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Small Offshore Fishing Boats in Shri Lanka

BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

Small Offshore Fishing Boats in Shri Lanka

by

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BAY OF BENGAL PROGRAMME
Madras, India
1993

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The Bay of Bengal Programme (BOBP) was invited in the early Eighties by the Shri Lankan Ministry of Fisheries to evaluate the offshore fisheries and the fishing craft being used in it. The evaluation was done by a consultant, O Gulbrandsen, Naval Architect. Subsequent to this evaluation, BOBP helped to develop and introduce two small multiday offshore fishing boats, the SRL-34 and the SRL-15.

When Shri Lankan fishermen began fishing further offshore, more and more boats began to disappear at sea. The BOBP was requested to provide assistance for studying the reasons for the disappearances and to help in making recommendations for the development of search-and-rescue facilities for the island's fishermen. A consultant (U Hallberg) studied the facilities available and prepared a report which was submitted to the Ministry of Fisheries. Similarly, another consultant (E Dahle) studied the safety aspects of boat construction and prepared a draft of regulations for consideration by the Ministry.

This report summarizes BOBP's assistance provided in offshore fishing boat development and related safety-at-sea aspects. The work started under the SIDA funded project "Development of Small-scale Fisheries" GCP/RAS/040/SWE and was concluded under "Small-scale Fisherfolk Communities" GCP/RAS/118/MUL funded jointly by DANIDA and SIDA.

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). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

This document is a technical report and has not been cleared by the Government concerned or the FAO.

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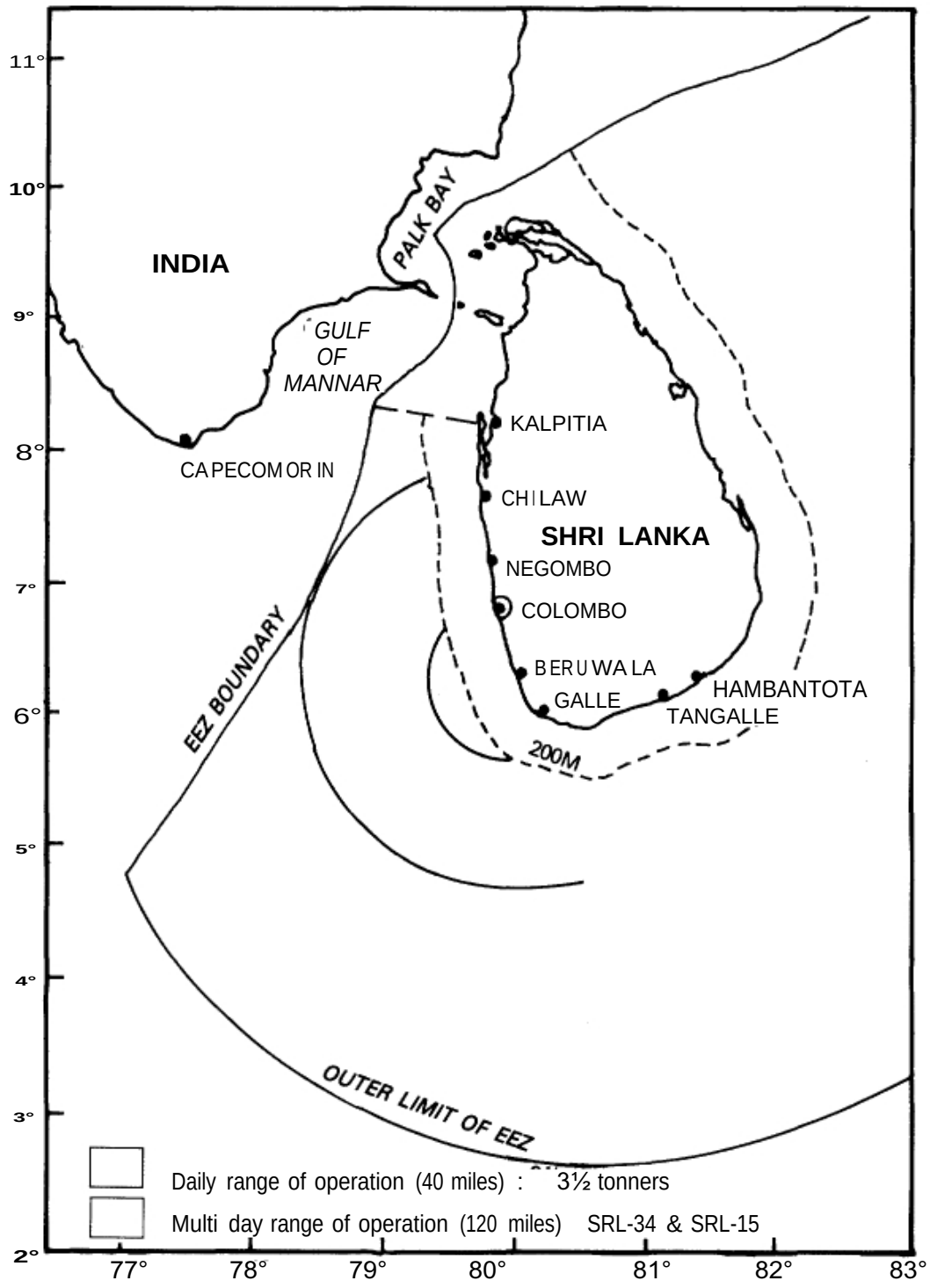

