BOBP/REP/54

Developing and Introducing a Beachlanding Craft

(on the east coast of India)

BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

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Small-Scale Fisherfolk Communities GCP/RAS/118/MUL

Developing and Introducing a Beachlanding Craft on the east coast of India

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This report reviews and analyzes the work of the Beachlanding Craft Development subproject of the Bay of Bengal Programme (BOBP). It briefly describes the development of these craft and their introduction on the east coast of India, analyzes their present status and discusses the results.

The report was prepared by a consultant with wide experience of fisheries in the Bay of Bengal region, on the basis of documentation on the subproject, published and unpublished, as well as impressions gathered during field visits to fishing centres in Andhra Pradesh and Orissa during August 1992. Assistance received by him in carrying out the field visits from Mr. S. B. Sarma of the Andhra Pradesh Directorate of Fisheries and information provided by fisheries officials, fishermen and boatyards are gratefully acknowledged.

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

This report has not been cleared by the governments concerned or the FAO.

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SUMMARY

The development of a new type of user-friendly and more efficient fishing craft for operation off open beaches was identified as an important component of technology development to help the participating countries of the Bay of Bengal Programme (BOBP) achieve their ultimate objectives of

- improving the standards of living and the quality of life of their small-scale fisherfolk, and
- increasing fish supplies.

With this in mind, a beachlanding craft (BLC) development project for the east coast of India was launched in 1979. Its immediate objective was to develop "fishing craft capable of operating satisfactorily, technically and economically, from surf beaches".

The development and trials of several prototype beachlanding craft during 1979-1984 resulted in two models – IND-20 and IND-25 -- being deemed suitable for commercial introduction.

Positive government interest during the development of the craft resulted in the introduction of over 300 of these craft between 1986 and 1992 through several government-sponsored credit schemes. About 50 more craft were introduced during the period without government assistance.

While the technical feasibility of the craft had been tested at the time when commercial introduction commenced, their economic viability was yet unproven. BOBP emphasized the need to continue the economic viability tests as well as the need for careful planning of their commercial introduction with special attention to :

- Careful selection of capable operators and suitable bases;
- Training; and
- Close monitoring and effective official support.

A considerable amount of development work continued to be carried out by BOBP even during the commercial introduction of the craft. This work included :

- The conduct of offshore fishing trials,
- Training;
- Transfer of FRP construction technology to boatyards, and
- Modifications to the engines, hulls and propulsion units.

There is a wide disparity in the relative present status of the two BLC types considered suitable, IND-20 and IND-25. Due to the manner of its utilization for fishing, as well as the attempt to operate it under a joint-responsibility system, the IND-25 is virtually non-operational in Tamil Nadu and Pondicherry. While better utilized in Orissa, it nevertheless has had only limited acceptance there. The IND-20, however, has become widely accepted, particularly in Andhra Pradesh and Orissa.

The present de facto locations of BLCs in Andhra Pradesh and Orissa are not the same as the locations they were originally introduced. Due to illicit transfers within Andhra Pradesh, as well as from Andhra Pradesh to Orissa, and seasonal migration along the Andhra Pradesh coast and from Andhra Pradesh to Orissa, the craft have tended to concentrate in a smaller number of fishing centres offering better prospects for fishing than the numerous locations originally targeted.

BLC now regularly operate in many areas of Andhra Pradesh and Orissa. The main fishing gear used are the large mesh driftnet and the drift longline. The BLC operations are mostly in waters of 50-70m depth, with a few craft operating in offshore waters. In some areas of Andhra Pradesh, operations are confined to inshore waters. Puri, in Orissa, has the largest concentration of BLC, and these have been landing large catches of Seer and, more recently, Shark. The performance of hulls has been generally satisfactory. Some engine problems encountered at first have since been

solved. Sails are used extensively by these BLC, but the modern rigs introduced by BOBP have not received wide acceptance.

Information on BLC earnings is scarce. The Uppada (Andhra Pradesh) fishing trials in 1985-86 and the Thirumullaivasal (Tamil Nadu) fishing trials in 1989-91 showed annual net earnings of Rs.32,656 and Rs.22,596 respectively. Circumstantial evidence points to very high earnings by BLC operating from Puri.

The handling of the development process of the BLC by BOBP was thorough and systematic, with two notable exceptions:

- The lack of justification for development of the IND- 25; and
- Insufficient attention to the solution of the engine problems

In the commercial introduction of the BLC, no attention was paid to the selectivity criteria, suggested by BOBP, when choosing capable operators and suitable bases. The uniform distribution of the craft to fishermen's cooperative societies proved to be **counter-productive** and most of the craft became *de facto* individually owned. **The issue of cooperative ownership of craft needs to be reviewed and provision made for ownership by selected members who are enterprising fishermen.**

The attention given to training during the process of commercial introduction was too little and too late. More fishing demonstrations should also have been carried out as follow-up to the Uppada fishing trials.

The BLC has proven itself in surf-crossing and beachlanding and there is a consensus among fishermen that it is a safe and comfortable craft. While none of its beachlanding characteristics could be considered superfluous, they have, nevertheless, imposed a limit on the craft's size and, consequently, on its operational range. While the main complaint of the fishermen has been about engine defects, such defects have not led to any craft being abandoned or rendered inoperable. The engine problems were due to the engine installed by BOBP. But, then, BOBP had no alternative but to use these engines, and, considering the handicaps, their development to the present level is a considerable achievement.

Given that the BLC is, in general, a technically satisfactory fishing craft, its earnings will be determined by factors related to fishing gear, location and human skills. **It is obviously not a craft for everyman and has to be operated and manned selectively.**

The cost of the BLC places it beyond the reach of the informal credit market. It has, necessarily, to be financed for the small-scale fishermen through institutional credit. In the case of craft acquired through government-sponsored institutional credit schemes, the question of cost and affordability have not been a consideration for the beneficiary fishermen. Illegal transfers have had no relation to these factors. The really relevant issue with regard to capital cost has not been its quantum, but the 'bankability' of the craft – and that depends on its earnings. In order to rationalize its introduction and establish its bankability, state fisheries agencies should :

- Establish systematic monitoring of BLC operations;
- Formulate 'project reports' for financing BLC on the basis of such monitoring;
- Make appropriate changes in state-sponsored schemes to consider such reports;
- Ensure selectivity in further introductions;
- Aim at promoting the establishment of bank-financed credit schemes; and
- Establish appropriate credit supervision measures.

The majority of BLC are being used to harvest food fish resources further offshore. In some locations, new resources of Flyingfish, large pelagics and Shark are being exploited. Considering the small numbers and local concentration of the BLC off Tamil Nadu and Andhra Pradesh, a significant impact on the resources seems, so far, unlikely. The situation in Puri, however, appears

to be different. The causes of the slump in catches of large pelagics since 1988-89 are unknown, but the decrease gives rise to concern. The recovery of the Puri season in 1991.92, with large and lucrative Shark catches, is likely to lead rapidly to excessive fishing effort on a very vulnerable resource. In spite of the resemblance of the Puri operations to the classic scenario which leads to overfishing, these operations are not being monitored. **Official action to monitor these operations is** an urgent **necessity.** Monitoring of the growing Shark fishery off the entire east coast also needs to be considered.

The proliferation of FRP construction technology on the east coast and commendable initiatives by boatyards in developing FRP craft, such as a FRP Nava and a FRP ***Teppa,*** are spin-offs from BLC development. Early action is needed to monitor quality of construction and to lay down quality standards for boatyards carrying out FRP construction.

Another spin-off is motorization of traditional craft, which has also begun to show an increasing trend. The operations of these craft, taken together with BLC operations, will from now on increase pressure on resources further offshore. Timely action should be taken to monitor these operations.

Other spin-offs from BLC development have been :

- The location of new, or less exploited, offshore resources;
- Use of new fishing methods;
- The diversification of fish marketing; and
- Use of the BOB Drive in the motorization of outrigger canoes in Shri Lanka and Indonesia.

The FRP nava which was first developed by the Andhra Pradesh Fisheries Corporation (APFC), one of the spin-offs of its work with BLC.

1. BACKGROUND

The Project Request (1977) of the FAO/SIDA project "Development of Small-Scale Fisheries in the Bay of Bengal" [1] identified the problem of the small-scale sector[2], with its acute need to improve the standard of living and the quality of life of fisherfolk in this sector, as "the biggest and most critical human problem in world fisheries". Although these fishermen contribute a very large proportion of the total fish production, their ***per capita*** production is very low, resulting in reduced income. This is the root cause of their poverty. The low level of their socio-economic conditions is also attributed to a combination of economic and technological considerations, such as low productivity, inefficient technology and weak institutional support.

The improvement, development and application of appropriate existing or new fishery technology was identified as one component of the Project's immediate objectives of developing and demonstrating technologies for the ultimate purpose of assisting the countries participating in the Project to improve the standards of living and the quality of life of their small-scale fisherfolk and to increase supplies of fish.

Fishing vessel technology (FVT) was one of the target areas proposed in this connection. One subproject contemplated the development of a fishing craft for beach operations, which would

- be affordable to the small-scale fisherman,
- allow him to use more and new or improved fishing gear,
- ensure his safety and comfort,
- expand the fishing seasons, and
- increase his operational range,

thereby increasing his fishing efficiency, productivity and income, as well as the landings of the additional food fish resources that are available in some coastal and inshore waters.

When the project activities proposed under FVT were placed before the Third Meeting of the Advisory Committee of the Project (Chittagong, 1978), India evinced keen interest in the Beach Craft Development (BCD) project.

The BCD project was launched in 1979 with the objective of **"developing fishing craft capable of operating satisfactorily, technically and economically, from surf beaches".** (Gulbrandsen, 1979).

The Project was to be implemented on the east coast of India, where about 64,000 non-mechanized craft, of which 75 per cent ***were kattumaram/teppa***[3], were operating from 860 villages situated mainly by exposed beaches. The total fisherfolk population was about 560,000, of which 25 per cent were active fishermen (Anon, 1973-77 Census).

A complete replacement of the kattumaram was, however, neither intended nor considered possible. A separate and supplementary project to attempt their improvement and facilitate the supply of materials for their construction was launched at the same time. It was also **appreciated from the outset that a new type of craft would be considerably more expensive** than the traditional

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1 From 1980, the Project was designated a programme – the Bay of Bengal Programme (BOBP).

2 There is no uniform definition of the small-scale fisheries sector in the region, but it excludes from its purview inland fisheries, fish culture activities and various forms of trawling (see Appendix B of the Report of the 2nd Advisory Committee Meeting, Madras 1977).

3 The remaining craft comprised masula or ***padavo*** (7%), nava (2%), canoes and vallam.

craft and that its viability would depend on increased earnings, through a combination of factors, such as

- type and quantity of fishing gear,
- number and duration of fishing trips,
- operational range, and
- price of fish.

2. HISTORY

The history of the BCD project covers two phases.

During the first phase, from 1979 to 1984, beachlanding craft (BLC) were developed and trials of several prototypes were carried out, resulting in two models being deemed suitable for commercial introduction by 1984.

Commercial introduction of the craft was carried out during the second phase, from 1985 to 1989. During this period and later, in fact, until 1992, considerable refinement of the technology, mainly in respect of the engine and propulsion system, but also in respect of the hull, continued to be carried out. Other BOBP activities during this period comprised :

- Technical and operational training;
- Transfer of technology to boatyards;
- Promotional activities in cooperation with the state and central government authorities;
- Offshore fishing trials; and
- Evaluation of the performance of the craft.

2.1 Development of the BLC

Beach landing craft development commenced in 1979 with the design of four intermediate motorized craft to meet the conditions of the east coast of India, viz. IND-10, IND-11, IND-13 and IND-14 (illustrated overleaf).

- IND-10 , a 7 m, decked craft of timber, was constructed in 1979. After initial trials in 1980, IND-10 was discarded as it proved too heavy to haul on to and off the beach.
- IND-11, a 7.4 m boat, with polystyrene blocks encased in a non-watertight framework, was based on the principle of the ***kattumaram.*** The prototype was constructed in 1979. Trials with IND-I 1 were conducted in Tamil Nadu and the craft was modified in 1982, on the buoyancy block principle. The new 7.2 m version, named the IND-21, was discontinued in 1984[4].

4 While the fishing trials of IND-21 were proceeding, a fishermen's cooperative society in Tamil Nadu placed an order for thirty IND-21s with a private boatbuilder under a Tamil Nadu Government 50 per cent subsidy scheme. The construction of the first five hulls was supervised by BOBP, which found the quality of wood and workmanship poor. The high cost of good timber, fasteners and polystyrene also became a matter of concern. It was, therefore, recommended that construction on the buoyancy block principle be abandoned, and no further development work was undertaken.

IND-10

IND-11

IND-13

IND-14

- **IND-13,** a 7.4 m decked craft of marine plywood was developed by 1980. The prototype, fitted with a 4.8 hp air-cooled diesel engine, underwent fishing trials from Uppada in October 1980 March 1983. These trials indicated that a BLC doing large mesh driftnet fishing would be economically feasible, but that a craft with more space for crew and storage of gear was needed.

- **IND-14,** a 7.2 m twin hull craft of marine plywood, was developed in 1980. The prototype was fitted with a kerosene-fuelled outboard motor, whereas in the other three craft diesel aircooled inboard engines had been used. The twin hull configuration of IND-14 exposed the bridge and crew to the full impact of the waves, and control during the critical beachlanding period was inadequate due to the difficulty of operating the twin-rudder assembly and manipulating the engine.

While trials with IND-13 were going on, a new 8.4 m plywood BLC, IND-18, was designed and started operations in Kerala in 1981 5. This craft, fitted with an 8 hp diesel air-cooled engine, was similar in most respects to the IND-13 except for the extra length.

IND-18

5 This craft was designed and constructed for use in Kerala under a separate UNDP-funded project

The combined experience with IND-13 and IND-18 resulted in the IND-20, which was essentially a FRP version of the IND-18. The IND-20 underwent trials in Madras in 1982 and, subsequently, at the request of the state government of Andhra Pradesh, six craft were supplied for trials in three villages during 1983-84 6.

These developments, together with the catch and cost data collected during the period of trials, led to the production of IND-20 for commercial introduction.

In the meantime, the IND-23 and the IND-24, with aluminium hulls, were also designed. Prototypes were constructed and tested, but these craft, though found in initial trials to be excellent surf-crossing and beachlanding craft, were not developed further as the correct grade and temper of aluminium alloy was not locally available.

The IND-11 had in 1980 been considered well-suited for surf-beach operations. It had the added advantage of being readily accepted by kattumaram fishermen. The IND-21, which was described in 1982 as the final design of this size and type of craft, was also acceptable to the kattumaram fishermen. But it suffered a setback due to structural defects. This prompted the new design of a FRP craft of similar capacity. The resulting design was the 6.7m IND-25 which was seen as "perhaps the smallest possible motorized BLC", a viable alternative to IND-21 and more suitable than the IND-20 for *kattumaram* fishermen. Construction of this craft commenced in early 1984 and, following trials in Tamil Nadu, was recommended for introduction.

IND-21

6 **The IND-20 went through three modifications: IND-20A had a modified hull incorporating widerm sections and a flatter run. In IND-20 B, the working deck was lowered toprovide better crew safety and comfort. In IND-20 C, 9 hp VST Shakti freshwater-cooled engine with 2:1 reduction gear was installed. The craft supplied to Andhra Pradesh comprised three IND-20s and three IND-20As.**

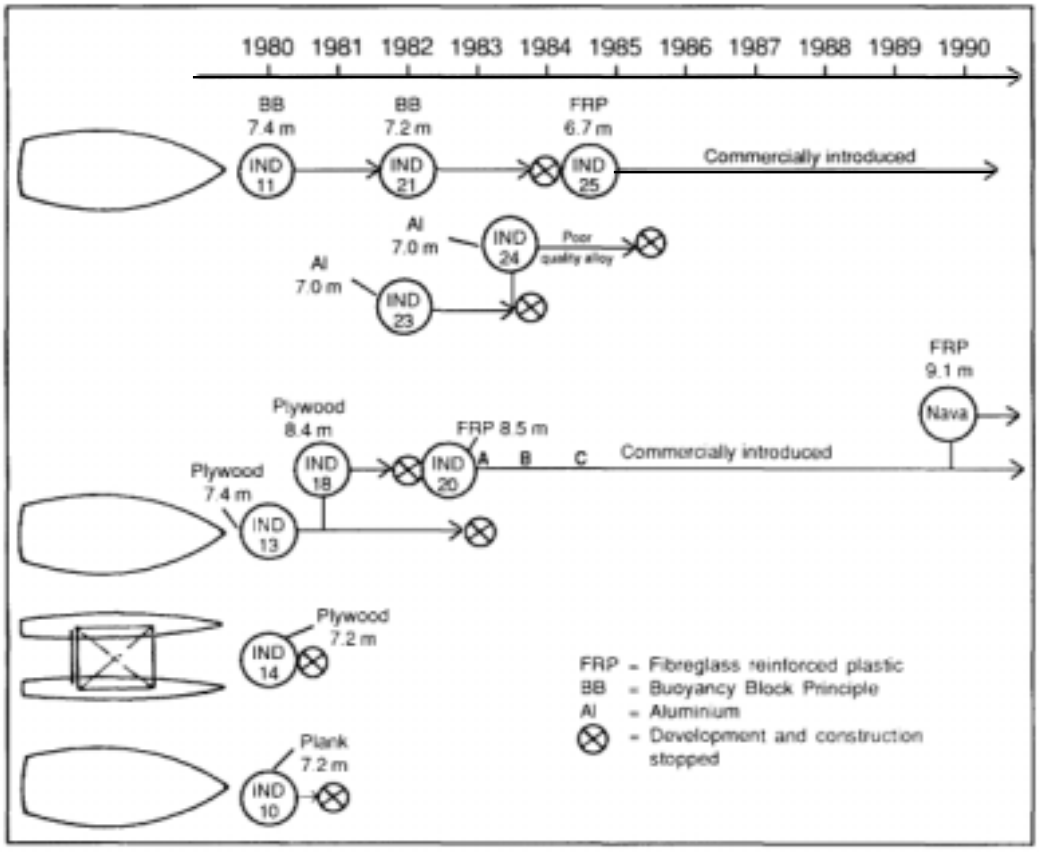
IND-24 crossing surf.

