BOBP/REP/59

Development of Canoes in Shri Lanka

BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

Development of Canoes in Shri Lanka

by

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This report gives an account of the successful attempts to develop and introduce a new type of outrigger canoe for the benefit of small-scale fisherfolk in Shri Lanka, who had been traditionally using dugouts called orus. It summarizes the activities of canoe construction and training of carpenters, demonstration, fishing and long-term fishing trials and discusses the impact and prospects for further development.

The work was undertaken from late 1988 till early 1993 as a subproject under BOBP's "Small-Scale Fisherfolk Communities" project GCP/RAS/l 18/MUL. The Boatbuilder Consultant assisting in construction of prototype canoes and training of carpenters was O Gulbrandscn, from Norway.

The Bay of Bengal Programme (BOBP) is a multiagency 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 technologies, methodologies and ideas to help improve the conditions of small-scale fisherfolk communities in member countries. The BOBP is sponsored by the governments of Denmark, Sweden and the United Kingdom, and also by UNDP (United Nations Development Programme) and AGFUND' (Arab Gulf Fund for United Nations Development Organizations). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

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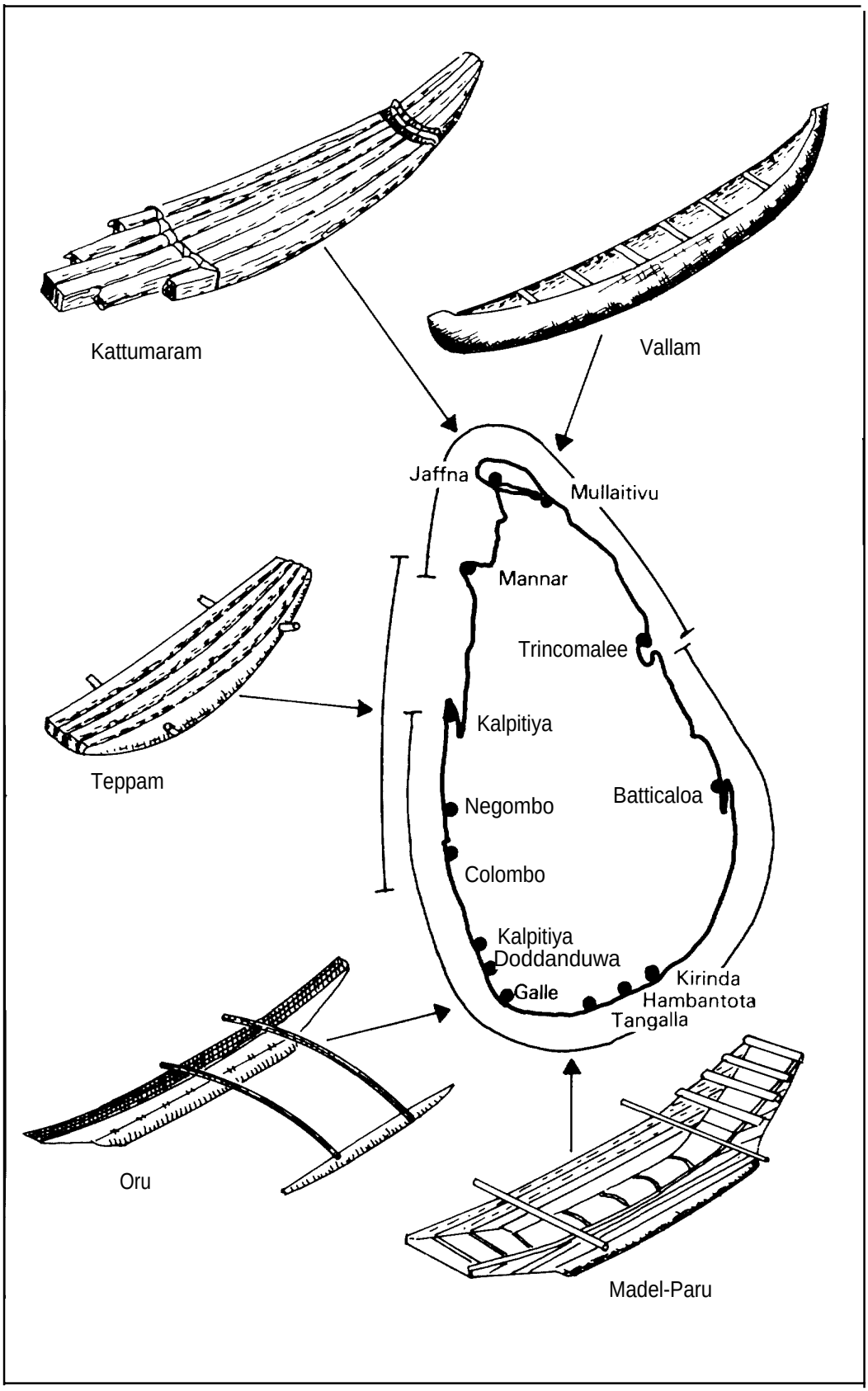

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Traditional oru *in Doddanduwa*

18-*footers*

1. *BACKGROUND*

The coastal fishery, defined as fishing within the continental shelf up to 40 kms from the coast, plays a dominant role in Shri Lanka. It still accounts for 80 per cent of the catch, even though, over the last decade, an offshore fishery has developed with the introduction of about 400 multiday boats of 10-12 m length.

Three groups of fishing craft are of importance in the coastal fishery:

- Traditional fishing craft, about 15,000 in number, of which about 1,700 *(kattumaram* and *oru)* have been motorized with outboard motors; (see Figure 1 on facing page);
- FRP boats (18-footers) with outboard motors of 7-25 hp, about 7,000 in number; and
- FRP 3½-tonners, mostly 28-footers, powered with 30-40 hp inboard diesel engines and numbering about 2000.

Over 50 per cent of the island's fishing craft still remain nonmotorized, but a noteworthy introduction since the late Sixties has been the 18-footers powered with outboard motors. They now constitute 30 per cent of the coastal fleet.

With most inshore fishery resources heavily exploited, the question of efficiency of operation in terms of cost *versus* output has assumed greater importance in Shri Lanka's coastal fisheries in recent years. This warranted a re-examination of the fishing craft being used and a look at more economic alternatives.

The Bay of Bengal Programme (BOBP) Advisory Committee in March 1987 endorsed a subproject entitled "Development of outrigger canoe in Sri Lanka". BOBP, thereupon, examined the possibility of developing an alternative fishing craft based on the traditional dugout - the *oru.* Such a multihull craft, it was felt, should

- offer greater fuel saving than the monohull 18-footers;
- eliminate the need for large logs, which are scarce and costly; and
- reduce the amount of timber wasted in the construction of traditional canoes.

The first phase of this activity, described in BOBP/WP/61 : *Development of Outrigger Canoes in Sri Lanka* (1990), consisted mainly of developing alternative hull shapes for the *oru* with sails that are used for shrimp trawling in Negombo. This work did not result in further development. The second phase concentrated on developing an outboard powered canoe of about 8 m length, suitable for fishing with gillnets, ringnets, trollinglines and handlines and which could operate from beaches mainly along the southern and eastern coast where Shri Lanka's traditional *orus* are mostly used. This development work took place mainly in Doddanduwa, north of Galle, and activities up to 1990 were included in the working paper referred to above. The third phase was trials with a diesel engine and liftable propulsion system as an alternative to the outboard motor.