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1. INTRODUCTION

Large pelagic species, including shark, contribute significantly to the total fish production in Shri Lanka. In 1990, the estimated production of tuna, shark, billfish and other large pelagic species, approximately 30,000 t, represented about 15 per cent of the total marine fish production in the island. It is at the southern and western harbours of Shri Lanka (See Figure 1) that most of this catch is at present landed.

The importance of this offshore fishery for large pelagic species grew with the introduction of the FAO-designed 3 ½-t wooden boat and the parallel introduction of synthetic fishing gear through Government subsidy schemes in the early Sixties. Traditional fishing gear (trollingline, handline and pole-and-line) employed previously with traditional canoes, in coastal and offshore areas, gradually became less important. Large mesh driftnets and, then, drift-longlines, became the most important fishing gear for the offshore fishery for large pelagics.

Many difficulties were encountered when the 3½-tonners were first introduced. The fishermen, being accustomed to day fishing and short trips, had to adjust to night fishing and longer trips. The boats and engines suffered frequent breakdowns, due to the fishermen lacking knowledge of how to operate and maintain these craft. Gradually, these problems were overcome.

Continued successful introduction of the 3 ½-tonner, later made of FRP, resulted in a fleet of more than 2500 boats operating by the early Eighties. More than 1500 of them were regularly engaged in driftnetting offshore on day trips and drift-longlining seasonally. Some of these fishing craft were also seasonally engaged in pole-and-line fishing and in trolling for tuna. Trollinglines were also often used to and from the offshore fishing areas.

When the 3 ½-t boats were introduced, they were designed for, and fitted with, diesel inboard engines of 15-20 hp. But, over the years, because of the fishermen's desire for speed and, as a result of the promotion of different makes and types of diesel engines by manufacturers and dealers, engine power was increased to 30-40 hp. The boats, thereby, became excessively powered and less fuel-efficient.

The potential for increasing the catches and fuel saving by staying at sea for more than a night was realized at an early stage of the offshore fisheries development. To expand the range of operation and endurance at sea, 11 m steel boats (11 t) were introduced in the mid-60's. They did not prove successful. The steel hulls were difficult to maintain. The boats became inoperative after a relatively short time. Attempts to do multiday offshore fishing, for which some of these craft were intended, also failed, as not only was the design not readily acceptable for such operation, but there was also a psychological barrier among the fishermen against venturing further offshore and staying at sea for several days.

Early in the Seventies, the Shri Lanka Fisheries Department demonstrated multiday offshore drift-netting-cum-drift-longlining with experimental 12 t FRP boats. The results were promising and an attempt was made to convert the smaller 3 ½-tonners for more than a night's fishing by insulating a small built-in fish-hold and by providing basic crew accommodation. Drawings and specifications were given to boatyards by the Ministry of Fisheries and a few meetings to promote the idea were held. But, very likely because of the lack of demonstrations, nothing further happened immediately; the fishermen were not particularly receptive, especially as saving fuel was not a serious enough concern. Nevertheless, the idea of multiday offshore fishing was talked about in fisheries circles.