IND-20, with water-cooled engine BOB Drive

IND-25, with air-cooled engine BOB Drive

Thus, by the end of the first phase (1984), the BLCs finally developed for commercial introduction were IND-20 and IND-25. A flowchart showing the development process is given in Figure 1. The former was considered to be suitable mainly for the *nava* fishermen of Andhra Pradesh, and the latter for the *kattumaram* fishermen of Orissa, Tamil Nadu and Pondicherry.

Fig. 1. Development **of beachianding craft**



2.2 *Development of engine*

The development of the BLC involved special arrangements for the installation of the engines.

From the outset, the engine was installed in a pivoting watertight box fitted in a well which was provided in the boat. The stern tube, propeller and rudder were part of the installation and the lifting of the rudder stock caused the propeller and rudder to retract. This system was used in all boats during the first development phase.

The choice of the engines to be used was determined by such technical considerations as type of fuel, weight and cooling system. But the prevailing import restrictions also played an important part in determining the engine : **any engine used had necessarily to be one produced in India.**

During the first development phase, a 4.8 hp Greaves Lombardini air-cooled diesel engine was used. It was found to be underpowered, unreliable under actual operating conditions and incapable of standing up to extended use. The second generation craft were, therefore, fitted with a VST AD8V 8 hp diesel air-cooled engine which effectively had a built-in 2:1 reduction, as the power take-off was from the crankshaft. This engine also had various problems, the most serious of which was overheating due to its installation in a watertight box, Improvements on it had to be made from time to time.

2.3 Introduction of the BLC

The second phase of the project was the introduction of the craft on the east coast of India.

DISTRIBUTION

The IND-20 and IND-25 BLC developed during the first phase were commercially introduced during 1985-89 through several credit programmes, viz. a Hire Purchase Scheme (HPS), the National Cooperative Development Corporation Scheme (NCDC) and the District Rural Development Agency Scheme (DRDA). The NCDC and DRDA schemes provide for subsidies. The terms and conditions of the schemes are outlined in Appendix II.

Even before the BLC were deemed to be ready for commercial introduction, the Central Government, as well as the State Governments of Tamil Nadu and Andhra Pradesh, showed positive interest in the commercial introduction of the craft.

In 1984 the Central government announced a decision to introduce 90 BLC. Later, at a meeting on BLC introduction in Madras (November 1985), a Central Government decision to introduce 330 BLC during the Seventh Five-Year Plan (1985-90) was announced.

The scheme became operational in 1986 and was channelled through the apex cooperative body, NCDC. In terms of the guidelines given to NCDC under the scheme, its benefits were "to flow to the members of viable fishermen cooperative societies". The scheme provided for a 50 per cent subsidy of the cost of the fishing craft. Only genuine cooperatives, with local, active fishermen as members, were to be selected for allotment of BLC. According to the guidelines given by NCDC to the State governments, each cooperative was to receive a maximum of five BLC.

Over 350 BLC (both IND-20 and IND-25) were distributed under the various schemes during 1986-1991. Table 1 shows how many BLC are operating as a result of these schemes in the different states (and Pondicherry Union Territory) on India's east coast.

Table 1 : Distribution of beachlanding craft on credit (1986-1991).

state :	Tamil Nadu	Pondicherry	Andhra Pradesh	Orissa	Total
Year					
1986	3	3	22	6	34
1987	18	4	44	20	86
1990	18	4	181	62	265
1991*	18	4	254	82	358
% share	5	1	71	23	100

* Includes BLC ordered but yet (August 1992) to be delivered (22 in the APFC boatyard, Kakinada, and 15 in Mechem boatyard, Bhubaneshwar, Orissa.)

Table 2 gives the distribution of the BLC under the various credit schemes.

Table 2 : Schemewise distribution of BLC

Scheme	State	% Share
NCDC	Andhra Pradesh	76
	Tamil Nadu	
	Orissa	
HPS & DRDA	Andhra Pradesh	24

In addition to these craft, a much smaller number of BLC were purchased without government assistance – 52 IND-20s had been purchased upto August 1992, according to available figures, and there were a further 15 IND-20s on order at two boatyards in Puri.[8].

7 It is understood that the Planning Commission had proposed introduction of 800 - 1000 BLC during the Seventh Plan, but was not able to obtain approval for the programme.

8 Figures were obtained from the APFC boatyard, Kakinada, and boatyards in Puri during field visits to Andhra Pradesh and Orissa. Nystrom et al, after field visits in March/April 1990, gave a figure of 25 BLC purchased without government assistance. Turner and Mathew implied that there were none on order (January 1991).

BLCs being built at the APFC boatyard in Kakinada

Of the BLC distributed under credit schemes, about 75 per cent were IND-20s. Over 70 per cent of the total number originally distributed were to Andhra Pradesh, 23 per cent to Orissa, 5 per cent to Tamil Nadu and 1 per cent to Pondicherry (Table 1). This pattern of distribution, however, does not accurately reflect the actual operational areas of the craft; migration and illicit transfers, especially between Andhra Pradesh and Orissa, tend to change the distribution pattern.

Although under the NCDC scheme, the BLC were distributed to fishermen's cooperatives, in actual practice the responsibility for each craft differed from State to State. In general, in Tamil Nadu, groups were responsible. In the other States, the cooperatives, after formally taking delivery of the craft, allocated them to individual members. This practice followed different norms in Orissa and Andhra Pradesh. In the former, the highest bidder in an auction or the winner of a lottery obtained the craft. In the latter, the operator was identified on the basis of a consensus of the members. In some cases, the beneficiary had to make an outright payment of Rs. 30,000/- to the cooperative before assuming control of the craft.

In actual practice, there were many instances where the craft were transferred illicitly by the beneficiaries, on an 'internal hire basis', to individuals in another village or in another State. The latter made a lump sum payment and undertook to pay the monthly instalment due on the boat – an undertaking generally honoured only in the breach.

DISTRIBUTION CRITERIA

In connection with the commercial introduction of BLC, BOBP suggested in 1984 that the respective roles of BOBP and the government fisheries agencies might be as follows :

> "... At the stage when the boats were sold, their technical feasibility had been tested, however, not their economic viability which depends on factors such as durability of the hull material and the engine, availability of repair workshops and mechanics, availability of fish resources

within the potential area of operation, use of suitable and sufficient gear and, finally, on working patterns and forms of social organization among traditional fishermen used only to non-motorized fishing.

"The economic viability tests need to be continued and will be carried out by the craft owners (Departments of Fisheries, Andhra Pradesh and Orissa) and private fishermen (Tamil Nadu). BOBP will only play the role of adviser in regard to quantity and type of fishing gear and in regard to craft repairs to be undertaken. BOBP, however, will not have the role of supervisor in fishing trials and use of gear."

BOBP also suggested to the government agencies that appropriate consideration be given to the following factors while formulating and implementing the schemes for commercial introduction of the BLC :

- The need for the craft to achieve high levels of productivity and earnings, to be economically viable, considering the fact that their capital cost as well as their operating cost, due to the use of engines, was higher than those of the craft they were replacing.

  The fishing trials carried out by BOBP had shown that their viability depended on their operation by fishermen who had the capacity to locate/operate in more distant fishing grounds, who were used to carrying adequate quantities of fishing gear and employing diversified fishing methods, and fishing for the higher priced varieties of food fish.

- As fishing of the type specified was not being carried out in every fishing centre, it was important to make a judicious selection of the fishing centres in which the boats would be introduced.

- An important criterion in the selection of fishing centres was the accessibility of repair facilities, particularly for the engines, as the loss of fishing days due to lack of such facilities would affect the economic viability of the craft.

- With regard to training, the main requirement was for training of some government officers, at the technical level, in maintenance and repair of the engine, so that they could supervise implementation of the schemes in the field. Some fishermen/mechanics drawn from the centres in which boats were introduced should also be given similar training.

- In order to achieve a successful introduction of the BLC, careful planning and preparation was called for and needed to be accompanied by close monitoring and effective support from the authorities concerned.

PERFORMANCE EVALUATION

A study was initiated in 1984 on performance evaluation of BLC and was completed in 1985 (Drewes, 1985). The report suggested that it might be advisable for Government to initially subsidize the investment costs for a limited number of BLC. This would enable Government to observe the earnings, performance and acceptance of the BLC on a wider scale before promoting a full-scale introduction of the craft through bank loans.

The participants in two workshops conducted in 1985 in connection with this evaluation also expressed concern over the heavy exploitation of inshore resources, the need for craft to fish further offshore and stressed the need to obtain better knowledge of the offshore pelagic resources.

FISHING TRIALS

Offshore' fishing trials with BLC were started in 1985. The trials were systematically carried out from a few fishing centres, including Uppada and Thirumullaivasal.

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9 The area 0-50 m depth is considered the coastal, or inshore zone, and the area 50-100 m depth the offshore zone. The deep sea zone is considered to be over 100 m depth.

The Uppada trials[10] showed that the BLC (IND-20) was capable of fishing in offshore waters upto 35 nautical miles. The achievement of 193 fishing trips and a 23 per cent rate of return on investment with a prototype engine installation indicated economic viability. Catch performance and profitability could be further improved with better organization and refinements to the propulsion unit. The limited carrying capacity of the boat and the limitations of the crew shelter indicated that offshore operations should be restricted to four months in a year.

In the Thirumullaivasal trials,[11] commercial fishing was carried out 15-35 nautical miles from the shore by an IND-20, using diversified fishing gear, comprising driftnets, drift longlines, gillnets and trolling lines, and targeting large pelagics and Flyingfish. Most of the operations were carried out at the edge of the continental shelf or beyond. The 364 fishing trips over two years yielded a catch of 40 t and a 12.7 per cent rate of return on investment. The trials provided evidence of the availability of lightly exploited large pelagic and larger Flyingfish resources in the offshore area which could partially be exploited by BLC. They also demonstrated the need for diversified fishing gear to exploit the resources economically.

TRAINING

As a result of the high incidence of engine problems encountered within the first six months in most of the BLC commercially introduced in the various east coast states, BOBP began to appreciate by 1985 that the technical support provided by the state fisheries agencies for repairs and maintenance was inadequate. It was felt that intensive training of fishermen was essential and that engine spare parts should be readily available always.

At a meeting with the BOBP staff in late 1986, state fisheries officials requested assistance in their training programmes.

The first BOBP training course had been already held at Gopalpuri (Orissa) in April 1986 — for two trainers and ten NCDC beneficiaries, who received instruction in BLC operation, with special attention to engine and craft maintenance. The two trainers, both from Andhra Pradesh, were to be based at training institutes, in Machilipatnam and Kakinada, which had invested in training equipment.

Similar courses held in 1987 led to the finding that institutional training was not appropriate as far as fishermen were concerned and that on-the-beach courses would be more effective. It was also concluded that the training content and material needed to be revamped, due to the low level of literacy among fishermen.

The first on-the-beach training was conducted in August 1989 as a 'pilot training programme' in Puri, Orissa. Further training was provided at three Andhra Pradesh fishing centres for 90 fishermen and 14 fisheries officers, in Tamil Nadu for 15 fishermen and three fisheries officers and in Orissa for 60 fishermen and four fisheries officers.

The conclusion reached after these training programmes was that the training of officers was of doubtful value. Most of them lacked the technical knowledge necessary to conduct training on their own. Furthermore, there were frequent transfers of such officers to non-marine sectors. It was therefore concluded that it was desirable to involve NGOs and private mechanics in the training programmes.

Suitable NGOs could not be identified, but in Andhra Pradesh and Orissa a number of private mechanics were trained on-the-beach in the maintenance of the engine and the liftable propulsion system. This was followed by further training in the workshops of the engine manufacturer (VST) in Bangalore. VST also provided training in their workshops for mechanics employed by their dealers.

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10 August 1985 to July 1986.

11 February 1989 to January 1991.

FRP TECHNOLOGY

When beachlanding craft development commenced in 1979, FRP craft construction in India was limited to a few boatyards. While a few fishing craft, particularly small trawlers, had been constructed, the material had not been widely accepted in the small-scale fisheries sector.

The development of the two final BLC prototypes and the choice of FRP as the construction material was followed by the transfer of FRP technology to local boatyards by BOBP. This took various forms and, inter *alia,* included the following :

- Initial training at the BOBP boatyard in Royapuram, Madras, of the Assistant Manager and two boat-builders of the APFC boatyard, Kakinada;
- Technical support to the same boatyard in establishing a FRP boatbuilding division, guidance in procurement and inventory practices, and supply of an IND-20 mould and plug with on-the-job training in mould-making and moulding;
- Supply of plugs and moulds to three private boatyards in Orissa and one in Pondicherry;
- Provision of technical advice and training in the construction of engine boxes and propulsion units for boatyards constructing BLC; and
- Construction supervision of BLC under commercial construction

HULL, ENGINE AND PROPULSION UNIT

Development work on the hull construction, engine and propulsion unit for the BLC continued to be carried out by BOBP even during the commerical introduction of the craft.

During the offshore fishing trials, the overheating of the AD8V 8 hp air-cooled engine, on long trips 20-30 nm. offshore, was a problem serious enough to make it necessary to consider an alternative water-cooled engine. The engine selected was the 10 hp VST Shakti freshwater-cooled horizontal cylinder engine, originally produced for a tiller tractor. The use of this engine required a 2: 1 reduction gearbox and a water pump with keel cooling system. The engine proved satisfactory in trials when used with an imported gearbox and water pump. But as the use of imported components was not practical, the engine manufacturer turned out local versions of these items. The quality, however, was inferior and eventually, therefore, the idea of a reverse gearbox was shelved. Nevertheless, a reliable reduction gearbox had been developed.

The water pump was also a source of complaint for some time in BLC fitted with the watercooled engine. A satisfactory water pump assembly was, however, eventually developed.

