form of periphyta on one hand and shelters to the moulting ones on the other. Once the young prawns grew to a stockable size of 40 mm to 50 mm the improved nursery structures were removed and they were allowed to spread over each compartment where enough natural food was produced by this time for ready consumption. This over, regular exchange of tidal water with the stored water to reduce the metabolite load on one hand and oxygenate the culture system on the other, was the primary objective of management.

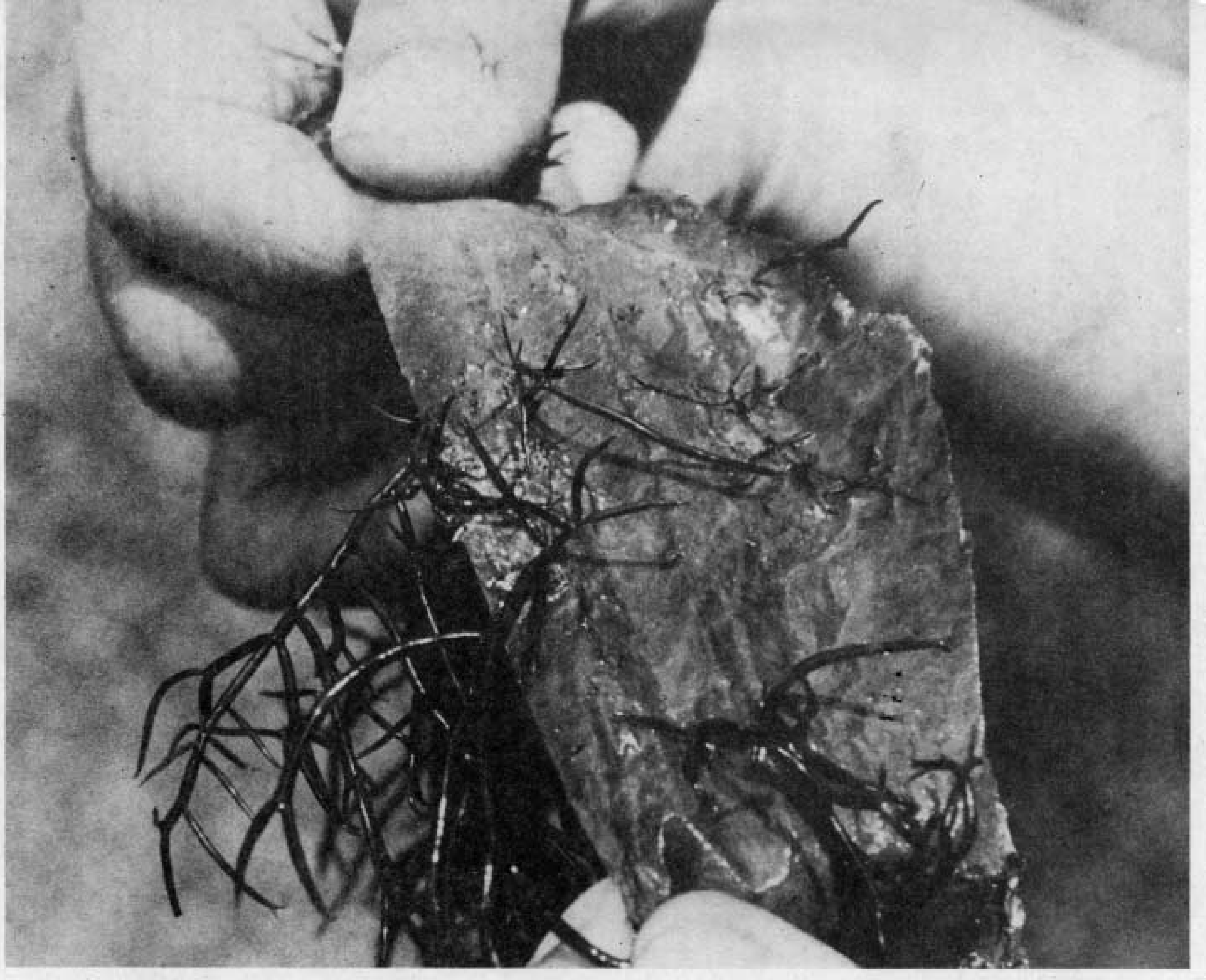
Because of delays in the completion of construction work, culture activities could be taken up only towards the end of February '83. But by this time the peak collection season of *P. Monodon* seed was almost over in the region and stocking was done at three different levels: at 8000 nos., 16000 nos. and 24000 nos. per hectare. Necessary nursery management, as envisaged, was carried out in most of the compartments. Supplementary feeding was done during nursery management, as and when necessary, with rice bran, mustard oil cake and dried powered mysid larvae. These. mysid larvae were collected from the farm site and dried there itself.