The next major attempt to promote multiday offshore fishing was made under an ADB-financed project in the late Seventies. Thirty 38-ft FRP boats (11 t), each provided with a built-in insulated fish-hold, crew accommodation, a hydraulic net-hauler and SSB radio communication, were introduced. This subsidized scheme also failed. According to many fishermen, the boats were not well suited for multiday fishing, as they had various technical shortcomings and were not economical for offshore fisheries operation due to high fuel costs. Most of the craft ended up as shrimp trawlers in the coastal areas off Kalpitiya and Mannar, or were abandoned. A small beginning was, however, made with multiday offshore fishing.

In 1982, despite the earlier attempts that had failed in the large-scale introduction of multiday offshore fishing boats, a northwest coast fisheries project was implemented with funding assistance from

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Abu Dhabi. It was planned to build and introduce over the next five years seventy 34-ft FRP multiday boats (15 t), each with 57 hp engine, insulated fish-hold, crew accommodation, hydraulic net hauler and SSB radio communication. This boat, although only a few feet longer than the bulk of the offshore day-boats, represented, in size and investment, a radical departure. Only fishing trials over longer periods would determine the economic viability of these craft, but it appeared likely that they would have to catch 2-3 times the fish a 3½-t boat did to be economical.

It was at this point that a techno-economic evaluation of all existing commercial boats and prototypes undergoing trials was undertaken by the Bay of Bengal Programme (BOBP) at the request of the Shri Lanka Ministry of Fisheries. The study resulted in short-term recommendations for fuel savings, primarily concerning the 3½-tonners, and in long-term recommendations for future craft. With regard to the latter, BOBP's input thereafter concentrated on the conversion of an existing type of boat into a craft more efficient for multiday offshore fishing and on the development of a new boat, the smallest possible for such fishing. Besides size, the three most important design requirements concerned fuel saving, preservation of catch and safety and comfort of crew.

As the offshore fishery developed, and particularly during the rapid expansion in the mid-Eighties, safety at sea became a serious issue. Boats started to disappear. Others landed on the shores of neighbouring countries, i.e., Maldives, India, Myanmar and Indonesia, after long periods of drifting (upto 3 months) during which surviving crew suffered greatly. BOBP therefore, on request, also assisted the Ministry in looking into the various aspects of safety at sea and search-and-rescue operations.

A chronology of major activities and events (1982-93) is given in Appendix I.

2. BOBP TRIALS WITH SMALL MULTIDA Y OFFSHORE FISHING CRAFT

2.1 The boats

SRL-34

In 1982, a local boatyard was producing an enlarged version of the popular 3 ½-tonner. It was 10.4 m (34 feet) in length, but intended only for one-day trips; there was no facility for preserving the catch and no crew accommodation. The area under the deck was just an open hold, a simple steering cabin covered the engine compartment and there was a small fuel tank but no tank for freshwater. It was felt that with modifications to the general arrangement and layout, this boat would be large enough for multiday offshore fishing and be more economical than the larger, much more expensive-to-build and operate Abu Dhabi boats that had just then been introduced. It was also believed that it was better to adapt and improve an existing type of boat than to design and build a new one, as fishermen are more receptive to what they are already familiar with.

To make this day-boat a viable, safe and affordable multiday fishing boat, it was felt that the following features were necessary and should be added :

- For fuel economy : A 20-25 hp diesel engine with a higher gear ratio (3 to 1). (This would make the craft more fuel-efficient than with its usual 33-40 hp engine.)
- For fish preservation : A fish-hold to store fish in chilled seawater and ensure preservation for more than a day. (This method, by rapidly chilling the fish and crushing it less than if ice were used, would result in the tuna being of good quality.)
- For crew comfort : A small offset deckhouse and sleeping accommodation for three crew members. (It was suggested that this be constructed under a raised aft deck.)
- For safety : A gear-hold, to keep the heavy fishing gear low in the boat and improve stability. Also, a dipping lug sail of 23m^2, for emergency use. The sail would also help to increase speed in a favourable wind.