2. *SUBPROJECT ACTIVITIES*

2.1 *Prototype canoes*

The activities of the first phase of the subproject were:

- Design and construction of two prototype wooden canoes;
- Trials and demonstration of these canoes; and
- Introduction of more canoes depending on the outcome of the trials and demonstration.

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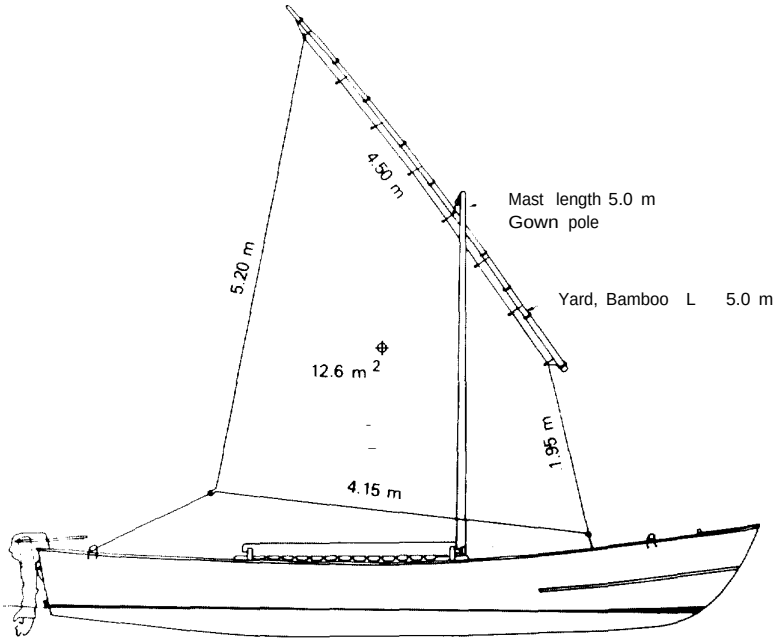
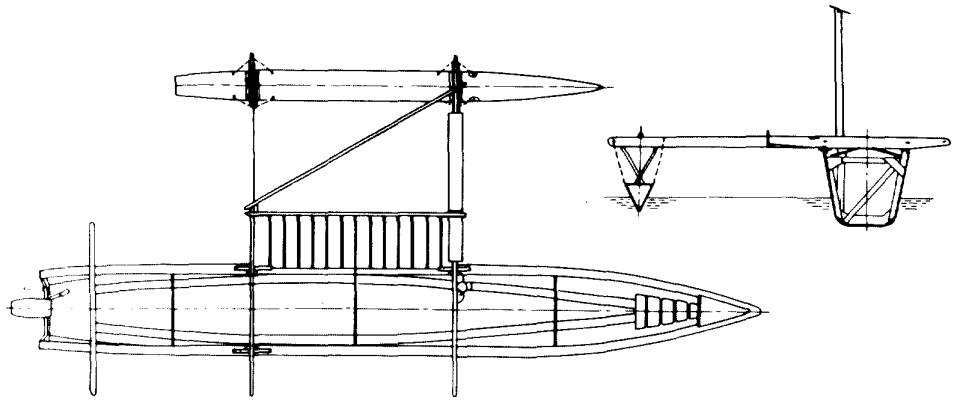
Fig 2. SRL-18 canoe





		Main hull	*Outrigger*
Length overall	*LOA*	8.0 m	4.9 m
Length waterline	*L*	7.2m	4.3m
Beam moulded	*BMO*	0.48 m	0.35 m
Depth moulded	*DMO*	0.83 m	0.37 m
Draft	T	0.29 m	0.20 m
Cubic No.		6.5 m^3	0.63 m^3
Weight Empty		460kg	80kg
Displacement		930kg	90kg

Engine 8 hp. Outboard

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The purpose of testing two different construction methods was to determine which type would be more satisfactory locally from the point of view of

conserving scarce wood resources,

ease of construction.

strength to withstand the rigours of beachlanding and

acceptance by the fishermen

A planked canoe uses considerably less wood than a dugout (see Figure 5. facing page). Due to saving in weight and a better hull shape. it would also save on fuel.

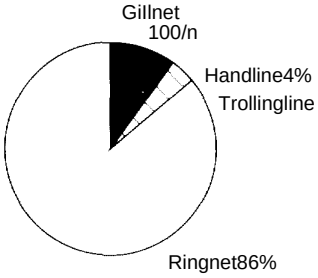
The two wooden canoes were fitted with single outriggers made of FRP to make the boats lighter and faster than the traditional log outriggers. Following satisfactory trials with the two prototype wooden canoes, a FRP version. designated SRL-19A, was launched in May 1990.

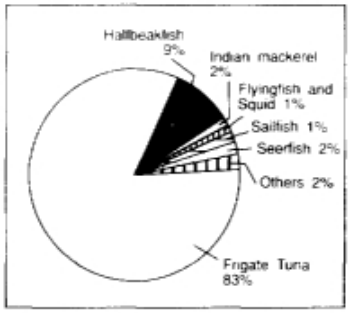
2.2 Fishing trails

canoes was made with skilled fishermen from Doddanduwa, thus ensuring their wholehearted participation in the evaluation of the craft. At all times. the fishermen decided for themselves what fishing gear they would utilize and where they would fish. Records of catches. costs and earnings were kept by an independent field worker appointed by BOBP. Data were collected for SRL-IX from June 1988 until May 1989 and for SRL-19 from July 1989 until June 1990. The reason for the delay in the start of operation of SRL-19 was partly due to repairs to the hull and partly due to trials with a 'longtail' diesel engine installation.

The two canoes were used for the same fishing operations. mainly ringetting for Frigate Tuna (Auxis thazard) and Halfbeakfish (*Heminamphis* spp) and gillnetting for a variety of small pelagic species, The ringnet accounted for as much as 86 per cent of the total catch (see Figure 6). The predominant (83 per cent) species was Frigate Tuna (see Figure 7). The ringnet fishery is highly seasonal. generally lasting from September/October till February/March (see Figure 8).

Fig 6. Weight of catch by fishing gear





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The prototype SRL-18 was built at the Fisheries Training Centre, Negombo. and the SRL-19 was built in a private boatyard. with *staff* from the boatyard and the training centre teaming with BOBP consultants and private carpenters. The two canoes, launched in 1988. were of similar size (see Figure 2. facing page). hut of different construction styles:

SRL- 18 Construction with short planks using hot dip galvanized fastenings (see Figure 3)

SRL- 19 : Strip-planked bottom construction using epoxy glue and hot dip galvanized fastenings (see Figure 4)