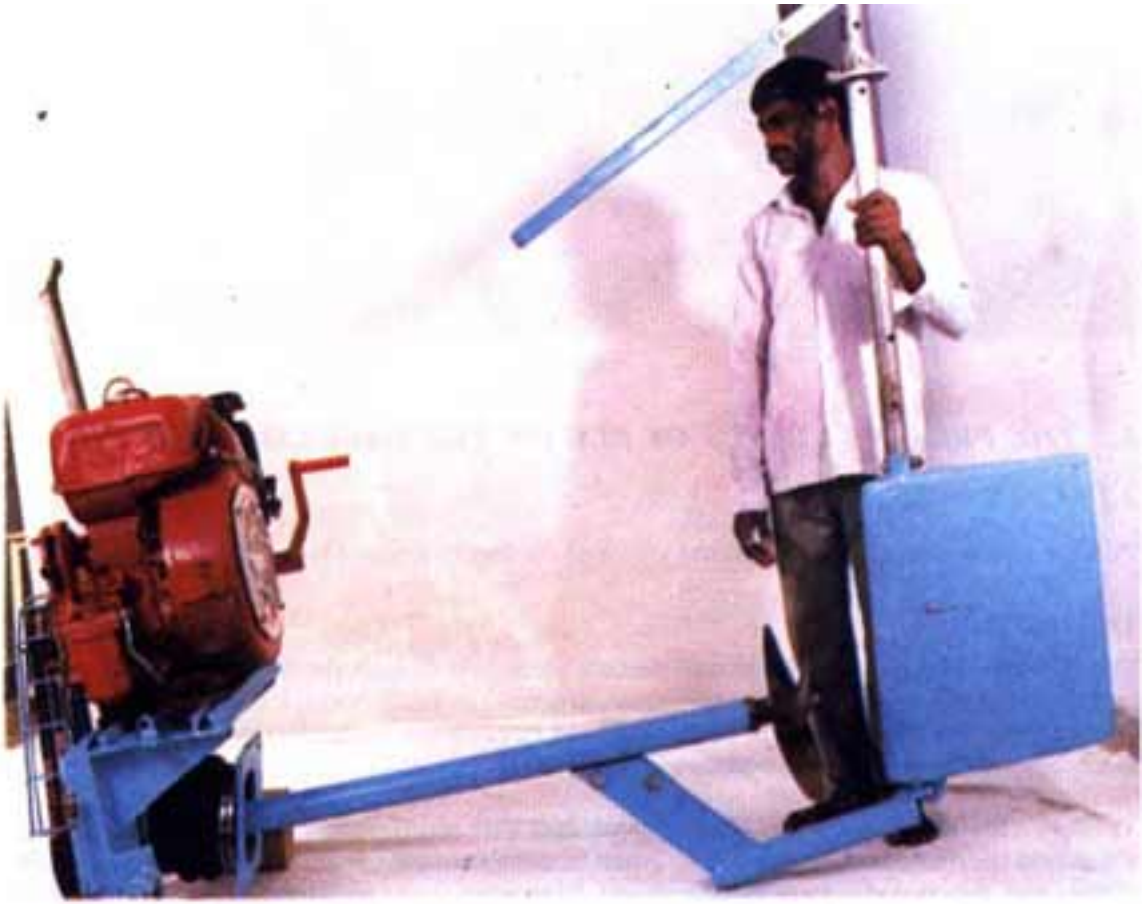
Experience with the engine installed in a pivoting watertight box fitted in a well – the so-called **Box Drive** used in all BLC – revealed such attendant disadvantages as :

- Overheating in air-cooled engines;
- Restricted access for maintenance; and
- Too much of space being occupied by the well and the box.

This prompted BOBP to look for alternatives and resulted in the design in 1989 of the **BOB Drive,** which combines a rubber bellows with a pivoting engine installation, thus eliminating the box and the well. It also permits the engine to be turned round by using a V-belt transmission system which ensures a 2:1 reduction. The result has been :

- considerable saving in space and weight,
- increase in speed, and
- elimination of the disadvantages of the Box Drive.

The Box Drive



The BOB Drive

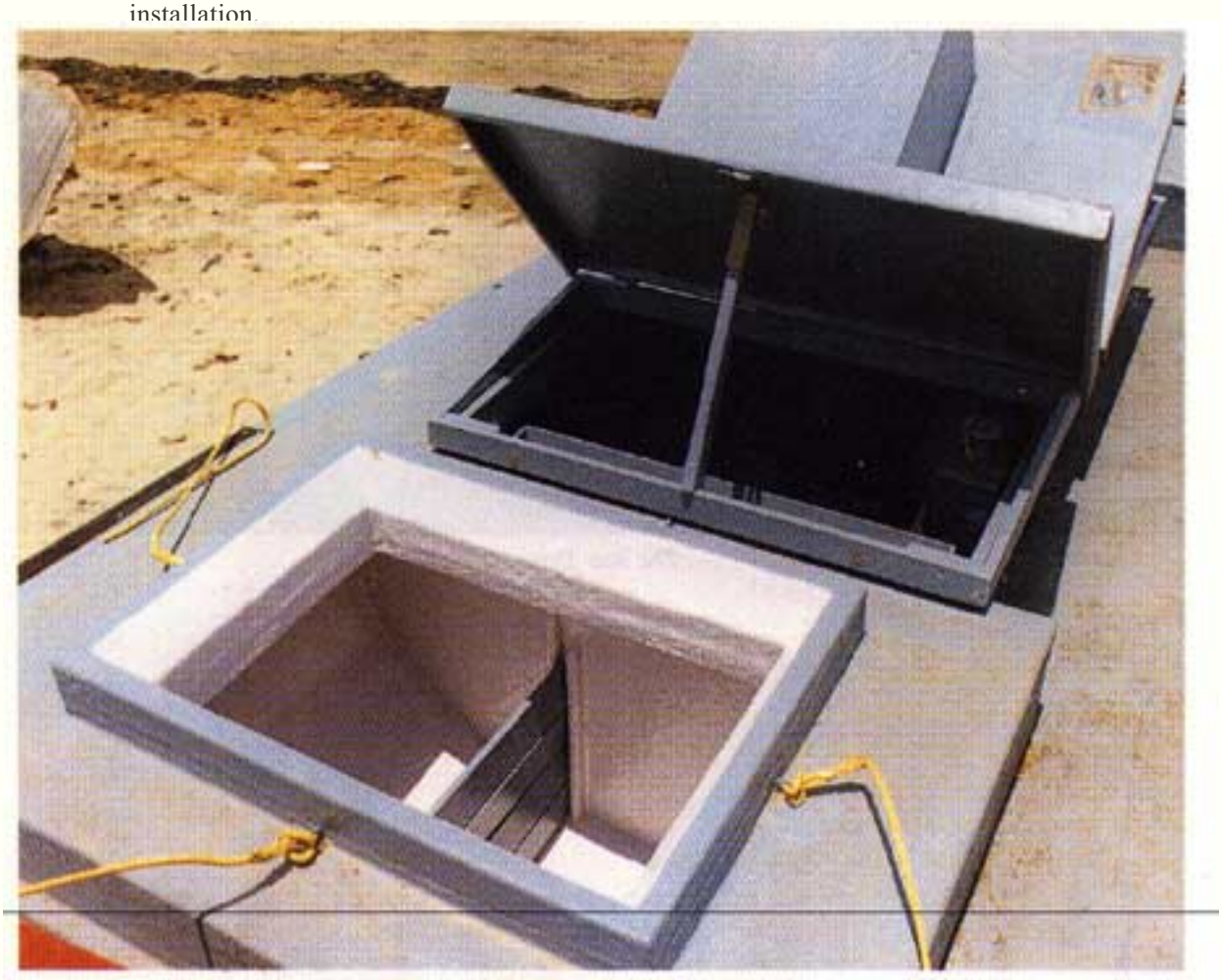
The rubber bellows is locally manufactured, low priced and has an adequate service iife. The new propulsion system has evoked a very positive response from fishermen and craft operators during recent BOBP demonstrations.

Several refinements to the hull of the BLC were also made by BOBP as a result of the process of continuous assessment of the craft by its technical staff. The refinements consisted of :

— Strengthening the hull by the redesigning of frames;

— Improving the general arrangement; and

— Providing a built-in fish-hold by utilizing the saving in space resulting from the BOB Drive installation.



Fish-hold

3. THE PRESENT STATUS OF BLC ON THE EAST COAST OF INDIA

3.1 Craft types

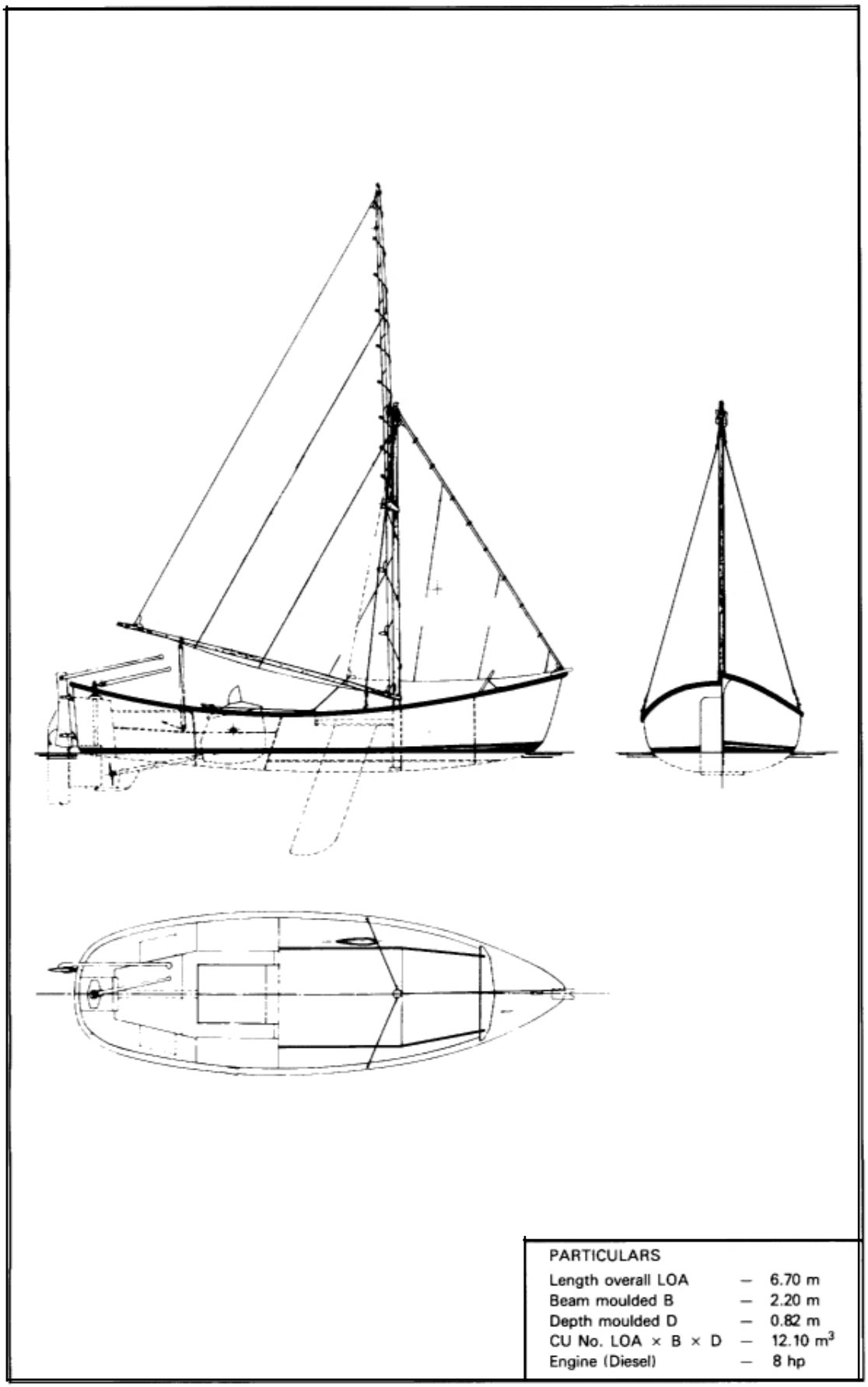
There is a wide disparity in the relative status of the two beachcraft types, IND-20 and IND-25.

THE IND-25

The IND-25 was expected to be an intermediate beachcraft to meet the needs of the ***kattumaram*** and teppa fishermen, **and** with that intention introduced in Tamil Nadu, Pondicherry and Orissa. The craft was virtually stillborn in Tamil Nadu and Pondicherry and no further introductions were made beyond those initially introduced in 1987.

The craft's beachlanding and surf-crossing capabilities were unquestioned. It was, however, operated virtually in the traditional inshore fishing grounds, using ***kattumaram*** gear such as lines, small mesh gillnets and, occasionally, large mesh driftnets. Even when the latter were used, the catch was not much different due to the inshore operations.

Fig. 2 Technical drawing – IND-25



PARTICULARS		
Length overall LOA	–	6.70 m
Beam moulded B	–	2.20 m
Depth moulded D	–	0.82 m
CU No. LOA × B × D	–	12.10 m^3
Engine (Diesel)	–	8 hp

The low returns were compounded by the system of joint responsibility under which it was attempted to operate the craft and the intra-village conflicts thereby generated among the fishermen. The result is that most of these craft, except for a few in Poompuhar and Tarangambadi in Thanjavur District", which are carrying out successful commercial operations beyond the inshore area, are **not** in operation.

In Orissa, the craft has been better utilized. However, it has been able to land good catches only in Puri District, where it has been operated mainly by nava fishermen in the large mesh driftnet fishery. In Ganjam and Cuttack Districts, where it has been ***used*** by ***teppa*** fishermen, generally for daytime fishing in the inshore fishery, catches and earnings have been inadequate and have not brought the expected benefit to the fishermen. Even in Puri, fishermen view it as a 'second class' BLC, considering its

- speed too low
- sailing performance not good enough
- carrying capacity insufficient and
- size too small for operations further offshore.

Significantly, all IND-25s have been introduced only under Government-approved credit schemes and there have been no private orders for this craft placed with any boatyard.

THE IND-20

The IND-20, on the other hand, has become widely accepted not only in Andhra Pradesh[13], where (except for a few IND-25s in the southernmost coastal Nellore District) only this craft was introduced, but also in Orissa, particularly in Puri. In Tamil Nadu, the only two BLC now in commercial operation are two IND-20s operating in Thirumullaivasal — this, however, is a result of the offshore fishing demonstrations started in that village by BOBP. Thus, the references to BLC hereafter generally connote the IND-20 rather than both craft types, unless specifically stated otherwise.

3.2 Distribution

A status report on.BLC in 1987 (R. Ravikumar, December 1987) lists 29 villages (26 in Andhra Pradesh and three in Orissa) where IND-20 BLC had been introduced by that time, on the basis of an 'equitable' distribution to a large number of fishermen's cooperatives. The present ownership of these craft is, however, quite different. One cause for this is transfer on a so-called 'internal hire' basis, which in reality is an illicit change of ownership on the payment of a lump sum and a promise of further monthly payments. Such transfers take place within Andhra Pradesh as well

12 Now Quaid-E-Milleth District.

13 (a) In Andhra Pradesh, twenty more BLC are to be introduced into the East Godavari District in 1992 under the Integrated Cooperative Development Project (ICDP). Under this scheme, IND-20 BLC will be supplied to marine fishermen's cooperative societies or groups comprising five fishermen who are members of a fishermen's cooperative society. The NCDC will be the modal agency in implementing **the scheme,** for which a subsidy may be provided by the State Government. The loan will be as follows :

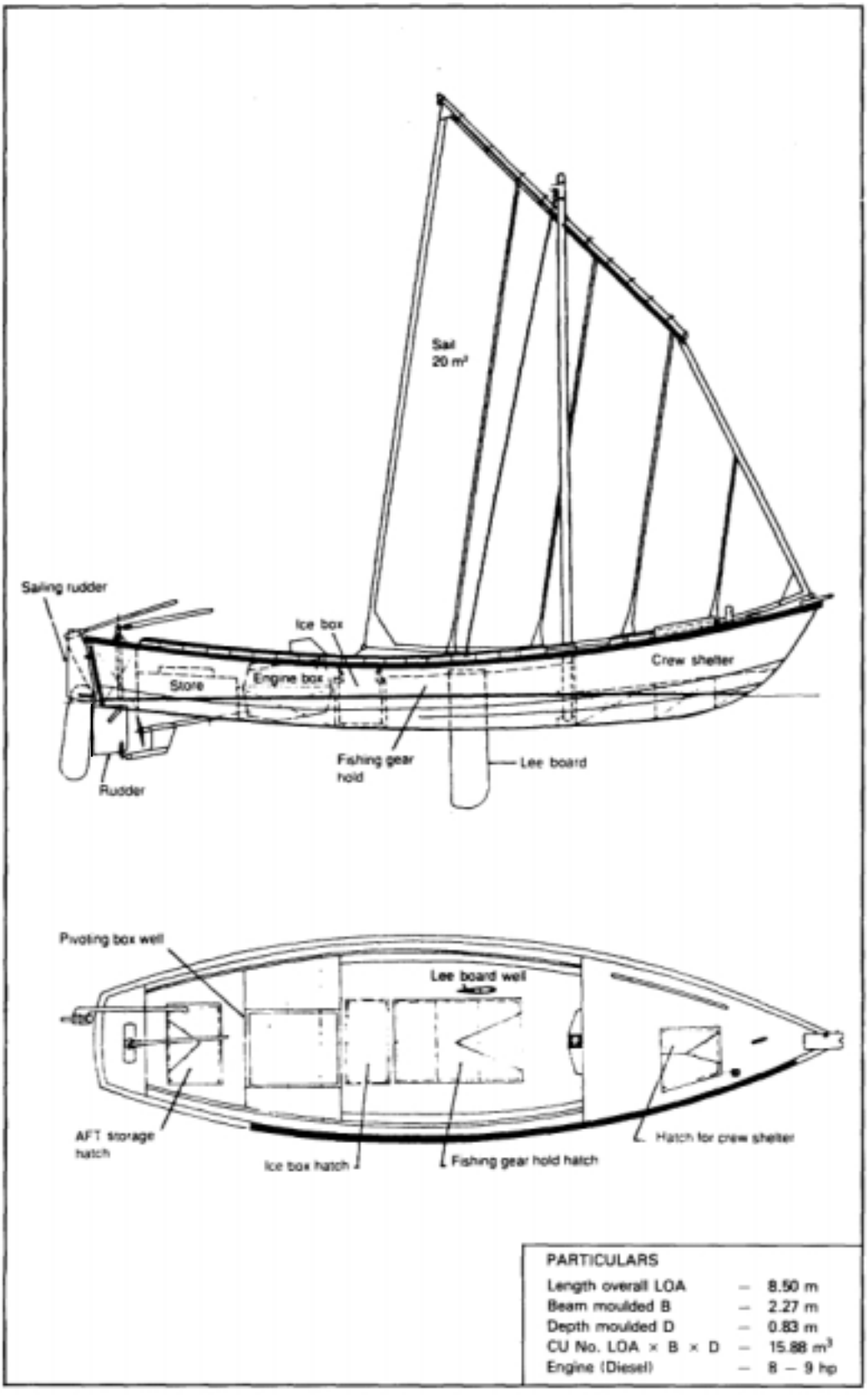
> **Hull:** IRs. **65,000**, **Engine:** IRs. 30,000, Nets: IRs. 45,000, and **Share capital contribution** (lo meet insurance and operational costs for the first year): IRs: 10,000 — **Total:** IRs 150,000*

50 per cent of the cost of the BLCs will be treated as interest-free margin money. The balance will be a bank loan at **I5** per cent interest. Repayment will be in 72 monthly instalments.