  A boat with these features was acquired from the boatyard and was named SRL-34. It was equipped with a 21 hp Kubota engine.

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Theflrst version ofthe SRL-34 (blue with white bulwark) alongsidethe regular3½-tonners.Bowandstem views.

SRL-IS

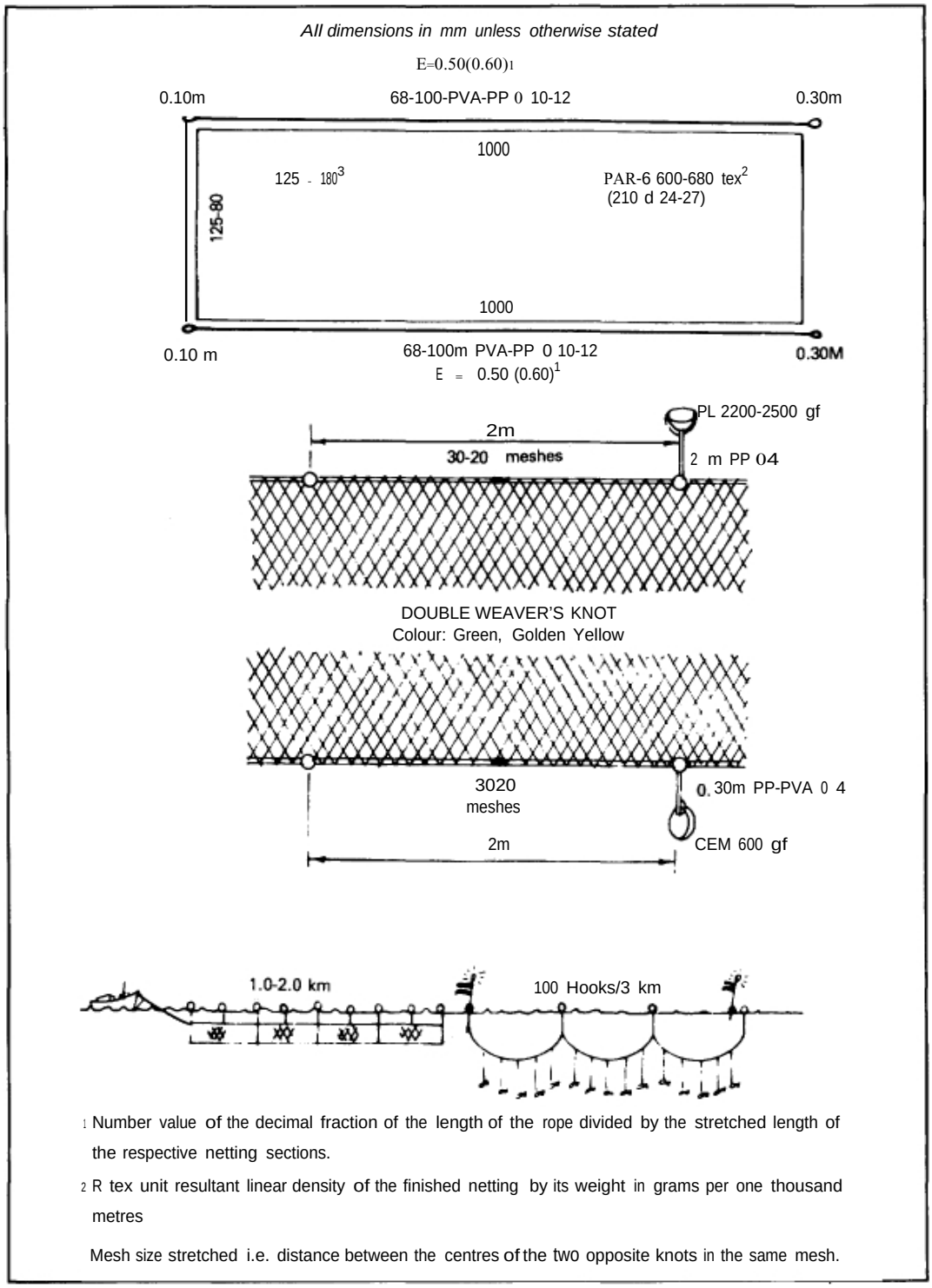
Based on the BOBP experience of operating a large beachianding craft (SRL-14) for day-trips and the SRL-34 multiday offshore boat, a new offshore day-boat called SRL-15 was designed in 1983. It had fine lines and a fin keel with skeg (instead of a continuous keel) to improve sailing performance. A masthead rig using a large Genoa was later replaced with a Gunter rig of 35m². The length was 9.65 m (31.7 feet) and the craft was intended as a fuel-efficient successor to the 3½-tonner with its 16hp engine and 3.5: 1 gearbox.