Fig 3. SRL-18 — Section

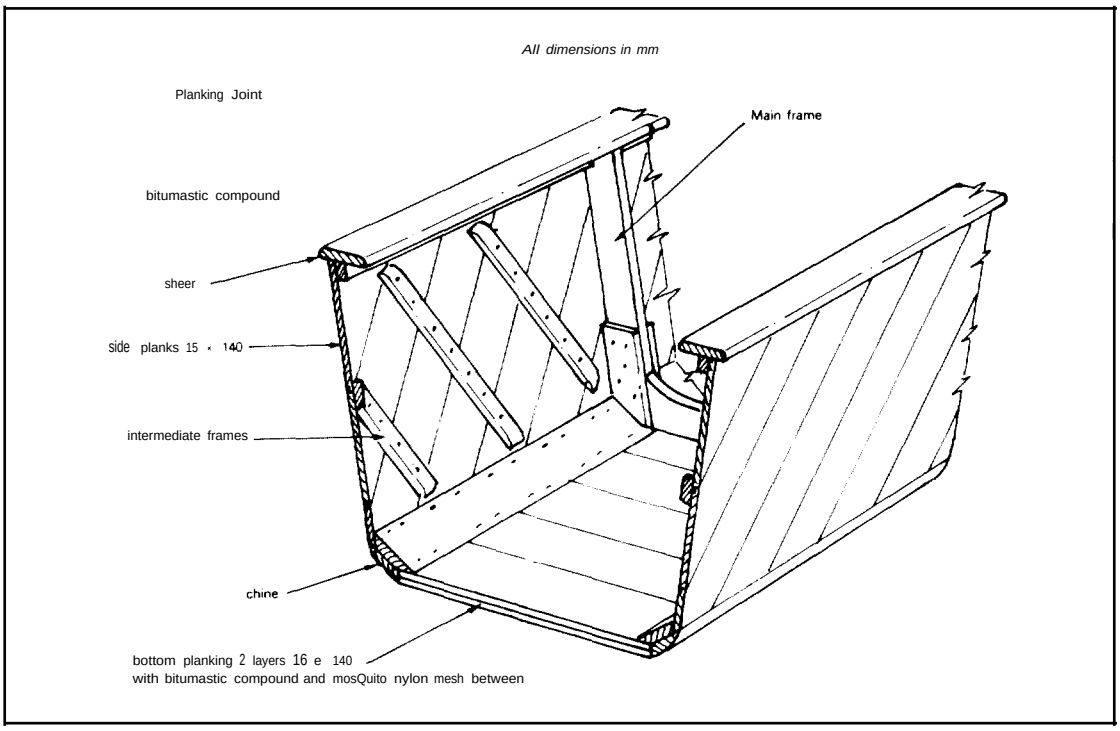


Fig 4. SRL-19 — Section

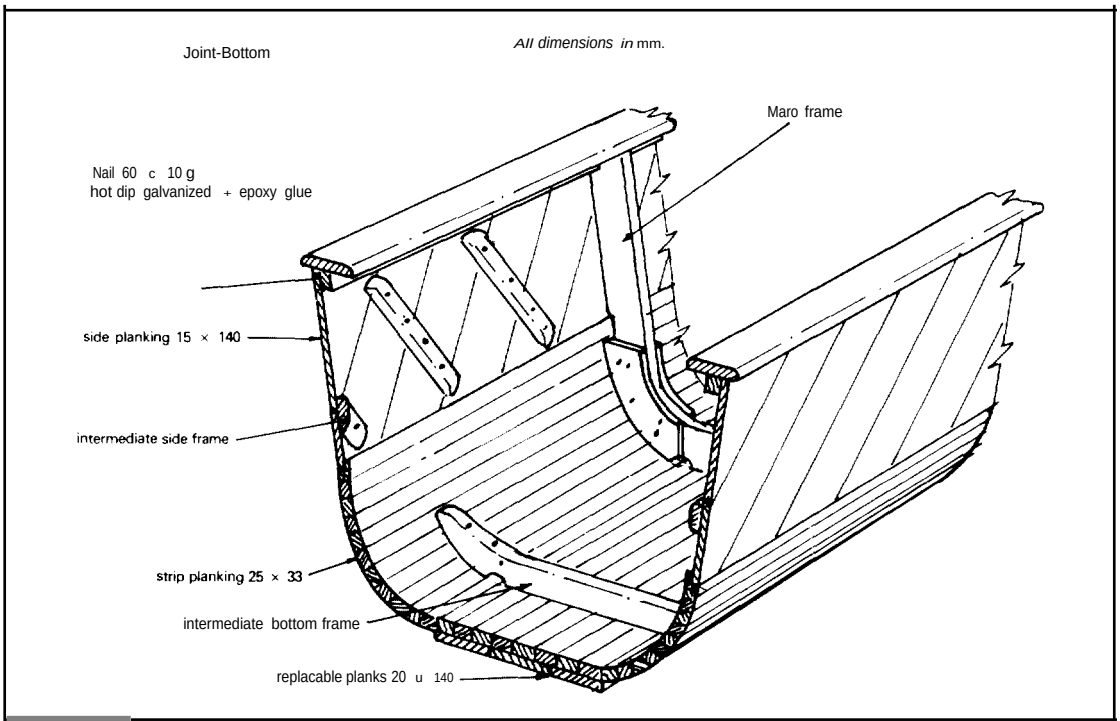
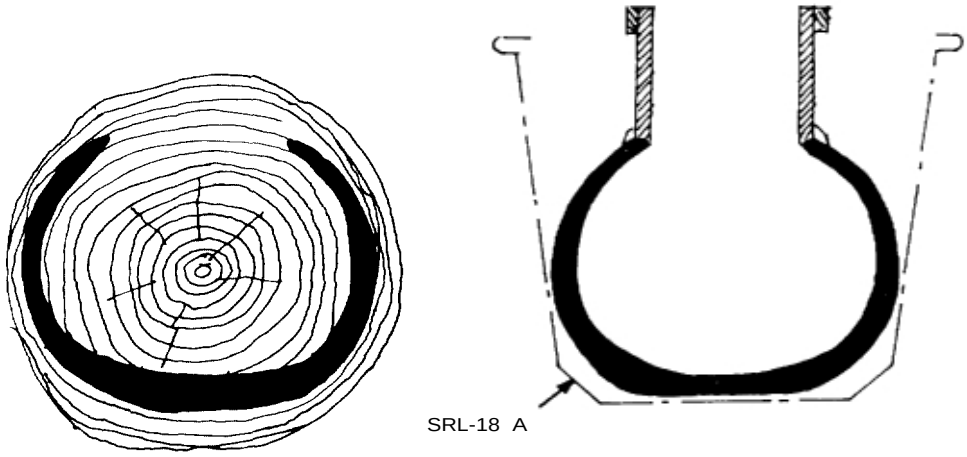
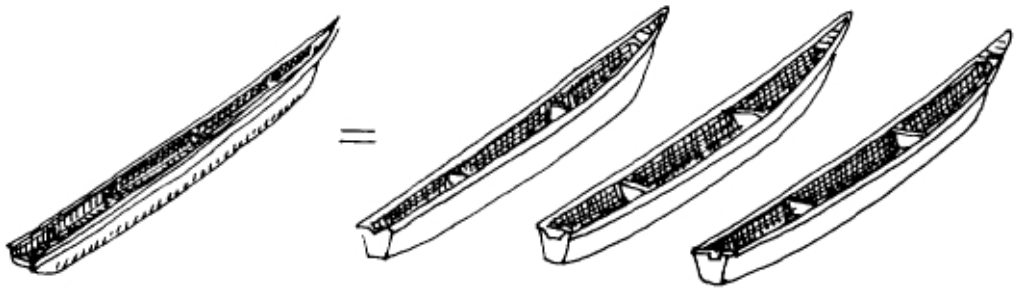


Fig 5. Saving in timber



9 0 m (29 ft) Dugoutcanoe require 6,5 m^3 (230 ft^3) in log form
SRL 18 A Canoe require 24 m^3 (85 ft^3) in log form (1.4 m^3 in sawn planks)

The dugoulcanoe require large trees SRL-18 A can use small trees



The timber in one dugoutcanoe can be used to build almost three SRL-18 A

2.3 *Economic evaluation*

The assessment of the economic viability has been based on data collected by field staff, expe rience of other commercially operated outrigger canoes and the following assumptions with regard to investment, cost and service life of the canoes:

	Capital cost SL Rs.	*Service life Years*	*Annual depreciation SL Rs.*
Canoe	36,000	10	3.600
7 HP OBM	32,000	3	10,667
Gillnets	20,000	4	5.000
Ringnets	20,000	7	2,857
Trolling/Handlines	800	1	800
Working capital	10.000		
TOTAL	**118,800**		**22,924**

After two years of operation, the new canoes demonstrated an accounting rate of return of 20 per cent for the SRL-l8 and 53 per cent for the SRL-19. The better economic results of SRL-19 are explained by a more intensive use of the lucrative ringnet, yielding much higher catches and earnings. Besides the skill of the crew, viability mainly depends on the type of fishing gear used. Economic details are given in the table below:

		SRL-18	*SRL- /9*
Period		I.6.l988-3l.5.1989	1.7.1989-30.6.1990
Fishing days		208	219
Total catch (kg)		7,035	10,100
1. Total investment (Rs.)		118,000	118,000
2. Value of catch (Rs.)		139,400	230,000 *
3. Variable operational cost (Rs.):	Fuel for OBM	19,900	22.000
	Food	9.400	21,000
	Others	3.100	2,000
	TOTAL	32,400	**45.000**
4. Net income before payment to crew member (2-3) (Rs.)		107,000	185,000
5. Crew share (50% of 4) (Rs.)		53,500	92 .500
6. Boat-owner share (50% of 4) (Rs.)		53,500	92,500
7. Total repairs (Rs.)		4.500	4.5 00
8. Insurance (Rs.)		2.100	2,400
9. Net income to boat owner (6 - (7+8)) (Rs.)		46,900	85 .600
10. Depreciation (Rs.)		22.924	22 .924
11. Net yearly return (9-10) (Rs.)		23,976	62.676
12. Accounting rate of return (II/I x 100) (%)		20	53

* **April 1990 catch data were not avaitabte** so **an average** of **March and** May **1990 has been substituted**

US $ l = **SL Rs. 36-39 appx. (1985-1990)**

2.4 Technical evaluation

SRL-18

After 1 1/2 years of fishing trials, the SRL-IX canoe was sold to a fisherman in Doddanduwa. It was structurally in good condition and the fishermen had gained the confidence that the planked canoe could stand up to the beating of a surf-landing even during the monsoon. By March 1993, the prototype canoe bad been in operation for five years. The only major repair during this period involved changing the outer layer of the bottom planking of the hull: this became necessary due to the normal wear suffered when hauling the canoe on to the beach. Otherwise. maintenance has been restricted to applying mastic (a glue-like substance) on leaking joints, as and when required. and giving the boat a coat of paint every second year.

'The short-planked SRL-IX canoe was built with mango (amba) planks. Ho-dip galvanized nails and bolts were used for fastenings. There is hardly any sign of corrosion on the nail\, while the bolts are rusted only on the surface and that too not seriously. The fishermen in Doddanduwa. however, showed a perforence for copper nails made locally from copper wire and these were incorporated in canoes subsequently built in the village. The conclusion was that the SRL-IX construction method, using short planks and not relying on glue for fastenings – as in the SRL-IY – would be most appropriate for adaptation at the village level.

SRL-19

The strip-planked SRL-19 canoe developed cracks in the bottom a short time after it started firhing from Doddanduwa. The reason was found to be delamination due to the use of epoxy glue that had been stored too long. The canoe was repaired, put back in operation and has, since, not experienced any serious problems. It is still (March 1993) in operation, bring used by a fisherman in Doddanduwa who bougth it from the Project.

SRI.-IYA FRP CANOE

The first FRP canoe, built in 1990, suffered a crack in the bottom after some months of fishing from Doddanduwa. This was due to the craft hitting some rocks while approaching the beach. The craft was repaired and has operated without any major problems since.

SRL-19 AFRP canoe

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THE **OUTRIGGER**

SRL— 18 and SRL— 19 were fitted with a suigle FRP outrigger each. using a flexible strut and a rope attachment system to the beams. This system had previously been used on hundreds of FAO—designed canoes in the Paci f ic. Initial ly there w ere some problems in Doddauduw a due to incorrect lash rig of the outriggers. hut th is **w** as rectified.

The first FRP outrigger, used with **the SRP—** l **8. w** as bin lt with the specified FRP laminate and did riot give any problems over five years of service. Subsequent outriggers were built by an FRP boatyard on a commercial basis. To reduce cost. the boatyard reduced the laminate thickness. Several of these outriggers e x perienced laminates cracking at the strut support and leaks due to **the deck—hu ll** con nect ion not **being** strong enough. The boatyard **later repaired these** at **their** ow n expense. after **it realized that the** lamination **could not he** reduced.

In spite of these problems. none of the canoe—owners w ho **use** FRP outriggers has c gone hack **to the** traditional **log** outrigger. The few fishermen who opted to use traditional log outriggers did so only because they lacked the financial resources to buy the FRP outriggers. The cost of Rs. 7.500 for a **FRP** outrigger is a maior obstacle to wider use, since a traditional log outrigger costs less than Rs. 2.000.

In June l **992** an SRL-l 8A w ooden canoe, being taken **by** sea from Colombo to Galle. capsized near Galle The reason was a leak in the FRP outrigger, which filled with **w** ater and sank. The outrigger design specifies that blocks of polystyrene. giving **80 kg** of buoy aucy. he inserted in the hull hcfore the deck is fixed: this is to make the outrigger unsinkable, even **if it** gets filled with water. The capsizal in this instance can only have been caused by the buoyancy blocks not being placed in the outrigger. **It** was not possible to verify this, because the outrigger broke loose and was lost when the canoe was thrown on the rocks. The canoe was later repaired and put hack *in* service. Though fishermen did not experience similar problems, the boatyard was requested to cheek and fill with polystrene. as required. **all FRP** outriggers that had been supplied.

Trials were also niade with planked outriggers filled with polystyrene. Various shapes were tried and an acceptable outrigger shape eventually developed. There are. however, doubts whether the advantage in terms of low weight is sufficient to outweigh the Rs. 2000 more it costs compared to a traditional log outrigger.

SAL L

The prototype canoes were fitted with a siniple dipping lug sail similar to that **w** hich is tradition-ally used by the *oru.s* **of the** southwestern coast (see Figure 2). The **sail** was mainly intended for emergency use in case of engine breakdowns. The use of the sail has been very limited and most fishermen leave **it ashore, relying on other fishing craft for help** in case of engine trouble.

2.5 Training of canoe-builders

Based on the encouraging economic results of **operating the SRL- 18** canoe and the interest shown **by** some fishermen in Doddanduwa, the subproject investigated ways of getting boathuilders trained locally in the building of this type of canoe. A scheme covering six canoes of a slightly revised design. **SRL-18A,** with copper fastenings, was prepared on the following basis:

Wood to **be** chosen, bought, sawn and stored for air drying for three months by the **fhermen.**

A payment of Rs. 1000 was to he made by the fishermen for buying fastenings.