(b) Bids were called for by BOBP in November 1992 for disposal of a seven-year-old IND-20, which had been fitted with the BOB Drive and used along the east coast for demonstration of the drive. Sixteen bids were received from persons in Tamil Nadu, Andhra Pradesh and Orissa. Of the bids, ten were for Rs. 100,000 and over. The highest bid, for Rs. 125,000, was from Thirumullaivasal.

* US $ 1 = IRs 28 appx.

Fig. 3 Technical drawing – IND-20



as from Andhra Pradesh to Orissa (Puri). Another cause is seasonal migration of craft along the coast of Andhra Pradesh and to Orissa (Puri)[14].

One report (Nystrom et al, 1990) documents a case where six BLC introduced in Maipadu, Nellore District, Andhra Pradesh were transferred on the day of delivery itself to fishermen in Puri and Kakinada without having carried out a single day's fishing from Maipadu. Another example observed during field visits was the situation in Pagadalapeta in Andhra Pradesh. Although only five BLC were introduced in this village through the fishermen's cooperative society, 25 BLC operate from this village nowadays, the additional boats having been obtained by various individuals from other cooperative societies through illegal transfer. The BLC in this village also seasonally migrate to Machilipatnam and Narsapur and. in fact, 22 craft had left for the latter village at the time of the visit.

The reasons for so many BLC gravitating to Pagadalapeta appeared to be :

- Proximity to good fishing grounds;
- Easy access to markets; and
- The availability of a competent mechanic.

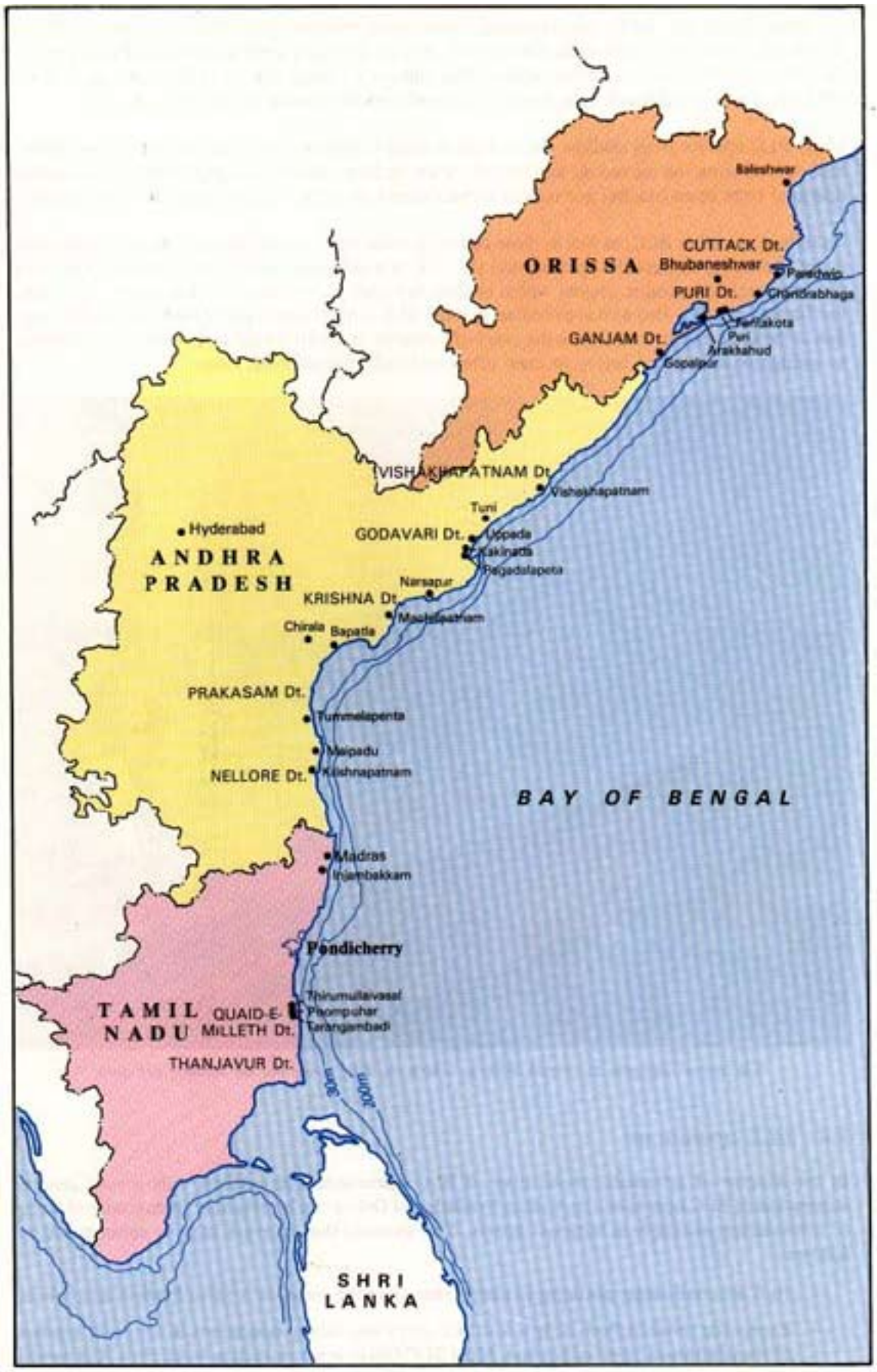
The case of this village is perhaps indicative of the manner in which BLC tend to concentrate in a few centres. About 100 BLC regularly operate from Puri. Assuming that about half this number are craft introduced through private orders placed with Puri boatyards, the remainder have come from Andhra Pradesh, either through migration or through illegal transfer.

BLC at Purr

14 In Nellore and Prakasam Districts in Andhra Pradesh, BLC migrate from Chirala in the north to Krishnapatnam in the south for short periods. They also move around whenever, and wherever, good catches are reported. In the Machilipatnam area, BLC migrate to Kakinada when catches are more promising there. In Kakinada, BLC migrate mainly south, to Bapatla, during June-August, with a few boats going for shorter periods, upto the Tuni area.

In Orissa, BLC from Ganjam and Cuttack Districts migrate to Puri during January-March (Nystrom *et al,* 1990).

Fig. 4 Map of BLC villages



3.3 Utilization as beachlanding craft

In areas where the BLC are operated from open beaches (e.g. Nellore District, North Vishakhapatnam, Puri) during the calm season, they are generally kept at anchor in the sea beyond the surf zone, but cross the latter when setting out on a fishing trip or to land the catch. They are hauled up on the beach only during the rough weather season or to effect repairs.

Many BLC operate from shallow waters such as creeks, lagoons and river inlets and from fishery harbours. During the monsoon, and periods when cyclones occur, even BLC which are normally operated from open beaches are moved to backwaters or other shelters available in the vicinity.

Fishermen operating BLC, as well as those operating other types of craft in areas where beachlanding is not necessary, express the opinion that the BLC is a safe craft due to its watertight deck, and the retractable propulsion system which enables the craft to negotiate shallow waters with sand bar formations. It is also well appreciated that the BLC is more comfortable than traditional craft, due to the crew shelter, and that in the event of a capsize, the craft would suffer only minor damage as against total loss and injury to crew often suffered by traditional neva

The arrow indicates the hatch through which the BLC crew sheller beneath the deck

3 4 BLC operations

In the absence of systematic monitoring of BLC operations and catches, only a very general impression of BLC operations in Andhra Pradesh and Orissa can be obtained from scattered items of information available in various reports. The scenario that emerges may be summarized as follows :

- BLC are consistently operating in many areas along the coasts of Andhra Pradesh and Orissa.
- Except for those in Puri, only a few BLC carry out fishing operations in the outer reaches of the continental shelf or beyond. Most BLC fish in areas extending from 50 to 70m depth.

A BLC crossing the surf

BLC at anchor in a lagoon

- They mainly use large mesh driftnets of HDPE, targeted at species such as Seer and other large pelagics, and longlines for Shark *(e.g.* Kakinada area, Krishna and Godavari Districts in Andhra Pradesh and Pun and Ganjam Districts in Orissa). In Tamil Nadu, a few boats operate large mesh driftnets for large pelagics as well as drift longlines for Shark and bottom longlines for large, deepwater Shark.

- These gear, targeted at the same species, are used in inshore waters in the Vishakhapatnam area and in some villages of Prakasam District in Andhra Pradesh. In most parts of southern Andhra Pradesh, operations are confined to inshore waters and the species targeted are small-sized Seer, Jewfish, Pomfret, Catfish and Shrimp.

Special mention needs to be made of the fishing operations during the Pun season from December to May/June, in view of the fact that the largest concentration of BLC on the east coast operates from this fishing centre. Before the '91-'92 season, the BLC mainly used large mesh driftnets and trolling lines to land catches of large pelagics, predominantly Seerfish. A drastic drop in Seerfish catches during the '88-'89 season brought about a lull in the operations, which again picked up momentum when BLC using drift longlines landed very large catches of Shark in the '91-'92 season.

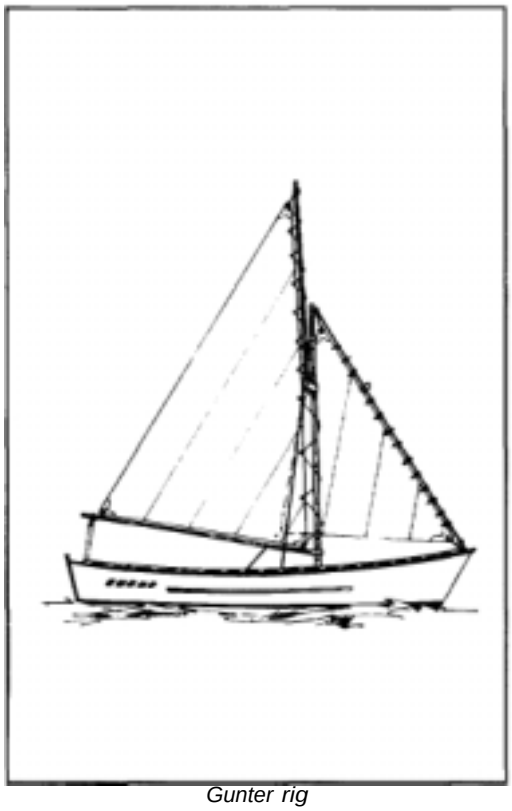
Shark landing at Puri

The performance of the FRP hulls of the BLC have been generally satisfactory and no serious problems have arisen during operations. Facilities for hull repair, however, are available only in the boatyards carrying out FRP construction.

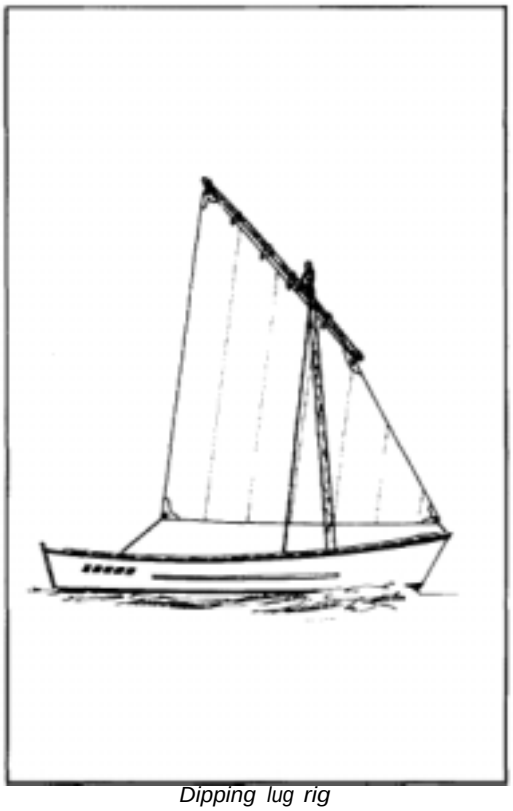
Overheating of the engine was the main problem with the air-cooled Shakti 8 hp diesel engine. Among the problems with the Shakti 9 hp water-cooled diesel engine, the most serious were the unreliability of the water pump and the gearbox. With the introduction of the BOB Drive and a new installation for it, these problems have now been solved in both engines.

Sails are being extensively used by the BLC to save fuel and as a means of auxiliary propulsion. Although BOBP introduced the Gunter rig after sailing trials and subsequently the dipping lug rig, the acceptance of these rigs has been limited; most BLC have changed to the lateen rig or the crab claw rig familiar to the *nava* and *kattumaram* fishermen respectively.

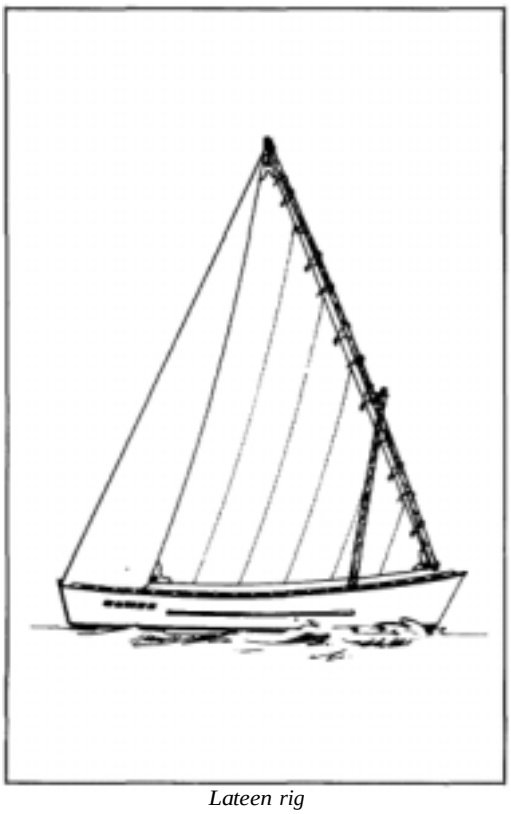
Fig. 5 Sailrigs used by BLC



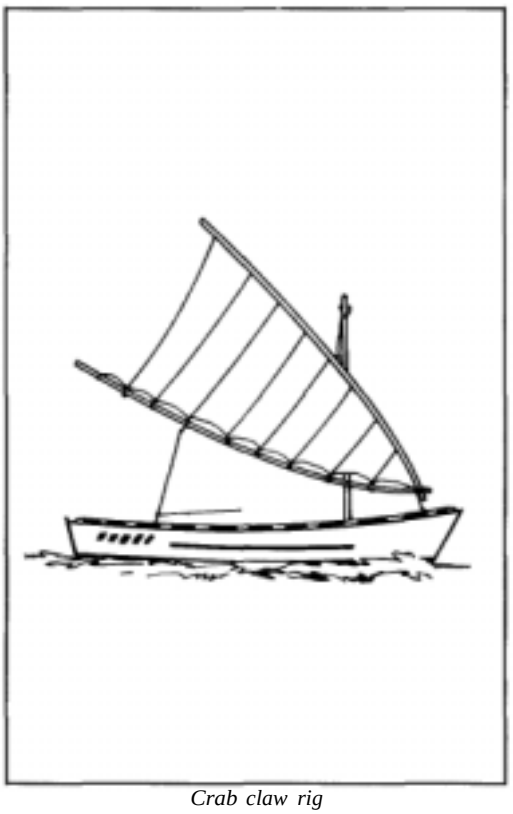
Gunter rig



Dipping lug rig



Lateen rig



Crab claw rig

3.5 *Cost of BLC*

The cost of a IND-20 (hull, air-cooled 8 hp engine and sail) at the commencement of commercial introduction (1985) was about IRs. 80,00015. The price increased to about Rs. 106,000 with an air-cooled engine and about Rs. 114,000 with a water-cooled engine in 1990, representing an average annual increase of about 5 per cent (or about half the national average annual inflation). The cost of an IND-25 fitted with an air-cooled engine in 1990 was about Rs. 92,000.