The first version of SRL-15 in full sail and under power.

2.2 Fishing gear

Driftnets (Figure 2) and drift-longlines (Figure 3, see overleaf) were the two main fishing gear used during the demonstration and fishing trials with both SRL-34 and SRL-l5. While the driftnets were used all the time, the drift-longlines were used only occasionally, when shark were available and when fishermen felt it was economically feasible to carry out drift-longlining together with driftnetting. Drift-longlining alone was not carried out. Trollinglines were only occasionally used

Fig.2 **Driftnets used in the trials**



1 Number value of the decimal fraction of the length of the rope divided by the stretched length of the respective netting sections.

2 R tex unit resultant linear density of the finished netting by its weight in grams per one thousand metres

Mesh size stretched i.e. distance between the centres of the two opposite knots in the same mesh.

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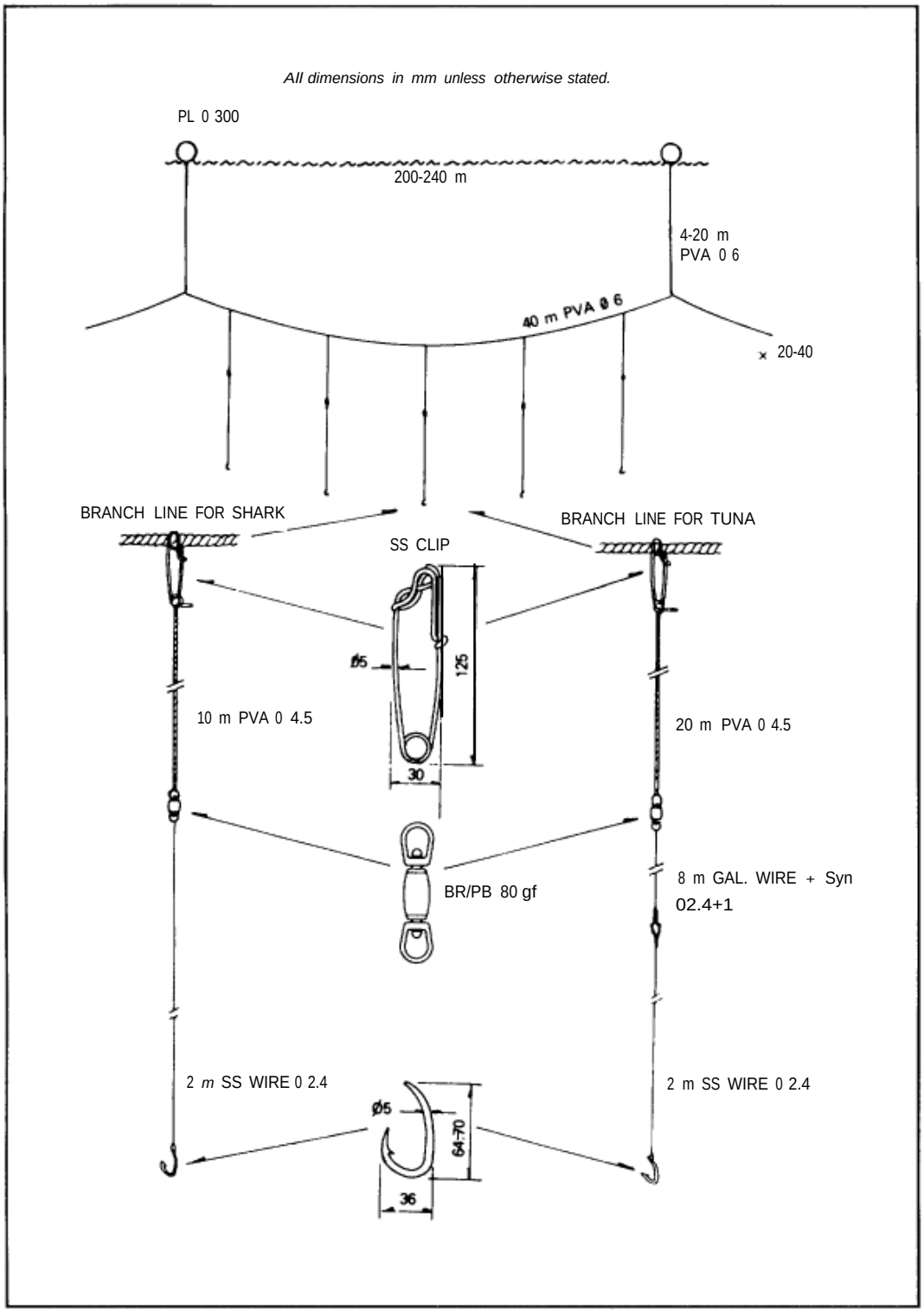
Fig. 3 Drift-longlines used in the trials