Loan for outboard motor and fishing gear obtained from the local branch of **The People's Bank.**

The Project to meet the cost of providing an instructor-boatbuilder during construc-**tion of the canoes in the village.**

— **The** Project to pay a **daily allowance to partly compensate** for **the loss of income** to **the boatbuilder-trainees.**

The training of the carpenters and the construction of the canoes to **he periodically checked by a national boatbuilding consultant.**

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A temporary shed was erected in Doddanduwa and work on the first canoe started in April 1990. After this canoe was launched in June 1990, the construction of the next two canoes was started simultaneously so that two teams, of two carpenters each, could be trained at the same time. The last of the six canoes was completed in November 1990. The fishermen who were to take possession of the canoes also participated in the building process. The four carpenters from the village who were trained in the construction of the canoes were all dedicated and good workers

Construction of SRL-18A wooden canoe in Doddanduwa above and below)

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Using the same procedure of training as in Doddanduwa. two canoes crc built by carpenter-trainees in Balapitiya in February-April 1991 and a third was built for the Hambantota Integrated Rural Development Project (HIRDP). The workmanship was inferior to that in Doddanduwa. Of the first two SRL–18A wooden canoes hui lt in Balapitiya. one was sold to a fisherman From Doddanduwa. As the fishermen of Balapitiya preferred the SRL-19A FRP canoe, no turther orders were placed with the carpenters in Balapitiva.

2.6 *Introduction of the SRL—18A wooden canoe in Hambantota District*

HIRDP wanted to promote the SRL-18A wooden canoe in the Flambantota District and ordered two canoes from the subproject and two from the trained canoe-builders. The first canoe was handed over to a fisherman in Kirincla, but he complained that it was too heavy to haul up the steep beach (the average size of traditional canoes used in the Hambantota District is considerably smaller than that of the ones used in Doddanduwa). The canoe was later transferred to a village near Tangalla and operated with gillnets and ringnets. Even though these are the same fishing methods used in Doddanduwa, the Tangalla fisherman complained about difficulty in handling the fishing gear. leaks in the hull and the outrigger attachment coming loose. The second canoe was given to a fisherman who was primarily carrying out lobster fishing. which requires a smaller fishing craft.

The contrasting reaction of the fishermen in Doddanduwa and Hambantota to the new canoe illustrates clearly the need for a careful approach in introducing new fishing craft in other areas in Shri Lanka. Such introductions should take into account the following:

The fishermen must have the opportunity of trying out and observing the fishing craft over a long period to see that it fits their needs.

The fishermen should not be told from above what type of fishing craft to choose.

Another reason for the negative response in Hambantota is that fishermen there, having been exposed to 18-footers, see wood as a less flashy and less modern material. In Doddanduwa, there were no FRP fishing craft in operation when the Project started with the introduction of a wooden canoe.

The experience in Hambantota also shows that the same size of canoe will not fit every fisherman's need. In the Hambantota District, there is clearly a requirement for a smaller (about 6.7 m) FRP canoe.

2.7 *Trials with a liftable diesel engine propulsion* system, *the BOB Drive*

Data from the fishing trials with SRL-18 and SRL-l9 from Doddanduwa have provided cost figures for fuel, food, repairs and crew. Assuming the annual depreciation cost, as given in Section 2.3. the following average yearly total cost of each component can be assumed (1988-1990):

	Cost of operation	*Repairs*	*Depreciation*	*Total cost*	*Per cent*
Engine (including fuel	21.000	2,500	10.700	34.200	25
Canoe		1.000	3.600	4.600	3
Fishing gear		1.000	7,900	8,900	7
Crew + Food	88.000			88.000	64
Miscellaneous	2.000			2.000	
TOTAL	**111,000**	**4,500**	22,200	**137,700**	**100**

The crew cost constitutes 64 per cent and any saving here cannot he envisaged. Potential saving on the canoe and fishing gear is limited. The only item, therefore, that offers some potential for saving is the propulsion system and fuel.

There are about 8,700 outboard motors in the 7 - 25 hp range being used in the coastal fisheries in Shri Lanka. the majority on the 18-footers. A major reduction in fuel cost is only possible by using a diesel engine instead of the popular kerosene outboard motor. In 1980. BOBP assisted the Ministry of Fisheries in fitting a 6 hp inboard diesel engine in an 18-ft boat (see BOBP/WP/4 *Inboard Motorization of Small FRP Boats in Sri Lanka. 1980).* The conclusion from those trials was that the inboard diesel engine, in spite of lower fuel cost, did not have sufficient advantages compared with an outboard motor because

investment cost was three times higher; and

a fixed installation, with the propeller, rudder and a skeg under the boat, made beachlanding difficult.

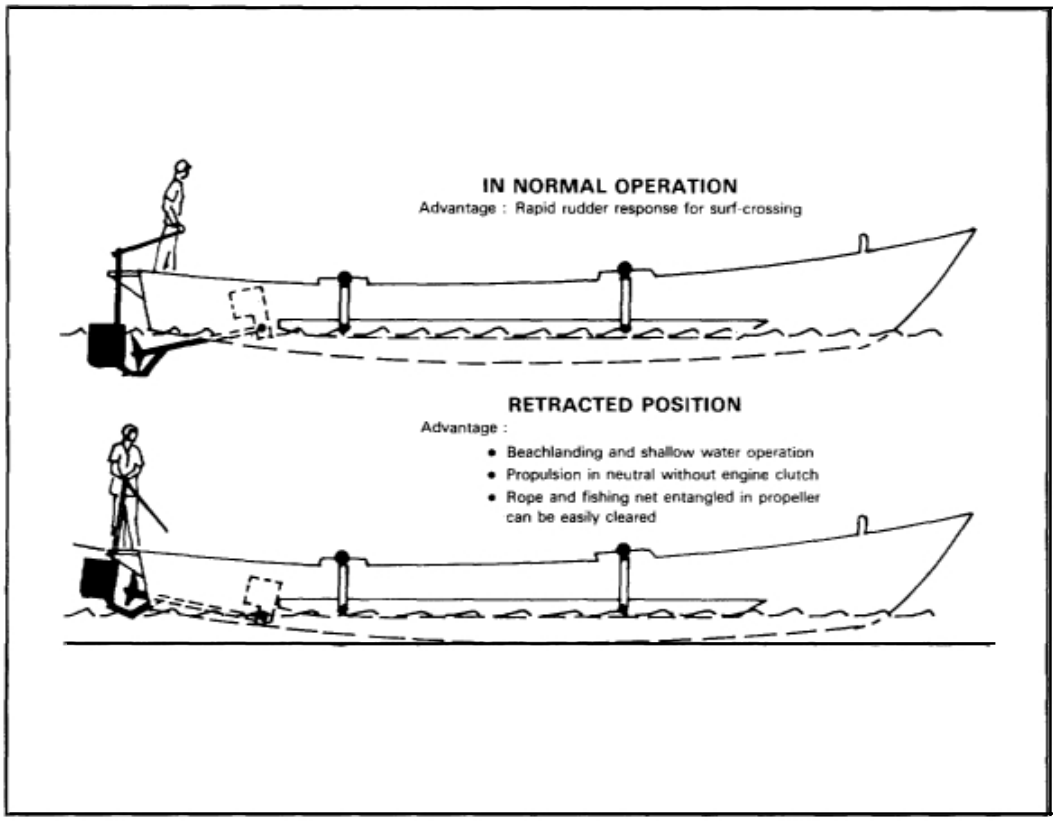
Today. the situation is. however, different, because

the cost of a diesel engine installation is less than 50 per cent more than a comparable 8 hp outboard motor. and

the liftable propulsion system (BOB Drive) developed by BOBP in Indiaissuitable for beachianding (refer BOBP/MAG/l4).

After some initial, unsuccessful trials using a longtail system for open sea operation, similar to what is widely used in ASEAN countries, the BOB Drive was selected as the most promising avenue of development. Figure 9 shows the principle of operation. When beachlanding the rudder and propeller are lifted so that nothing protrudes under the bottom of the craft. The engine used with the BOB Drive in the trials was a YANMAR L-90 air-cooled diesel engine developing 8 hp continuous at 3000 rpm. A V-belt transmission gives a reduction of 2:1 to the propeller shaft.