3.6 *Earnings of BLC*

The absence of systematic monitoring of BLC operations and catches has been referred to already. Consequently, information on earnings of BLC is also scarce. Circumstantial evidence, in the form of scattered items of information, suggests that the earnings of BLC in Pun have been very high, *e.g.* according to statistics collected by fisheries officials in Pun, six fish merchants exported salted Shark meat and Shark fins valued at Rs 100 million to markets outside the State, during July 1991-April 1992. Considering that the Shark was landed by about 100 BLC and about 50 migrant Andhra Pradesh *nava* (which, however, were engaged in Shark fishing for only about two months), this indicates very high earnings for the BLC. Fishermen interviewed during field visits stated that, during the season, BLC landed catches valued at about Rs. 10,000- 40,000 a fishing trip and that there were instances when about Rs. 100,000 was grossed for a single trip.

One of the BLC boat-builders at Pun (who is also engaged in the marketing of Shark) stated that he had financed thirty of the fifty IND-20s constructed by him to the extent of Rs. 30,000 - 40,000 each and that the loans on all thirty boats had been repaid within six months. He had orders for twelve more IND-20s on hand. No information, even of a similar nature, is, however, available from the other fishing centres where BLC are being operated.

In the Uppada fishing trials, the single IND-20 BLC used grossed Rs. 117,396 for twelve months; the net earnings were Rs. 32,656, after deduction of fixed and operating costs. In the Thirumullaivasal trials, the comparable figures for twelve months were Rs. 127,514 and earnings of Rs. 22,5%. In both cases, however, the figures relate to one boat operating in one fishing centre.

Some figures of BLC earnings excerpted from a recent study (El Gendy, 1992), covering 12 months during 1989-90, on the performance of five IND-20 BLC in three centres on the east coast are given in Appendix III. The study, however, is subject to several limitations. The wide differences in the fishing situation of different villages along the east coast and the small number of craft whose operations were studied mean, at best, that the data is applicable only to the villages concerned. They could sometimes be applicable only to the particular craft studied and cannot be considered sufficiently representative or statistically significant. For example, in respect of (Pentakota *i.e.* Pun), where there is the largest concentration of BLC, the data are from the season following the one where catches of Seerfish slumped after a series of good seasons. The figures from the study are, perhaps, mainly useful in providing some indicative data of a localized nature on the earning potential of a BLC operating commercially under satisfactory conditions with regard to fish resources, fishing grounds, fishing gear, fishing skills and basic infrastructure *(i.e.* the BLC IND-20 operating from Thirumullaivasal) or the poor earnings of BLC operating commercially under unsatisfactory conditions with regard to the same factors *(i.e.* the BLC IND-20s operating from Tummelapenta, Andhra Pradesh).

Flyinrfish catch being landed from a BLC on the coromandel coast

15 US $ 1 = IRs. 15 appx. in 1985, IRs. 19 appx. in 1990 and IRs. 28 appx. in 1992.

4. THE EXPERIENCE

How appropriate was the manner in which development of the BLC was handled?

The historical outline given in Section 2 commences, in the interests of brevity, with the design of four BLC prototypes. A series of preceding actions need, however, to be also noted, as they demonstrate a thorough and systematic approach to the problem of beachcraft development. Before any design work was undertaken, previous attempts to develop such craft in India, as well as in other countries, were studied to extract the learnings from those efforts. This was followed by a detailed consideration of technical and environmental requirements, from which the design considerations that should govern the BLC prototypes were derived.

How necessary was it to have as many as four different prototypes?

The rationale was to provide as varied a menu as possible : the teak-planked IND-20 was expected to appeal to nava fishermen; the buoyancy block IND-I 1 resembled the *kattumaram;* the IND-13 was conceived as a marine plywood substitute for the IND-11; and the twin-hulled IND-14 had greater stability than its single hull counterparts, besides the advantage that it could be quickly dismantled. The merit of considering an exhaustive list of options was that it left no room for later regrets over a feasible solution that was overlooked. The fact that, even in retrospect, such a solution does not come to mind, bears out the validity of the approach.

The subsequent chain of events, up to the beginning of 1984, also shows the same systematic thoroughness as put into the initial work namely :

- The selection of two of the prototypes after beachlanding and surf-crossing trials;
- The trying out of alternative boatbuilding materials — timber, plywood, aluminium and FRP;
- The conduct of fishing trials with a few boats of the selected prototype designs, leading to the development of the modified second generation prototypes, IND-20 and IND-21; and
- The discarding of the IND-21 after further trials and testing and the emergence of the IND-20 as a BLC suitable for commercial introduction.

A similar approach, however, is not evident in the development of the IND-25. The idea of developing this craft appears to have arisen at a rather late stage, i.e. when it became necessary to discontinue production of the IND-21 in 1984. The idea was to produce a substitute for the latter, in the same size range, at a lower cost and offering a "better working position — standing low down and leaning against the gunwale" — than the IND-20. It was meant for use by the inshore *kattumaram* fishermen. The initial outcome of this concept was an open, undecked craft, which, after undergoing sporadic fishing trials, for a period of about five months, was, without any detailed evaluation, deemed ready for commercial introduction towards the end of 1984. The craft was subsequently provided with a hatch cover and most IND-25s commercially introduced used these covers.

Why was the IND-25 developed and introduced?

The justification for designing an entirely new craft at this stage of the development process is unclear. If a smaller open craft was indeed needed, it would have been more appropriate to shorten the hull of the already proven IND-20 and remove its deck. When the Kakinada boatyard later developed its so-called FRP *nava* it did remove the deck to make an open boat, but it also lengthened the craft for better sailing performance. On the other hand, one of the reasons why the IND-25 has been unacceptable to Orissa fishermen has been its size (Section 3.1). Further, in both Orissa and Tamil Nadu, one of the main reasons for its failure has been its operation in inshore waters. And its cost was only 1.5 per cent lower than that of the larger IND-20, which cost Rs 86,000 at the time (Section 3.5).

The development of the IND-25 seems to have been **an aberration** from the norms of the BLC development process. Longer fishing trials, carried out in more fishing centres, and more detailed evaluation, of the order to which the IND-20 was subjected, would perhaps have exposed the weakness of the assumptions on which the design and construction of the IND-25 were based and would have prevented the recommendation of a 'second class' BLC for commercial introduction.

Was sufficient attention paid to the engine installation?

As mentioned elsewhere in this report, the main complaints by fishermen about the BLC have been in respect of the engine. The engine problems, particularly the biggest problem of overheating of the air-cooled engine, surfaced quite early, during the fishing trials in the development phase. As also mentioned elsewhere, this problem has recently been solved by substituting the BOB Drive engine installation for the Box Drive. The former is itself an old idea, suggested during the early BLC trials but not applied.

In retrospect, it appears that the **attention given to the engine problems was insufficient** and that the effort expended by BOBP on, for instance, the design and construction of new craft, such as the IND-25, could have been more effectively and fruitfully diverted to finding solutions to the engine problems.

How satisfactory was the process of commercial introduction of the BLC?

Reference has been made in Section 2.3 to the stance taken by BOBP on the preconditions for a successful commercial introduction of the BLC and the criteria suggested to government authorities. The need to do so arose because the previous experience of the government had mainly been with traditional craft.

The criteria related to :

- The need for selectiveness in choosing
  - Fishing centres;
  - Where the craft were to be introduced, and
  - the fishermen who would operate them;
- The training requirements; and
- The importance of
  - planning and preparation,
  - monitoring, and
  - effective follow-up support.

As the introduction of the craft was carried out through various state-sponsored credit schemes, the first two criteria needed to be integrated into the terms and conditions of the latter, particularly of the NCDC scheme through which the largest number of BLC were financed. This, however, does not appear to have been done. On the contrary, the stipulation in the NCDC scheme for allocation of a maximum of five BLC per fishermen's cooperative society seems to have militated against the application of the selectivity criteria suggested by BOBP. This initially resulted in the BLC being thinly spread over a large number of fishing centres. Subsequently, it also led to various malpractices in the cooperative societies, as a result of which the craft gravitated to a smaller number of fishing centres, ultimately nullifying both the principle of numerically 'equitable' distribution as well as the principle of cooperative ownership (Section 3.2).

Was the policy of commercial introduction through cooperatives the best way of going about it?

The issue of cooperative ownership of fishing craft needs to be reviewed. As mentioned earlier (Section 3.1), one of the causes of the failure of the BLC in Tamil Nadu was the attempt

to operate them under a system of joint responsibility. As mentioned in Section 2.3, the cooperatives in Andhra Pradesh and Orissa virtually resold the craft to individual members or even to non-members. These experiences seem to show that **collective ownership and operation of this type of fishing craft is unworkable** – a conclusion borne out by similar experiences in other countries of the Bay of Bengal region.

While it is appreciated that the NCDC has a commitment to channel its financing through cooperatives, it is perhaps necessary to recognize the reality that cooperative ownership tends to become a fiction and that, therefore, it would be best to make provision for ownership of craft by selected members of cooperatives during future BLC introductions.

It is often argued in support of cooperative ownership of BLC that it enables their ownership by the poorer sections of the small-scale fisherfolk who constitute the target group of BOBP and, conversely, that allocation of a BLC to an individual generally means that the beneficiary moves out of the target group and, often, becomes a manager rather than a fisherman. It is a fact that many BLC owners have found that the logistics of operating a BLC have made it necessary for them to spend more time ashore than when they were operation traditional craft. As a result, they either become occasional crew members or full-time shore managers. The latter is the norm if they become the owner of more than one boat.

The implications of this change are fully in accordance with the objectives of BOBP :

- Several members of the target group are provided full-time employment as crew in an efficiently operated BLC;
- The change also represents the upward mobility of an enterprising member of the target group.

As mentioned later in this section, it has to be accepted that the target beneficiary of a BLC should be the enterprising (rather than just any poor) small-scale fisherman.

Was adequate training provided for BLC operators?

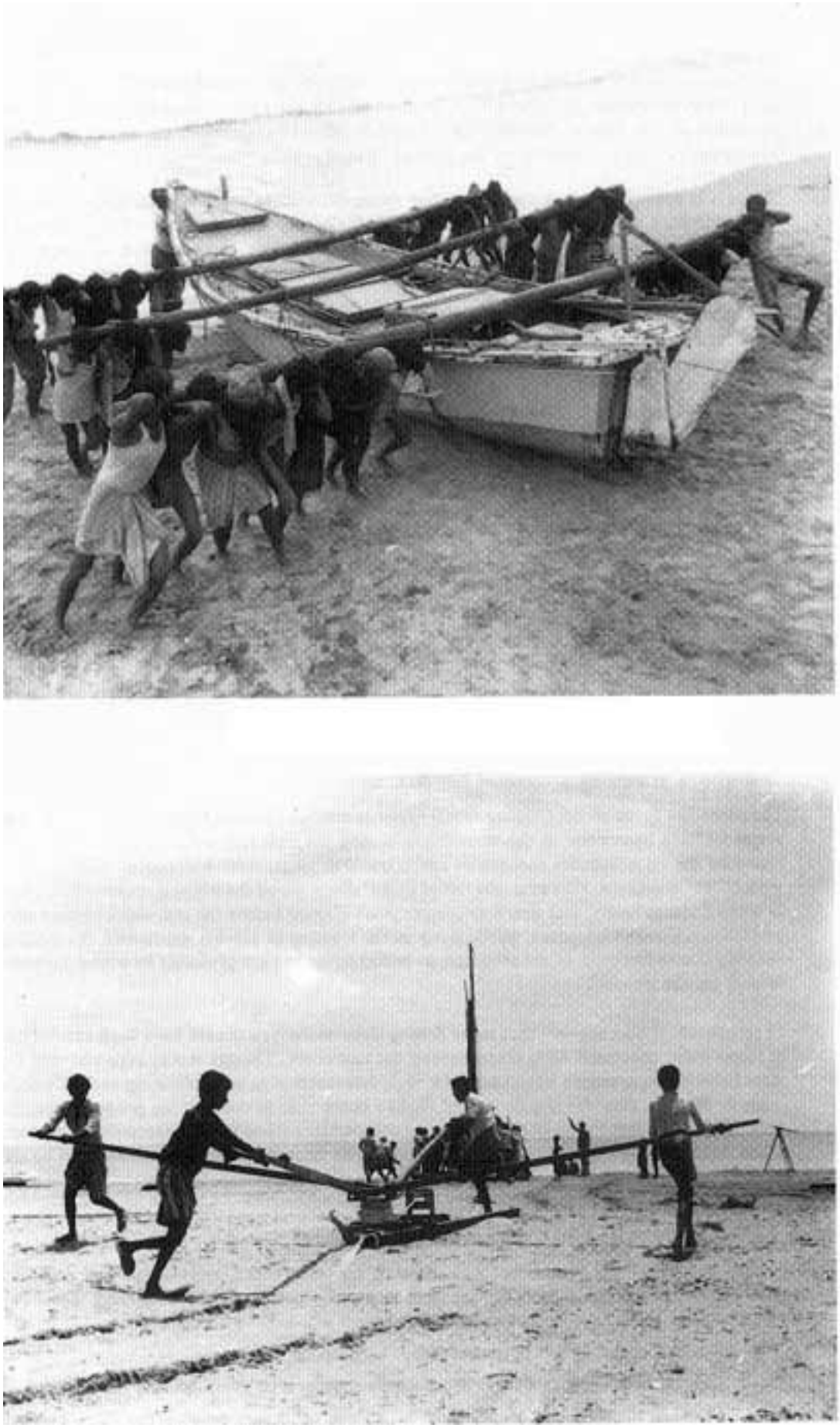
The attention given to the training requirement is seen to have been insufficient. Very little seems to have been done in this connection during the first two years of the introduction phase by the state fisheries authorities and a training programme was started only in 1987, with BOBP assistance. However, the initial BOBP diagnosis of the training requirements was, in some respects faulty, and nearly two more years elapsed before the real requirements were established. **Greater attention, particularly to the training of private mechanics,** dovetailing with the commencement of the commercial introduction, **would probably have had a greater impact on the process.**

In retrospect, it also appears that **more fishing demonstrations should have been carried out** at many more selected fishing centres along the east coast.. Though it was expected that the state fisheries departments would organize such demonstrations as a follow-up to the Uppada trials in 1985-86, they did not do so and, unlike in the case of the training programmes, the breach was not filled by the BOBP. In fact, it was partially filled by the fishermen themselves, when they started commercial fishing for Shark with drift longlines as demonstrated by the BOBP.

How satisfactory is the BLC on technical grounds?

From experience during the trials, as well as during commercial operations since 1985, the BLC can be considered to have proven itself as a surf-crossing and beachlanding craft. The main features of the hull contributing to this are :

- The flat and rounded bottom without skeg or keel;
- The flat middle part of the bottom which enables it to sit upright on the beach; and
- The high manoeuvrability achieved by a large rudder directly behind the propeller, complemented by the pivoting engine installation.



Hauling a BLC on to the shore with a steel winch

These features, combined with inbuilt buoyancy and a watertight deck, have led to a record of very rare capsizes in the surf and the absence of any loss of life on these rare occasions.

The hull also has provision for a crew shelter below deck. This facility, together with its watertight deck and surf-crossing capability, seem to be the reasons the a consensus among fishermen that the BLC is safer and more comfortable than other small fishing craft.

An evaluation of the few problems that have been experienced with the hull shows that the latter are due to defects in workmanship and that a properly constructed hull should have a service life of at least 15 years (0 Gulbrandsen, 1990).

The BLC is generally hauled on to the beach in the same manner as the nava, being lifted by about 24 men with the help of two poles lashed across the craft. While BOBP has developed beach hauling devices, these are generally not being used because of the ready availability of manpower and lack of space on the beach, as in Puri — they may, however, become necessary in areas with steeply shelving beaches or where labour is in short supply. A few manual steel winches are, in fact, being used in a few fishing centres in Tamil Nadu short of manpower.