to and from the fishing ground. This fishing gear was of traditional design and what was being commercially used by the fishermen. No improvement to any of the fishing gear was attempted during the trials.

The quantity of each type of fishing gear used was left to the discretion of the fishermen operating each boat and differed from boat to boat and according to the fishing season. This sometimes resulted in under-utilization of the boat.

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2.3 Operational arrangements

The SRL-34 and SRL-15 were built and modified in Colombo and Negombo boatyards and demonstrations and trials were carried out from Negombo, Beruwala and Galle fishing harbours from where offshore boats usually operate. These harbours have all basic services and facilities required for operation of small offshore boats : slipways and workshops for maintenance of boats and engines, supplies of ice, fuel, water and fishing gear, and auction markets.

Commercial fishing trials in areas beyond the continental shelf, that is, 25-100 n miles from the shore, were carried out from Beruwala and Galle harbours.

Only fishermen used to offshore fishing were recruited to operate these boats. However, none of them had had multiday fishing experience. Because of the commercial nature of the trials, the crew worked on a catch-share basis. After deduction of operational costs from the gross revenue, 50 per cent of the net revenue went to the crew and the rest to the fisherman-boat-owner cooperating in the trials by providing the fishing gear and managing the operation of the boat.

The project staff showed the fishermen how to make observations and record operational data throughout the fishing trials. Project staff, however, monitored fishing operations only during the last year of commercial fishing trials of both craft.

2.4 Fishing demonstrations

After initial technical trials and demonstrations spread over a few months, the SRL-34 started fishing trials in earnest from Beruwala in January 1983 and continued till October 1985.

During these three years, the focus was on getting a local crew to regularly carry out, on their own, fishing trips of more than a day at a time. During the first year, the SRL-34 was mainly operated on day-trips, but as the crew gained confidence over the next two years, the number of two- and three-day trips increased (see Table 1).

Table 1 : Yearly record of fishing days and trips

Year	Fishing days	1-day trips	2-day trips	3-day trips
1983	176	156	10	
1984	180	148	16	–
1985	127	28	33	II

Multiday fishing operations were seen as possible with this type of boat and, more important, proved acceptable to the fishermen of Beruwala.

Figure 1 compares the offshore area which can be covered by a multiday boat, like the SRL-34, and the standard 3 ½-t day-boat. The figure also illustrates the improved fishing opportunities for a multiday boat should there be resources to exploit further offshore.