Fig 9. BOB Drive principle



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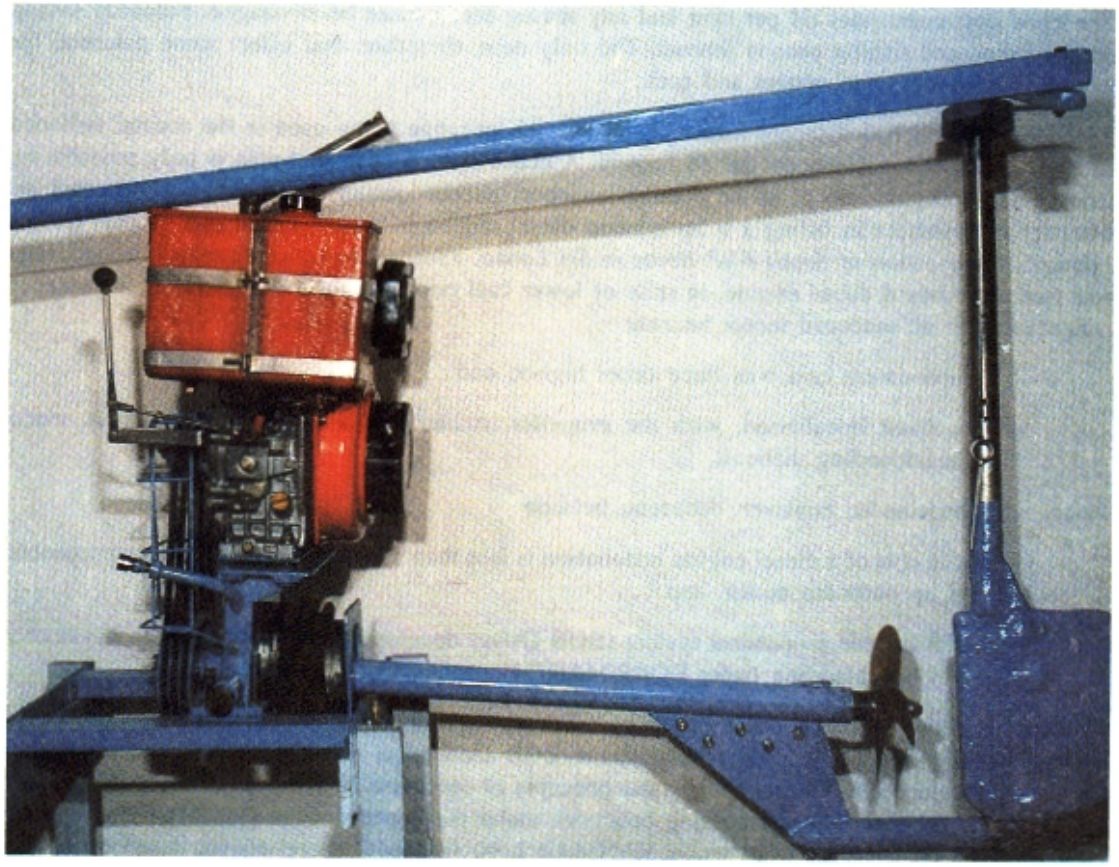

L-90 Yanmar diesel engine with BOB Drive

SRL-18A canoe with the propulsion system shown above

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Two canoes were fitted with the BOB Drive. a wooden SRI-ISA and an FRP SRL-19A. They underwent prolonged technical trials in Colombo, logging 1000 hours of operation. before being shifted to Galle District for fishing triaLs. The SRL-19A canoe was operated in GalLe from September 1992 till it was sold in January 1993. The SRL 18A capsized while being transferred to Galle (see Section 2.4). After repairs to the hull and the engine. it operated from Balapitiya for two months before it was sold in January 1993. Both diesel-powered canoes were sold to fishermen in Balapitiya who had previously bought new canoes and cooperated in the trials of the liftable propulsion system (BOB Drive). The fisherman who had operated the SRL-l9A FRP canoe in Galle also bid at the auction, which shows that the fishermen who had been given a chance to try the diesel-powered canoes were convinced about the economic benefits.

The conclusion from the trials with the two canoes fitted with the BOB Drive is that the BOB Drive is acceptable to the fishermen as an alternative to the outboard motor, but the 1-90 Yanmar engine used for the trials is not readily available in Shri Lanka.

3. *PRESENT STATUS AND FUTURE DEVELOPMENT*

3.1 *Government Policy*

The Shri Lankan Fisheries Development Plan 1990-91 expresses the need for a concerted attempt to reduce the cost of fishing and, thus, increase the benefits to fishermen in the coastal fishery. This includes the design and development of cost-effective fishing craft. In the Development Plan 1995-99 it is stated:

> ... increasing the efficiency of the industry involves improvements to fishing craft and gear. better utilization of existing capacities. improving the cost-efficiency of the fleet. etc. In all these the state sector has to play a catalytic role, by providing inducements and incentives, indicating the research and development needs and whenever possible promoting support in terms of funds. However, the actual work could be handled by the private sector and the NGOs..."

Further

> 'In the case of smaller traditional fishing craft such as *orus* and *vallams.* the prime needs are the use of more cost-effective boatbuilding materials. and the use of fuel-efficient propulsion systems in order to reduce investment and operating costs. The work initiated by BOBP and other agencies will be continued."

3.2 *canoes*

In all. 25 canoes of the new designs have been built. 12 of them as part of the Project. and. so. under supervision, while the remainder have been outside orders. Twenty of the canoes have been made of wood, the rest with FRP.

The distribution of the canoes built is as follows:

Type qf canoe	*Doddanduwa*	*Balapitiya*	*Hanthantota*	*Total*
SRL.18 Wooden prototype	1			1
SRL.19 Wooden prototype	1			1
SRL-18AWood	12	I	4	17
SRL-l9A FRP	3	1		4
SRL-l9A BOB Drive		1		1
SRL-19A BOB Drive		1		1
	17	4	4	25

Two canoes not in use

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The most experienced hoathuilder trainee in Doddanduwa. D V Danasiri, decided to establish his own workshop and, subsequently. built four canoes on order from fishermen in Doddanduwa, two canoes for the HIRDP project in Hambantota and one for BOBP. in which a diesel engine with a liftable propulsion system was installed.

The two SRL-19A FRP canoes built by the subproject for outboard motorization were, after demonstrations in various villages in the Galle District, sold by auction to fishermen in Doddanduwa at Rs. 45.000 and Rs. 50,000 respectively. Another SRL-19A was bought by a fisherman from Balapitiva from a private boatyard at its cost price of Rs. 77,000. In spite of initial misgivings about the strength of the FRP canoes, the fishermen are now convinced, after seeing them in operation over several years. that the FRP canoe is a viable alternative to the wooden canoe and **the traditional oru. PROVIDED the correct thickness of laminate has been used.**

Operators of SRL-l 9A in Doddanduwa and Balapitiya have complained that the outboard motor sits too low and is exposed to splashing from the waves. The original design was intended mainly for gillnetting with a crew of three, totalling a 400 kg load. Ringnetting with a crew of upto six. making a load of 800 kg, has, however, become the dominant fishing method. The increase in draft due to the load has led to the problems indicated. The mould of the SRL- 19A FRP canoe has. therefore, been modified by raising the bottomline aft to avoid any deep imniersion of the transom when operating the ringnet.