The main complaint by fishermen with regard to the BLC has been in respect of the engine. The major problems encountered with the air-cooled and water-cooled engines have already been referred to. In the case of the air-cooled engine, the problem of overheating has been linked with the Box Drive propulsion system. The new BOB Drive propulsion system under introduction offers a solution to this problem.

Hove there been any complaints by the fishermen about the introduced BLC?

Some of the complaints, have, tended to be exaggerated and appear to be an excuse for poor maintenance or non-repayment of loans.[16] Significantly, there are no reports of boats rendered inoperable or abandoned due to engine defects.

The engines used in the BLC were small, marinized diesel engines designed originally for agricultural automotive and electrical applications. As no small marine engines (below 20 hp) were being produced in India in 1979, and the use of an imported engine was not practicable, BOBP had been forced to use the available engines, initially supplied by Greaves and subsequently by VST, in developing the BLC. The problems in the engines stemmed mainly from the engine installation devised by BOBP, in which the engine manufacturers had little confidence. This lack of confidence, combined with the fact that the potential market for marine engines is likely to be only a small fraction of the total small diesel engine production (which is predominantly for the agriculture sector)[17], seems to have inhibited research and development work by the engine manufacturers.

In the circumstances, development of the engines to their present level represents a considerable achievement by the local manufacturers. This achievement also appears to be partly due to sustained testing, frequent assessments of engine performance and proposals and requests for various modifications by BOBP staff.

It has been argued that commercial introduction of the BLC should not have been allowed to proceed when various problems with the (air-cooled) engine surfaced during trials (Turner and Mathew, 1991), presumably implying that an alternative engine should have been used or that all problems should have been eliminated before the engine was utilized. A more satisfactory engine, however, was not available, and, in fact, the air-cooled engine has proved itself to be remarkably sturdy and reliable, in spite of the problems.

I6 Many fishermen interviewed during field visits (August 1992). most of whom were using the air-cooled engine, did not complain of serious defects in their engines. Some of them mentioned overheating. Some of them had engine problems in the first two months of commissioning the boat. but experienced no recurrence after the engines were rectified by the manufacturer.

17 A Minor Field Study on Marine Engine Development, Nov/Dec 1989, estimated that the maximum potential market for Marine Engines under 20 hp would be only 590 engines/year. This appears to be an underestimate. Even so, the market share is certainly fractional, considering the total annual production of 60,000 engines under 20 hp by the three manufacturers (Greaves, VST and Kirloskar), mainly for agricultural, automotive and electrical applications.

The increasing motorization of indigenous craft, such as *teppa* and *nava* with small diesel engines probably marks the beginning of a continuing demand for small motorized industrial engines. This may provide an incentive for the engine manufacturers to improve their R&D work on such engines as well as their after-sales service and supply of engine spare parts, on which counts there have been many complaints from the fishermen.

Does the manner of the BLC's operation from open beaches, as described in Section 3.3, imply that there is an element of 'overkill' in the design and that some of its features could have been modified to cut down costs?

This does not appear to be the case. For craft operating from open beaches, surf-crossing is the normal practice in both calm and rough weather seasons and beaching becomes necessary during rough weather as well as for repairs. Fishermen using river inlets, creeks and lagoons as shelters have also found the features that facilitate beaching — e.g. hull shape and retractable propulsion system — an asset, particularly when negotiating the sandbars on which many traditional craft, such as *nava* and *masula,* have been totally wrecked.

The beachlanding characteristics of the craft, as tailored to fit the requirements of BOBP's target group, have, in fact, imposed a limit on the size of the craft. This, in turn, has imposed limitations on crew accommodation and carrying capacity for fishing gear, fish catch and ice on board and, therefore, on its operational range. The BLC's range is now essentially limited to one night's offshore fishing.

These limitations, however, do not preclude the BLC from access to fishing grounds in the outer reaches of the continental shelf or beyond the edge of the shelf in most parts of the east coast, except in the extreme north and south. The BLC, however, cannot be used without risk as multiday (two nights and more) boats for fishing far offshore, e.g. the attempt to use BLC in this manner off Puri resulted in the loss of six BLC at sea in cyclonic weather in June 1992.

How satisfactory is the BLC in terms of economic considerations?

The situation concerning the earnings of BLC and the lack of concrete data has already been outlined in Section 3.6. Given that the BLC is a technically satisfactory fishing craft, to be used in a particular way, its earnings will be determined mainly by factors related to :

- **Fishing gear,** ***i.e.*** the availability of adequate and diversified fishing gear;
- **Location,** i.e. access to good fishing grounds where high-value food fish resources are available, as well as adequate basic shore infrastructure, such as repair and marketing facilities; and
- **The human factor,** ***i.e.*** skills in employing diversified fishing methods and managerial skills in operating and maintaining the craft.

Obviously, therefore, **the BLC is not a craft for Everyman. Nor is** it **a craft which should be operated from any and every place** on the east coast nor was it ever intended to be so from the outset. It was not intended to replace the traditional craft but to construct an intermediate craft to be used selectively for harvesting fish resources untapped, or lightly exploited, by the traditional craft. For this purpose it should also be manned selectively by some of the traditional fishermen.

The cost of an IND-20 BLC in 1990, without fishing gear, has already been given. If the cost of diversified fishing gear, including both nets and lines, were added, the 1993 cost was expected to reach Rs. 190,000 - 200,000. The question that arises is whether this capital cost places the craft beyond the reach of the traditional small-scale *kattumaram/nava* fisherman.

If the question relates to the capacity of the latter to invest in a BLC with his own resources (savings) or with non-institutional or informal credit, which is the normal manner of investment in traditional craft, the answer is 'YES'. But a craft in this cost range or, for that matter, even at half of this cost,would necessarily have to be financed by institutional credit, as the amount involved is too large for the informal credit market. And if such arrangements are available, the answer is 'NO'.

Till now, the main investment in these craft has been through government-sponsored institutional credit schemes. But in Puri, investment has initially been with the private resources of affluent members of the fishing community, supplemented in some cases with informal credit (e.g. from one of the boatyard owners), and, subsequently, from the high earnings generated by the BLC.

In the case of the craft provided to fishermen through the institutional credit schemes, whether with subsidy (NCDC/DRDA) or without subsidy (HPS), the question of cost and the question of affordability have not been considerations in the acquisition of the craft as far as the beneficiary fishermen have been concerned. The reasons why many of them have illegally transferred ownership to others have been either absence in their villages of such factors as already mentioned as determining the earnings of the craft or the lure of easy money (the lump sum consideration for change of ownership). **None of these reasons are connected with considerations of high cost or affordability.** On the contrary, these reasons are closely related to the lack of selectivity in extending credit.

With regard to the craft's capital cost, what is really relevant is not so much the quantum of the latter, as the 'bankability' of the craft, which, in turn, depends on its earnings.

What are the actions necessary to rationalize further introduction of BLC?

There is a **need for** state fisheries agencies to establish **systematic monitoring** of BLC operations, including catches and earnings, at least at the fishing centres where there are concentrations of BLC. Such monitoring should lead to :

- Project reports for financing BLC, applicable initially to these centres;
- Appropriate changes in the government-sponsored credit schemes to consider these project reports and to exercise selectivity in further introductions of BLC; and
- The establishment of bank-financed credit schemes by providing convincing data on the 'bankability' of BLC.

One of the impediments to the future continuance of government-sponsored credit schemes and to the establishment of the 'bankability' of the BLC is the unsatisfactory loan repayment record of many of these craft. In some reports, the record of repayments has been used as an indication of the earnings. Some cases of poor loan repayments are, no doubt, due to inadequate earnings in villages where the craft are not, or cannot, be properly operated. In most cases, however, it seems to be due to the absence of credit supervision. It has been the experience with credit to small fishermen and farmers that **good repayments depend on close supervision,** e.g. frequent contact with the debtors for the collection of instalments. It appears that, in the NCDC scheme, the requirement is for repayment of the loan in annual instalments. While officials do sometimes encourage the fishermen to pay monthly instalments, they are generally left to their own devices in making repayments. It is likely that measures such as the establishment of a system of weekly loan collection (geared to the weekly payment for fish by traders) and the 'seizure' of the boats of persistent defaulters will bring about a big change in the situation.

Are the crew members' earnings better or worse than when they were crew of traditional craft?

Here again, a conclusive answer is not possible in the absence of the requisite data. Some comparative figures of crew earnings during commercial operations are found only in the El Gendy study referred to in Section 3.6. They are subject, however, to the same limitations pointed out there and have to be similarly evaluated. The relevant figures are given in Appendix IV[18].

[18] The percentage of total net income represented by the figures of crew earnings according to the statistics collected was first calculated. This is shown in Table 2, El Gendy, 1992. It was, however, found that in one centre (Thirumullaivasal) there were slight changes in the sharing according to the type of fishing gear operated and/or the number of crew; that in another centre (Pentakota) one or more close relatives of the owner generally went out fishing as crew members, that their earnings had possibly been added to the boat-owner's earnings and that only payments made to non-family crew members had been recorded as crew earnings; also that in the third centre (Tummelapenta), the crew worked for a fixed wage of appx. 20 Rs./fishing trip/person. To make a comparative analysis of earnings receivable by crew members, the crew earnings were, therefore, recalculated on the basis of the share system for each craft. The figures given in Appendix IV are excerpted from this comparative analysis.

Circumstantial evidence, however, does indicate better earnings by crew members of BLC. For instance, the high earnings of BLC in Puri also mean that the 50 per cent crew share is substantial. It was also observed during field visits that BLC operators had no difficulty in recruiting crew and that many fishermen working as crew in nava were eager to shift to BLC. Crew members of BLC, who were interviewed, were not prepared to give specific figures of their earnings, but asserted that they were better off than when they were working in traditional craft.

What is the impact of BLC operations on fish resources?

In this area too, there is a lack of concrete data due to the absence of systematic monitoring of BLC operations.

Scattered items of information in the BLC documentation give the impression that, except for a minority of BLC, which have got into and remain in the hands of unenterprising inshore *kattumaram* fishermen and are operated in the traditional inshore *kattumaram* fishing grounds, using mainly the same fishing gear and methods, the rest are being used to harvest food fish resources further offshore. How far offshore the BLC operate is determined by the location and the limitations imposed, as already stated, by the size and carrying capacity of the craft. Reference has also been made to the fact that in some locations, e.g. off Thirumullaivasal, new resources of larger Flyingfish and large pelagic resources, mainly Shark, are being exploited. In certain parts of Andhra Pradesh waters (e.g. off Kakinada) too, Shark resources are being increasingly exploited.

Considering the total number, and local concentration, of BLC presently operating off Tamil Nadu and Andhra Pradesh, it seems unlikely that these operations could have had any impact **so far** on the resources. Circumstantial evidence supporting this assumption is the absence till now of conflict between the operators of BLC and traditional craft. The only documented instances of conflict are in the Vishakhapatnam District of Andhra Pradesh where the traditional *teppa* fishermen have 'banned' BLC operations; there was also an incident where a BLC was set on fire and a fisherman beaten to death. These localized conflicts, however, appear to be due more to personal rivalries rather than to issues concerning fish resources. It is also understood that the 'ban' on BLC operations has recently been relaxed.

A different situation seems to prevail in Puri, where there is the largest concentration of BLC in one fishing centre and where more BLC are due to be introduced. From 1985, the large and lucrative catches, particularly of Seerfish, seem to have motivated the steady increase of BLC year by year at this centre. In the 1988/89 season, there was a sharp drop in catches. It is not known whether this slump is an indication of overfishing or is merely a result of bad seasons. It is, however, a fact that the *teppa,* some migrant Andhra Pradesh *nava,* as well as the BLC have all been targeting the same species. There is, therefore, at least a possibility that the fishing efficiency of a rapidly increasing number of BLC is beginning to tip the scale in the direction of overfishing.

The Puri 'season' is reported to have recovered in '91-'92 due to heavy catches of Shark, which has a more lucrative market than Seer. Very large amounts of money are reportedly being earned by the BLC operations, (as shown in Section 3.6). It is certain that more and more BLC will be introduced to tap this resource.

Shark, however, are a very vulnerable resource. The Shark species are very long-lived and their rate of propagation very low, with the result that any excessive fishing effort could lead to rapid resource depletion. This danger would be greater if the resource being targeted comprises of coastal rather than oceanic Shark. An index of the serious consequences of the collapse of a Shark fishery is a recent estimate made in Australia that a period of more than ten years would be needed for recovery.

Even though the Puri operations seem to have some resemblance to the classic scenario that leads to overfishing, no action has so far been taken for a proper monitoring of these operations. There has not even been an adequate identification of the Shark species harvested. **Official action to start an adequate monitoring of the fishing operations in Puri is seen as** an urgent necessity. The results of such monitoring would have to indicate whether or not management measures should be considered.

It may also be necessary to rightaway give some thought to the need for monitoring the entire Shark fishery off the east coast. As a spin-off from offshore fishing trials conducted by BOBP, some nava fishermen have started longlining for Shark in Andhra Pradesh and there seems to be a steady increase of fishing effort in this fishery by the nava that are being motorized in increasing numbers, as well as by BLC. As mentioned in Section 3.4, there are already instances of Shark longlining by BLC and other motorized craft even in Tamil Nadu. As fishing pressure increases in Orissa and Andhra Pradesh, fishing operations can be anticipated as moving southwards to cover the entire east coast.

What are the spin-offs from beachcraft development?

1 A substantial spin-off from BCD has been the proliferation of FRP craft construction technology on the east coast. As noted in Section 2.3, there was very little FRP construction prior to 1979, and no FRP construction at all of small marine fishing craft. During the period of BCD, nine boatyards on the east coast took up FRP craft construction and eight are still in production[19]. The technology was initially transferred by BOBP to a few of them. The remainder acquired the knowhow from other sources, but in all cases the initial impetus came from the construction of BLC. Some of the boatyards have taken the initiative to produce other small fishing craft, as well as construct plugs and moulds.

The APFC boatyard has, by modifying the IND-20 mould, started producing a craft which it calls a FRP Nava. The craft is virtually a stretched (0.6 m longer), undecked IND-20,

A FRP Beach Nava built by the APFC boatyard with the BOB Drive

19 **The boatyards are Andhra Pradesh Fisheries Corporation Boatyard, Kakinada, Mecbem. Bhubaneshwar; Rheinpaast, Baleshwar: Marine Builders, Puri: Marine Manufacturers and Suppliers, Puri: Monarch. Puri; Aquamarine. Madras; and Gear Transmission, Pondicherry.**

A FRP teppa made in Orissa

intended originally for use as a sailing craft. There are also two motorized versions – one with a fixed engine installation and, more recently, one with the BOB Drive; APFC has named the latter craft the 'FRP Beach Nava'. The boatyard personnel had gained sufficient confidence in their technical competence to carry out this development, as well as swamping and sailing trials, without referral to, or request for assistance from, BOBP.

Marine Manufacturers and Suppliers, Puri, built two expanded versions of the IND-20 on its own initiative and also produced a FRP teppa in 1988 by taking a mould off a teppa hull. It has produced 45 FRP teppa till date. The idea was taken up by Marine Builders, Puri, which has, by a similar procedure, constructed moulds and produced about 150 FRP teppa, of which about fifty are a modified two-piece version.

Some concern has been expressed about the lack of proper conditions in the Puri boatyards for moulding FRP hulls, e.g. high humidity, and lack of temperature control and ventilation in the moulding shops. Some short cuts in construction work, resulting in twisted hulls and inadequate thickness of FRP laminates, have also been noted. **Early action to monitor quality and to lay down quality standards needs consideration.**

2 Another spin-off from the BCD is the motorization of traditional craft. The idea of using motorized craft spread among the fishermen as a direct result of the BCD trial operations and subsequent commercial introduction of the BLC. It became a practical proposition with the availability of small, marinized diesel engines, also a spin-off from the BCD.

In Orissa, motorization of the dinghy was carried out in 1984-85 with BOBP assistance. In Andhra Pradesh it has mainly been the nava that has been motorized. It is estimated that

10 per cent of the fleet of 3000 nava have already been fitted with engines. This development is seen as a spin-off from BOBP's involvement with nava fishermen commencing with the first Uppada fishing trials (1982-85). The first nava were motorized in 1986 with a few second-hand engines purchased from BOBP.