2.5 Modifications after trials

SRL-34

The demonstrations also indicated that, for regular multiday fishing operations, the crew accommodation was too basic, the engine needed a reliable hand-starting system, the fish-hold was too small and the sail rig needed improvement. The fishermen also prefered to use a Yanmar engine, which is the most popular make in Shri Lanka. For subsequent commercial fishing trials in 1986, the Kubota diesel engine was, therefore, replaced with a 25 hp Yanmar engine (2TDGG) fitted

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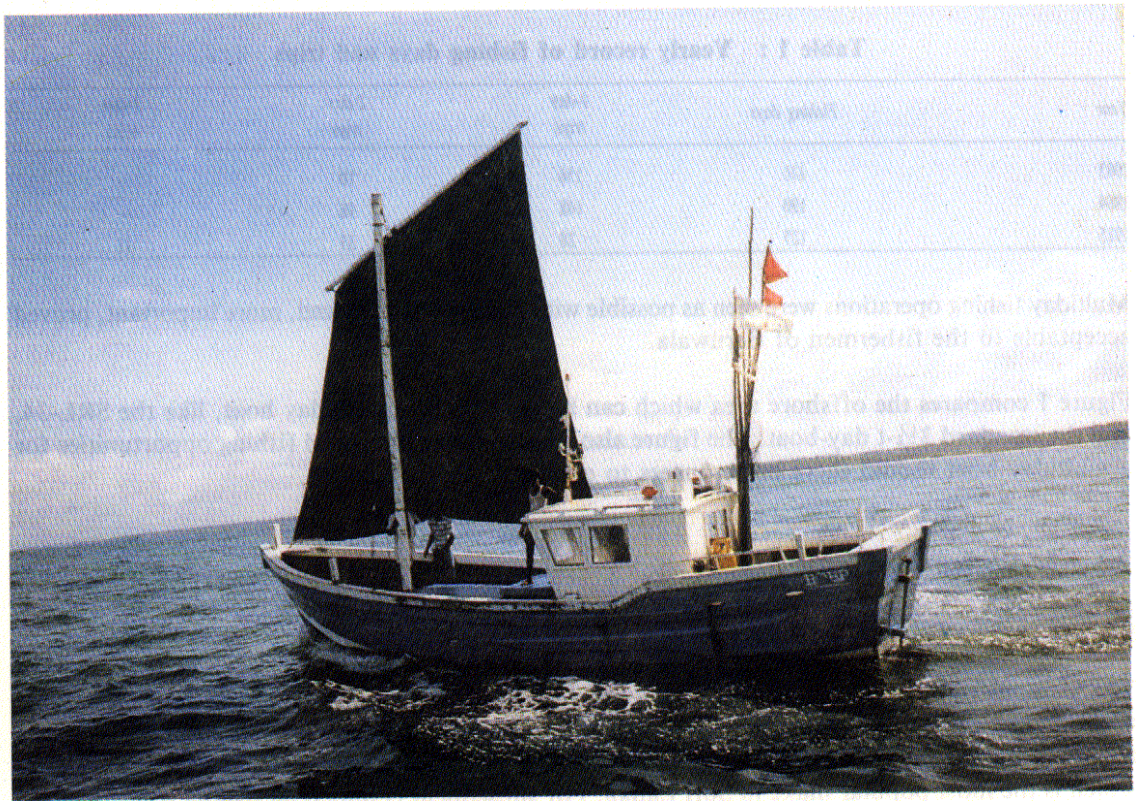
with a 3 : 1 gearbox, hand-starting facilities and direct fuel injection that would ensure lower fuel consumption. Modifications to the general arrangement and layout of the boat were made to bring about other improvements as well.