With large logs difficult and expensive to get and the price of imported FRP materials likely to escalate in the future, the planked SRL-l 8A canoe built of local wood, and proven in trials over a long period, is a valid alternative to both dugouts and FRP craft. Future wood supplies seem assured, as forest plantations in Shri Lanka are likely to be producing, in ten years' time, substantially more than at present.

Two types of planked canoes, each using a traditional outrigger, cost, in 1990:

	SLRs
Wooden canoe with *domba* or *mara* framing. *amba* planking and hot-dip galvanized fastenings	33.000
Wooden canoe of *domba* with copper fastenings	40,500

With an FRP outrigger, the cost increased by Rs. 4,000. (A cost breakdown is given in Appendix I.)

The fishermen were initially sceptical about the SRL-19A FRP canoe on the grounds that it might not he strong enough. But observing, over several years, the three SRL-19A working from Doddanduwa. the fishermen actually prefer the FRP canoe **PROVIDED** its **cost can be brought** down to around Rs. 55,000. The price of Rs. 77.000 (1992) being charged by the two large boatyards for the SRL-19A (Appendix II) has resulted in only two orders. one for Doddanduwa and one for Balapitiya. The high cost is mainly due to overheads and a profit of 40 per cent. The quantum of FRP materials needed for an SRL-l9A is only 11 per cent higher than that used in standard 18-footers, and they sell at Rs. 45.000 (1992). The reason for the big price difference between the SRL-19A and the 18-footer is that the latter is sold in large numbers in a competitive market, while the SRL-19A FRP canoe is considered a one-off sale by the large boatyards.

A reduction in selling price is essential if the SRL-19A is to gain in popularity. This can be achieved only if the canoe is built in smaller boatyards where overheads and profit margins are lower, The mould of the hull and outrigger of the SRL-19A was sold in March 1993, through auction, to Diyakawa, a small boatyard in Moratuwa which has experience in building small FRP *orus* and 18-footers. The fact that this boatyard invested in this mould would indicate that it sees a potential in this type and size of canoe. In Kuddawella, Hambantota District. FRP canoes of traditional shape are being built in the village and, although the finish and quality of the work could be improved, there are buyers because the price is competitive.

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The experience in Hambantota District indicates the need for an FRP canoe smaller than the SRL-19A. Such a canoe. powered with a 6-8 hp OBM, would he able to operate the same fishing gear as the 18-footer more economically and with lower investment cost.

3.3 *The liftable diesel engine propulsion system — the BOB Drive*

While there is very limited scope for cost reductions on the fishing craft and fishing gear (see Section 2.7). there is potential for significant savings in fuel by converting from kerosene to diesel.

The diesel engine consumes less that half the fuel of the kerosene-driven OBM. The initial cost of the diesel engine is higher. hut the difference is earned hack in a year because of the lower cost of fuel. The service life of the diesel engine is double that of an outboard motor and that reduces the cost of capital. The total yearly saving is around Rs. 17,000. which corresponds to the average earnings of a crew member. This is illustrated in Figure 10. Figure 11, based on data in Appendix Ill, shows the economic advantage of diesel propulsion.

The BOB Drive developed in India and now installed in the two canoes operating from Balapitiya offers the best prospects for utilization of diesel engines in the small-scale coastal fishery because of its proven record in beachlanding and its relatively low cost.

In the future, it is likely that a water-cooled horizontal cylinder diesel engine will be used. This type of engine is produced in the range of 5-15 hp and is utilized for pumps, generators. power tillers and small tractors. Because it is a mass-produced, multipurpose engine the cost is relatively low. An 8 hp engine can be obtained in Colombo for less than Rs.30,000. Spare parts are also usually available because of the large number of engines in operation. This type of engine has become by far the most popular propulsion system for small fishing craft in Southeast Asian countries.

The BOB Drive can he produced in a local workshop. A detailed manual, BOBP/MAG/14: *Building a Liftable Propulsion Systemfor Small Fishing Craft - The BOB Drive.* has been published by BOBP. The cost of the BOB Drive

Fig 10. Fuel saving with diesel engine

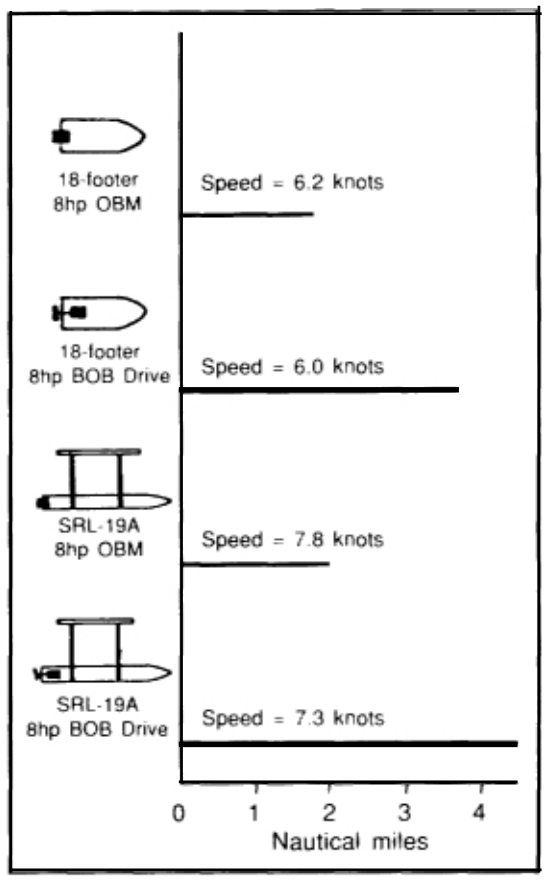
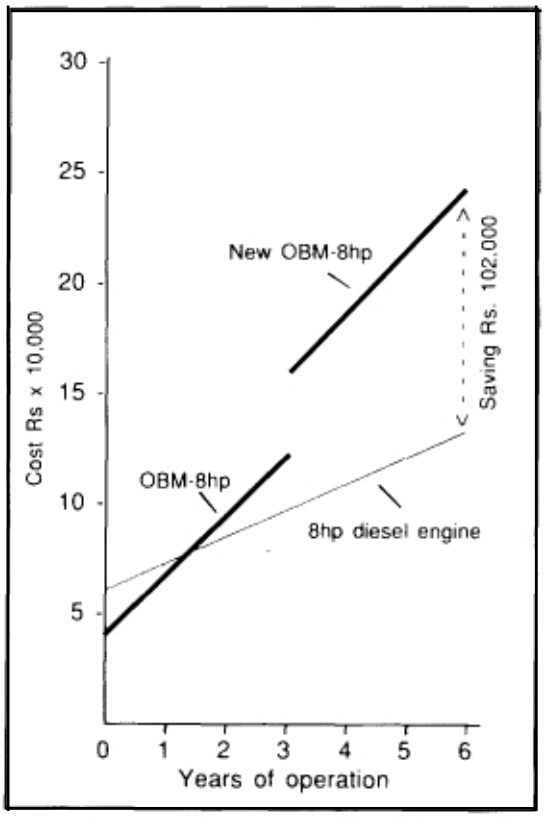


Fig 11. Saving by using diesel engine



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is about Rs. 30.000 (1992). The total cost for an 8 hp diesel engine installation with BOB Drive should. therefore. be around Rs. 60,000 as against Rs. 44,000 for an 8 hp outboard motor.