An increasing trend in motorization is presently observable. The improved mobility, increased operational range and fishing efficiency of these craft, taken together with the operations of the BLC, will, in time, lead to increasing pressure on the offshore resources. Timely action, to **commence the monitoring of these operations as well is needed.**

3 Other spin-offs from BCD include

- The location of less-exploited offshore resources of larger Flyingfish, Tuna, Shark and Billfish, as a result of offshore fishing trials;
- Increasing use of drift longlines for Shark fishing; and
- The diversification of fish marketing, e.g. new sources for Salted Shark meat in Kerala and for Seerfish in Delhi, and a new source for dried Shark fins in the export market in Singapore and Hong Kong.

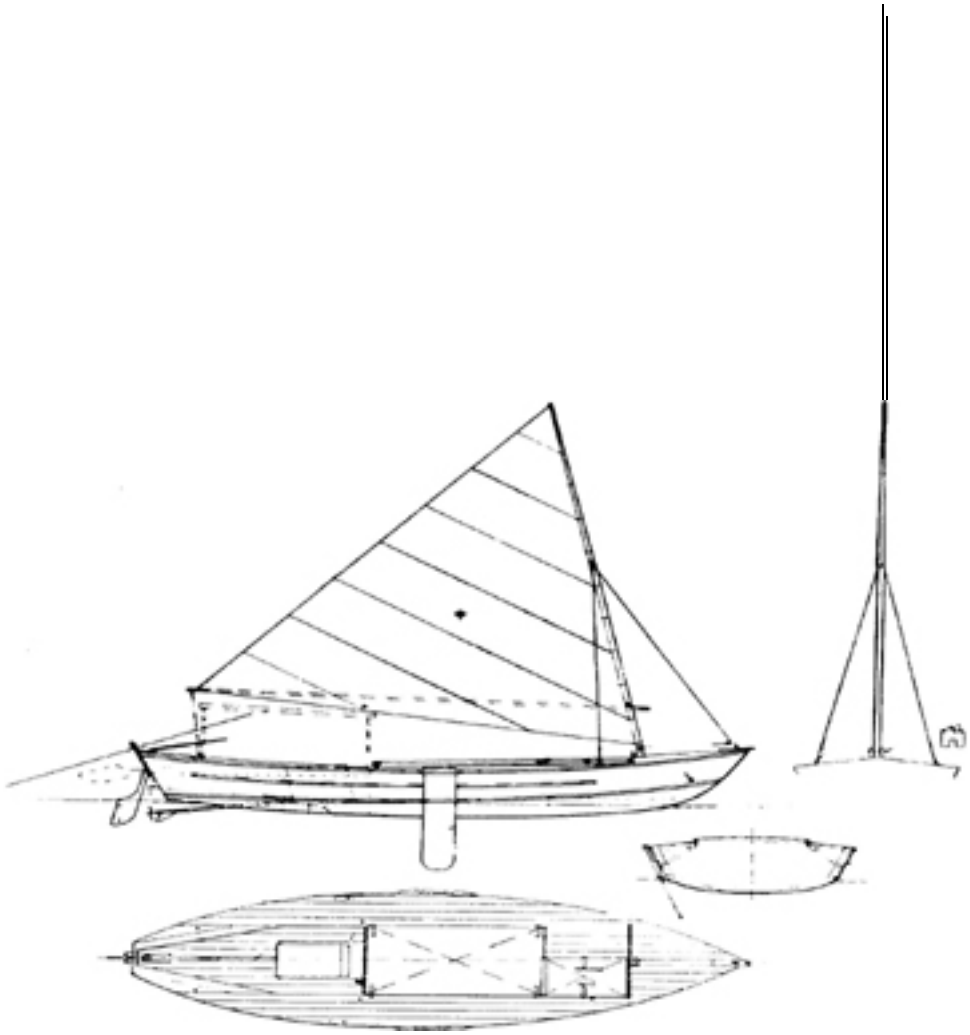
4 Use of the BOB Drive in the motorization of outrigger canoes in Shri Lanka and Indonesia, through BOBP subprojects in those countries, is a spin-offs outside India from the BCD. For the future, it is anticipated that a manual on the construction of the BOB Drive, now being prepared by BOBP, will promote its application in countries within and outside the Bay of Bengal region.

A dinghy in Orissa *that has been motorized.*

APPENDICES
and
REFERENCES

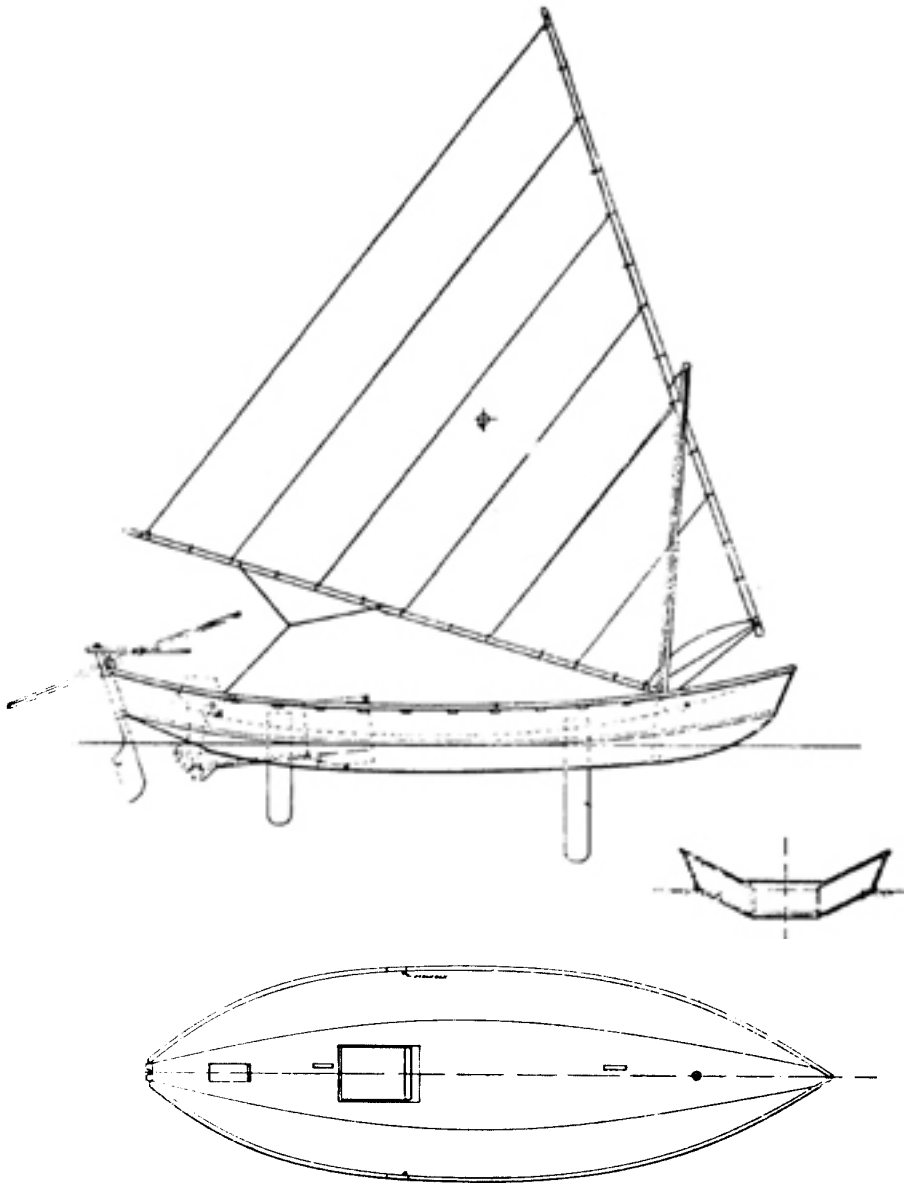
APPENDIX I
Technical drawings of the early BLC

Fia. 6 IND-10 General Arrananment



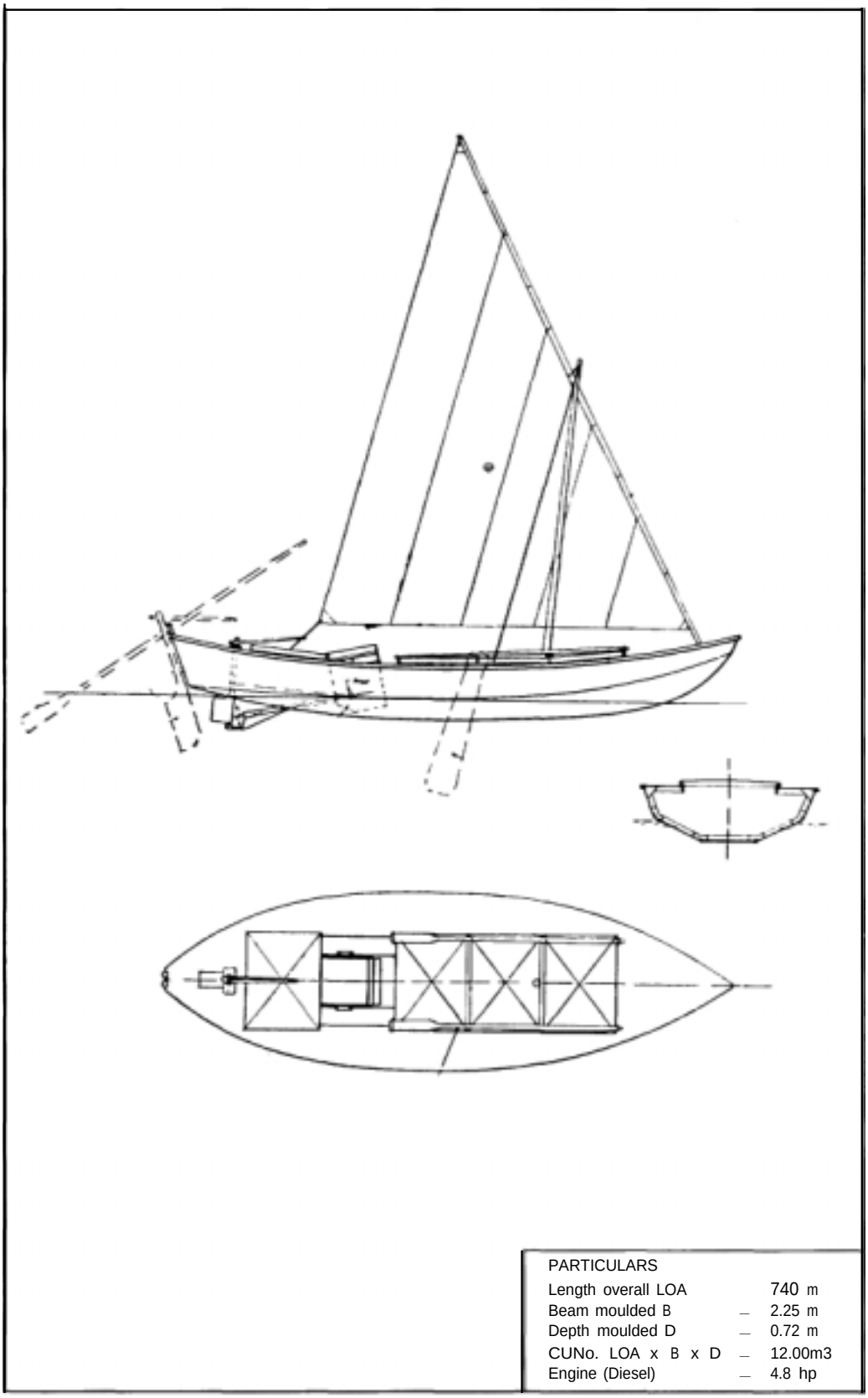
PARTICULARS	
Length overall LOA	7.00 m
Beam moulded B	– 2.45 m
Depth moulded D	– 0.85 m
CU No. LOA x B x D	– 14.60 m^3
Engine (Diesel)	– 4.8 hp

Fig. 7 **IND-II** General Arrangement



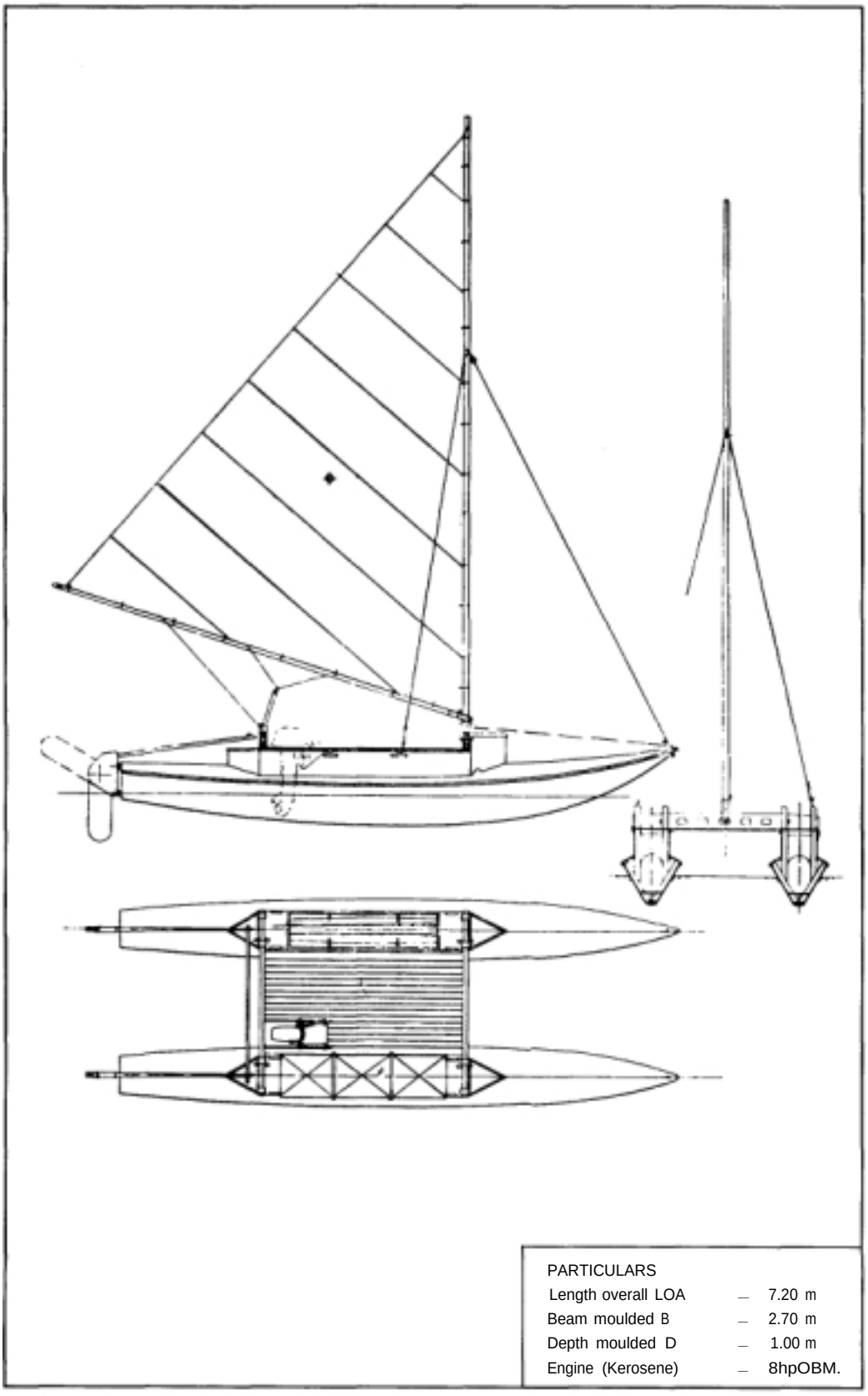
PARTICULARS		
Length overall LOA	–	7.40 m
Beam moulded B	–	2.25 m
Depth moulded D	–	0.72 m
CU No. LOA × B × D	–	12.00 m^3
Engine (Diesel)	–	4.8 hp