Frequent pre-monsoon showers after stocking interfered with the culture operation. The interference took two forms : fluctuation in the salinity levels and (ii) erosion of soil from the newly constructeddyke on to the bed, hindering the production of benthos which formed the natural food fo,r the stocked organisms. In spite of these Jiandicaps, the production was not discouraging. In six months a production of 1264.6 kg was obtained from a culture area of 8 ha. Of this quantity 986.0 kg was shrimp. This figure compares well with production obtained through traditional culture methods and encouraged local fish culturists to visit the project site for help and guidance.

Perhaps production would have been still better but for a fungal attack in some of the culture ponds endangering the survival of stocked material. Timely action and relentless effort on the part of all the project staff controlled the spread of disease and saved the stock. Soon the monsoon burst and, with its onset, torrential rains, coupled with strong south winds, endangered the very existence of some of the dykes and dislodged parching soil from them. This also gave the project staff some anxious moments. The concerted effort of all project personnel warded off this danger too and gave them the confidence to tackle furture adversities. This confidence was also passed on to loeal fish culturists who visited the project for advice on solving their p?oblems.

However, we have a long way to go to realize the objective of optimal sustainable production. That is why Satkhira is a challenge to us. A challenge to harness nature's resources and help local farmers modernize aquaculture and improve their incomes and social status.

Project staff hurl castnets to sample shrimp under culture.



Gracilaria thalli developing from spores naturally attached to a plastic bag collected from the Middle Bank.

How to farm seaweeds

(Continued from page 23)

quite considerably. Fortunately, mangrove vegetation, which can provide the stakes at no cost, is abundant in Malaysian shores. We are also still working on possible methods of reducing the number of stakes needed for farm operation by linking'stakes with strong cord and tying the rafia to this cord rather than to individual stakes. As an example, our present pilot farm utilizes 240 stakes. But if stakes were set five metres apart instead of half a metre apart, the same area would need only 28 stakes.

Q: *Pond culture of Gracilaria thal/i was tried out in the Ban Merbok ponds in Kedah state. Was it effective?*

A: Attempts to induce spore development with Ban Merbok water in the Glugor institute were unsuccessful : the spores disintegrated within 78 hours of spore discharge. Thus, Gracilaria induction at Ban Merbok can only be vegetative – that is, by growth of thalli, rather than by spore seeding and outgrowth. Test gracilaria thalli placed in the Ban Merbok ponds have reacted well to the environment. There has been very little predation of thalli in the shrimp ponds but it has been noticed in the connecting canals where fish abound.

Q: *What problems and failures did the project as a whole experience?*

A : Let us cite just two or three examples.

- Seedstock collection was often hampered by high tide, by rain, and by transport difficulties.
- Initially, the cockle shells showed excellent promise as substrata, but field growth was poor.
- We were hopeful about culture in the Jelutong fish cages, but good growth was nullified by such problems as silt, epiphyte growth and tip predation.

Q: *What have you Mr. Fisher, learnt from this project? What do you regard as its most positive features?*

A : I have learnt to shed preconceived notions. Each environment has its peculiar problems, and there is no universal formula for seaweed culture. On the whole, it has been an eventful and fairly rewarding year. While there is a long way to go before substantive commercial seaweed production is realised, we have made a good beginning and established what appears to be a successful methodology albeit applicable to one site. However, the techniques can be niodified at other sites to suit peculiarities encountered there. Also heartening has been the cooperation with the Glugor Institute and the enthusiasm and ability shown by its scientists, and the co-operation with the BOBP which funded ARDP's participation in the project.

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