The main disadvantages of the diesel engine with the BOB Drive. compared with an outboard motor. are:

Greater weoght 140 kg versus 40 kg. This makes hauling the craft on to a steep beach more difficult:

Lack of 3 reverse gear:

Lack of appeal (OBMs tend to be sleek and modern looking): and

Higher cost (of about 40 per cent)

These disadvantages arc serious enough to dampen any hope of a rapid acceptance of the BOB Drive in Shri Lanka. The trials with the canoes fitted uith the BOB Drive. however. show that some fishermen will respond positively. But the introduction will take a long time and will have to he done gradually in selected fishing centres.

Initially. two sites should he selected for pilot introduction. The selection of the location of the trials will have to take into account the fishermen's present perception of the need for fuel-saving. Fishermen in the Negombo-Chilaw area now using 18-footers with 25 hp outboard motors will certainly. at this stage. not be receptive to the diesel engine. Locations where 8-15 hp outboard motors are used and where the fuel cost is a substantial part of the gross earnings will have to be considered. In the ringnet fishery, as in Doddanduwa, the fuel cost is only 10- 15 per cent of the gross earning\ and it is. therefore. not a fishery of the highest priority for diesel propulsion. Fishing methods such as trolling. handlining and gillnetting in distant grounds would prove more attractive for diesel users.

The BOB Drive can be fitted either to a canoe or a monohull fishing craft. The choice of fishing craft must be left to the fisherman. It should, however. he noted from Figure 10 that the canoe is more fuel-efficient than an IX-footer when fitted with the same 8 hp outboard motor and carrying the same load and that a longer boat would give a better performance with a heavy load of nets.

3.4 Credit for fishing craft and engine

Neither formal nor informal credit was readily available to the individual fishermen for purchase of canoe, engine and fishing gear at the time the subproject started. Credit had to be obtained for the beneficiaries on an ad hoc basis through persistent intervention of the subproject staff.

For the target group fishermen to have access to the new type of canoe, it is essential that

- credit is rnade available for canoe. engine and fishing gear as a total package;
- procedures for obtaining credit are simple:
- terms and conditions are flexible, in keeping with the seasonality of the fishermen's incomes: and
- village-level institutional mechanisms are operative for granting and recovery of loans.

There is some improvement in the means of granting loans to fishermen with the establishment of the Fisheries Cooperative Societies. These societies will be the main channel for credit during the present and the next development plans. During 1991-92, 787 cooperatives were established.

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The total number of members in these cooperatives is around 75,000. Financial resources totalling Rs. 52 million have been mobilized for the period 1990-1994. The societies aim to issue between 200 and 350 motorized traditional fishing craft and FRP boats with OBM a year. Developments so far indicate that this target will be substantially exceeded.

The majority of the fishing craft for which loans are being given are 18-footers with 15 hp outboard motors. In many areas, this is the only fishing craft acceptable to fishermen. However, in areas where the *oru* is predominant at present, it should be the policy of the Government to encourage the use of fuel-efficient fishing craft, such as the new canoe powered with an outboard motor or the BOB Drive. It is essential that more fishermen are made aware of the possibilities of such a craft through a pilot scheme.

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APPENDIX I

Cost of SRL-18 Planked Canoe and outrigger

(Based on records by Supervisor of boat building training course in Doddanduwa - 1990)

Item	*Unit*	*Qty.* SLRs	*L1ni Cost SLRs*	*Cost SLRs**
MAIN HULL.				
TIMBER. SAWN				
3/4" Planking	sq ft	342	8.00	6.156
I" Planking	sq ft	53	23.00	1,219
1-¼" Planking	sq ft	92	27.00	2,484
2" Planking	sq ft	27	45.00	1,215
Subtotal Timber				**11,074**
FASTENINGS				
Copper nails	kg	18.8	150.00	2,814
Copper roves	kg	6.0	150.00	900
Brass screws: 1-¼ 10	pcs	429	2.76	1.184
Brass screws: 2" x 12	pcs	19,0	5.35	102
Subtotal Fastenings				**5,000**
MISCELLANEOUS				
Green plastic netting	m	9.0	25.00	225
Bitumastic compound "No leak"	kg	30.0	40.00	1.200
Epoxy glue	kg	1.73	50.00	595
Kuralon rope. 6 mm	vds	70.0	5.55	388
Sandpaper	pcs	6.0	8.00	48
Paint	l	9.0	150.00	1,350
Brushes 2"	pcs	2.0	53.00	106
Thinner	l	0.5	50.00	25
Subtotal Miscellaneous				3,937
Total cost Materials				**20.011**
LABOUR				
l Carpenter	mandays	31	150,00	4,650
I Helper	mandays	31	100,00	3,100
Subtotal : Labour				**7,750**
TOTAL : MATERIALS AND LABOUR				**27,761**
OVERHEAD AND PROFIT 20%				5,552
SELLING COST MAIN HULL				33.3 3
TRADITIONAL OUTRIGGER AND BEAMS				2.500
TOTAL				**35,813**

In 1992, the selling price by Danasiri, the boatbuilder in Doddanduwa, was Rs.38.000 for the main hull.

* US $ l = SL Rs 44/- appx.

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APPENDIX II

Cost of SRL-19A FRP canoe and outrigger (1992)

					SLRs. **
MATERIALS*					
1.	Wax polish	0.50	kg	150	75
2.	Compound	0.25	kg	132	33
3.	Cotton waste	1.00	kg	19	19
4.	R Agent	5.00	kg	218	109
5.	Gelcoat resin	20.00	kg	105	2.100
6.	Moulding resin	2 10.00	kg	65	13,650
7.	CSM	80.00	kg	115	9,200
8.	Catalyst	4.50	kg	250	1,125
9	Accelerator	1,00	kg	220	220
10.	Pigment	1,25	kg	540	675
11.	Acetone	12.00	l	57	684
	COST OF FRP MATERIALS				27.890
12.	Timber components				4,350
13.	Hardware items				1,825
	Total cost of materials				34,065
LABOUR					
4.	FRP: 4 men x 8 hrs x 7 days				224 m/h
IS.	Carpentry and handling	2 men x 8 hrs x 7 days			112 rn/hr
					336 rn/hr
	Total cost of labour	336 rn/hr X Rs.20/hr			6,720
6.	Overheads : 200% of **labour**				13,440
17.	Profit				18,345
IS.	Turnover tax				4,632
	TOTAL				77,202

* **FRP** meterials —- iniporied pricc by large boatyards Small boatyards will have to buy from importers a! 20% higher cost
** US $ 1 = **SL** Rs 44/- **appx.**

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APPENDIX III

Cost data of engine
(March 1993)

	8 hp Kerosene outboard motor	8 hp *diesel engine with BOB Drive*
Cost of engine (SLRs*	44,000	30,000
Cost of installation (SLRs		30.000
TOTAL. COST	**44,000**	**60,000**
Service life years)	3	6
Depreciation per year (SLRs)	14,700	10.000
Hours of engine operation per year	700	700
Fuel consumption (litre/hour)	3.6	1.5
Fuel cost including oil (SLRs/litre)	10	2
Fuel cost (SLRs/hour)	36	IS
Fuel cost (SLRs/year)	25.200	12.600
Cost per year — Fuel and depreciation (SLRs)	39.900	22.600
Saving per **sear (SLRs)**		**17,300**

US $ 1 = **SLRs** 46/- appy

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The BOBP brings out the following types of publications:

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.

Working Papers (BOBP/WP/...) which are progress reports that discuss the findings of ongoing work.

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.

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