Fig. 8 IND-13 General Arrangement



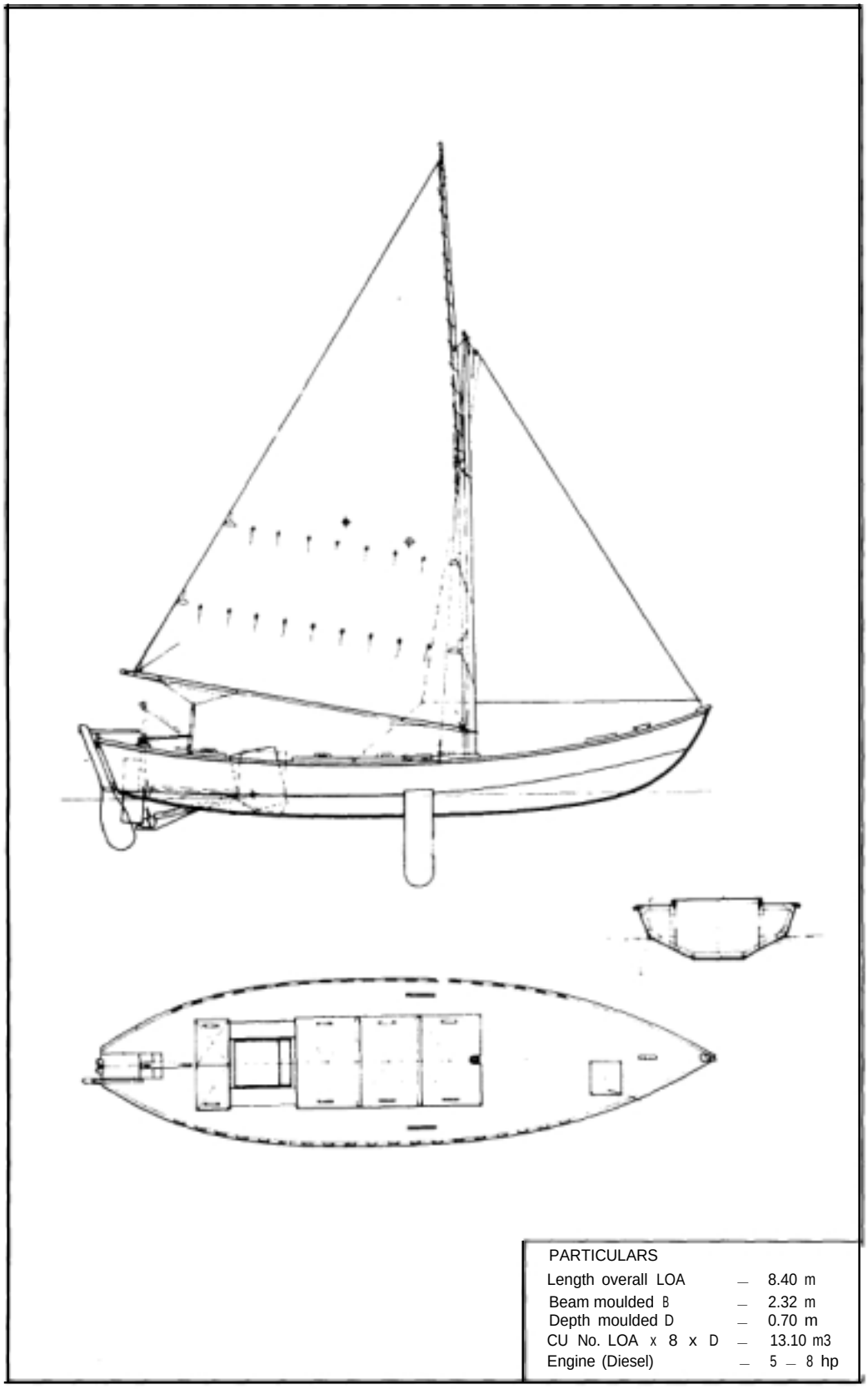
PARTICULARS		
Length overall LOA		740 m
Beam moulded B	–	2.25 m
Depth moulded D	–	0.72 m
CUNo. LOA x B x D	–	12.00m3
Engine (Diesel)	–	4.8 hp

Fig. 9 IND-14 General Arrangement



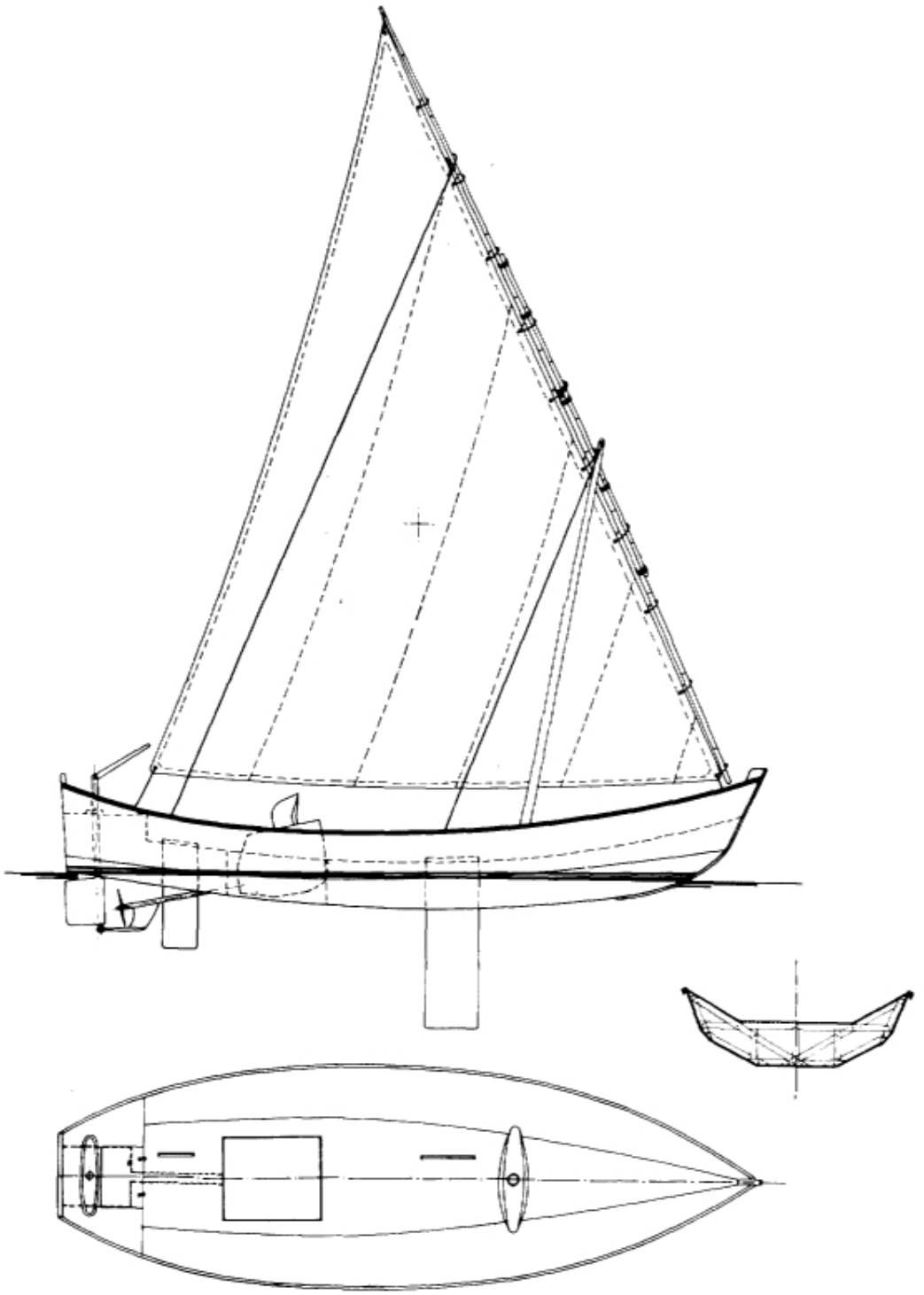
PARTICULARS		
Length overall LOA	–	7.20 m
Beam moulded B	–	2.70 m
Depth moulded D	–	1.00 m
Engine (Kerosene)	–	8hpOBM.

Fig. 10 IND-18 General Arrangement



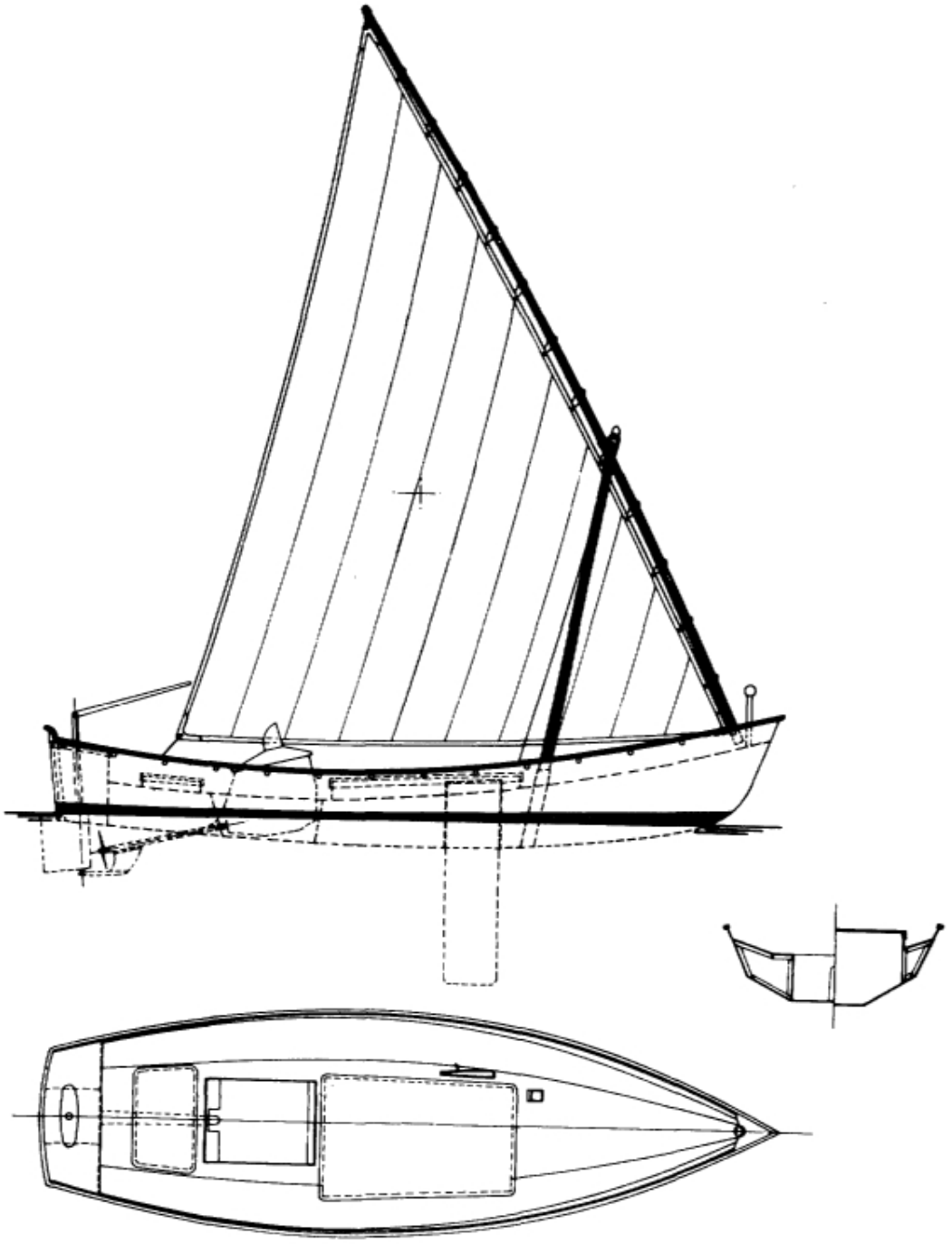
PARTICULARS		
Length overall LOA	—	8.40 m
Beam moulded B	—	2.32 m
Depth moulded D	—	0.70 m
CU No. LOA x 8 x D	—	13.10 m3
Engine (Diesel)	—	5 — 8 hp

Fig. 11 IND-21 General Arrangement



PARTICULARS		
Length overall LOA	—	7.20 m
Beam moulded B	—	2.25 m
Depth moulded D	—	0.80 m
CU No. LOA x B x D		13.22 m^3
Engine (Diesel)		5 — 8 hp

Fig. 12 IND-24 General Arrangement



PARTICULARS		
Length overall LOA	—	7.13 m
Beam moulded B	—	2.13 m
Depth moulded D	—	0.75 m
CU No. LOA x B x D	—	11.35 m^3
Engine (Diesel	—	5 - 8 hp

APPENDIX II

Terms and conditions of credit schemes for BLC

1. National Co-operative Development Corporation Scheme (NCDC)

Village fishermen cooperative societies with financial security are eligible.

CONDITIONS : 50 per cent of the cost of boat and fishing gear as subsidy;

5 per cent society contribution; and

45 per cent loan at 11.25 per cent interest p.a., repayable in ten years by nine annual instalments.

NOTE : 1) Cost of fishing gear is included in the unit cost in Andhra Pradesh only.

2) By a subsequent revision, the amount of the subsidy was reduced to 20 per cent and the loan component correspondingly increased.

2. Hire Purchase Scheme (HP'S)

Individual fishermen trained in Fisheries Training Centres are eligible.

CONDITIONS : Loan for full cost of the boat, including fishing gear, at 8 per cent interest, repayable in eight years (nine instalments per year) with penal interest at 12 per cent for delayed repayment.

3. District Rural Development Agency Scheme (DRDA)

Individual fishermen are eligible.

CONDITIONS : Each individual fishermen in a five-member group receives a subsidy of Rs. 3,000, totalling Rs. 15,000 for the group;

15 per cent margin money is provided by the Backward Classes Development Corporation;

5 per cent contribution by the borrowers; and

80 per cent loan from a national bank.

APPENDIX III

Data on economic performance of BLC (in IRs)

	PENTAKOTA		TUMMELAPENTA		THIRUMULLAIVASAL
BLC	**BLC-AC**	**BLC- WC**	**BLC1**	**BLC2**	**BLC**
Gross revenue	57,633	59,378	23,586	26,863	140,341
Variable costs	30,398	16,525	11,170	9,585	80.350
Fixed costs	26,225	25,125	26,225	26,225	28,088
	23,600	24,010	20,113	20.113	28,088
Net earnings	1 010	17,728	(13809)	(8,974)	31 903
	3,635	18,843	7,697	(2,835)	
IRR	1%	23%	(18%)	(11%)	38%
	9%	23%	(17%)	(6%)	
Breakeven point	56 623	41,650	37,395	35,810	108.438
	53,998	40,535	31,283	29,698	
B/C ratio	1.02	4.43	0.63	0.75	1.28
	1.08	1.46	0.75	0.90	

N.B. For fixed costs, net earnings, IRR, breakeven point and B/C ratio, two figures per fishing craft are given. The first figure is calculated on the basis of the present investment costs per fishing unit. The second figure represents the actual investment made, taking into account subsidies and secondhand purchase.

(Source : BOBP/WP/74)

APPENDIX IV

Earnings receivable by crew members of small fishing craft on the basis of the share system (in IRs)

PENTAKOTA

CRAFT:	BLC-AC	BLC- WC	TEP-LONG	TEP-OBM	TEP-SAIL
Cash before payment to crew and boat owner	45,891	45,358	29,645	25,911	27,902
Percentage to be paid to crew	50%	50%	62.5%	55.5%	71.5%
Actual payment to crew	22,946	22,679	18,528	14,417	19,950
No. of crew members	5	5	5	5	4
Yearly earnings per crew member'	4,589	4,536	3,706	2,883	4,988
Monthly earnings per crew member	**417**	412	337	262	453

TUMMELAPENTA

CRAFT :	BLC1	BLC2	KAT-L1	KAT-L2	KA T-S
Cash before payment to crew and boat-owner	11,105	22,243	18,863	17,179	17,808.50
Percentage to be paid to crew	50%	50%	–	–	–
Actual payment to crew	5,553 **	11,122	–		–
No. of crew members	5	5	–	–	–
Yearly earnings per crew member	1,111	2,224	–	–	–
Moothly earnings per crew member	**139**	**185**	**–**		**–**

THIRUMULLAIVASAL

CRAFT:	BLC	FRP1	FRP2	MOT-KAT	NM-KAT
Cash before payment to crew and boat-owner	119,891	16,248	37,209	36,449	20,738
Percentage to be paid to crew	50%	33%	33%	60%	60%
Actual payment to crew	59,945	5,361	12,279	21,869	12,443
No. of crew members	4	3	3	3	3
Yearly earnings per crew member	14,986	1,787	4,093	7,290	4,148
Monthly earnings per crew members	**1,248**	149	**341**	**608**	**346**

* For Pentakota the figures represent an income over eleven months.
** For BLC1 the figure represents an income over eight months.

(Source : BOBP/WP/74)

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Reports (BOBP/REP/...) which describe and analyze completed activities such as seminars, annual meetings of BOBP's Advisory Committee, and subprojects in member-countries for which BOBP inputs have ended.

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Manuals and Guides (BOBP/MAG/...) which are instructional documents for specific audiences.

Information Documents (BOBP/INF/.. .) which are bibliographies and descriptive documents on the fisheries of member-countries in the region.

Newsletters (*Bay of Bengal* News) which are issued quarterly and which contain illustrated articles and features in nontechnical style on BOBP work and related subjects.

Other publications which include books and other miscellaneous reports.

Those marked with an asterisk (*) are out of stock but photocopies can be supplied.

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