The main changes were :

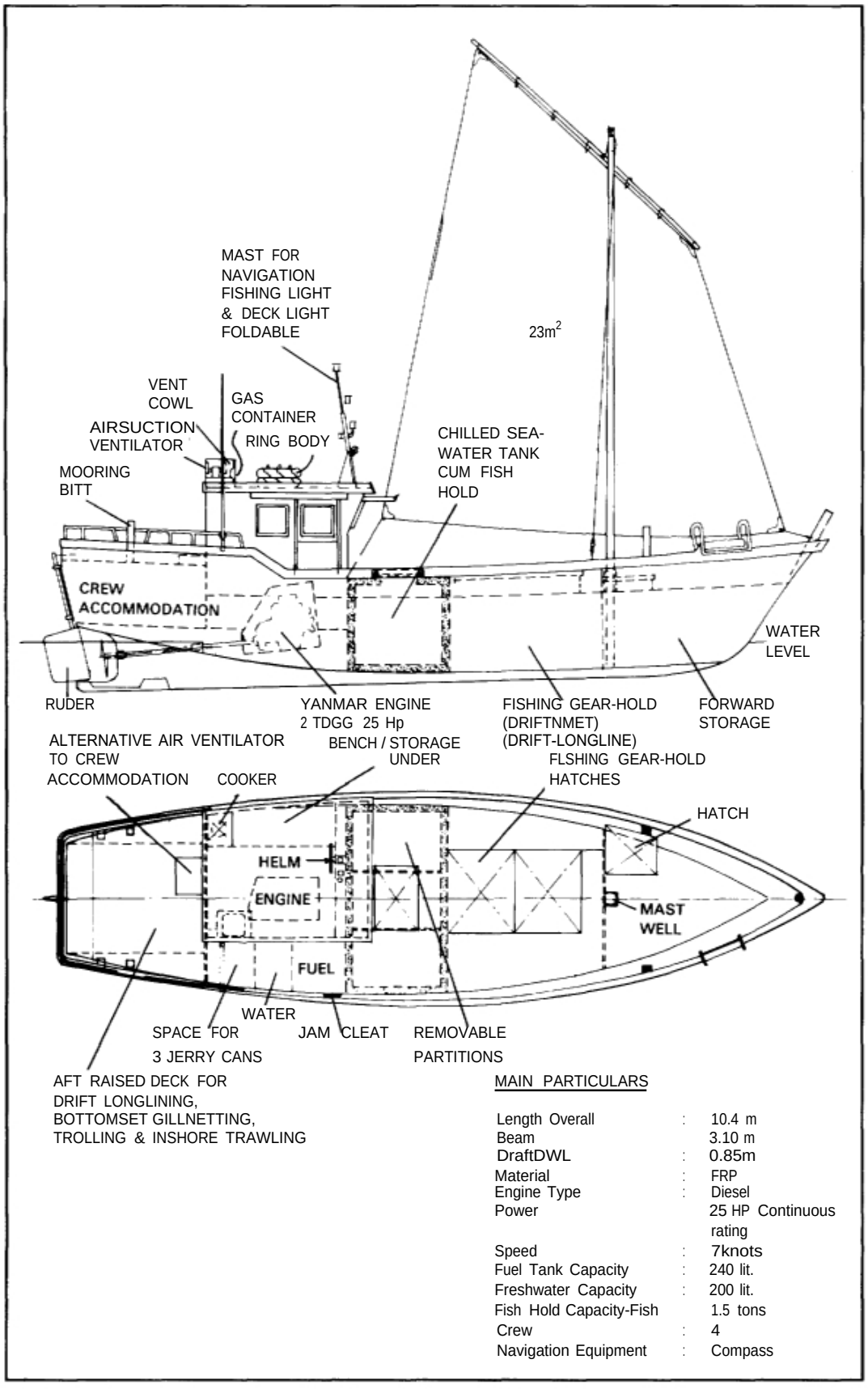
- A new, more fuel-efficient direct injection diesel 25 hp Yanmar engine with a higher reduction ratio of 3 : 1 and, for safety, an easy, reliable hand-start.
- A larger, well-insulated fish-hold to keep 1500 kg of fish in ice-chilled seawater.
- A larger fishing gear-hold to keep under deck 2000 m of driftnets and 6000 m of drift-longline.
- A larger, well-ventilated offset deckhouse to provide adequate protection and comfort for the crew.
- A higher, raised deck aft for a better sleeping area for the crew.
- Raised coaming for better safety.
- increased and sufficient under-deck storage of diesel and freshwater for stability and a longer endurance at sea, of 3-4 days.
- Improved electric system for crew accommodation, navigational safety and better illumination on deck.
- Safety equipment (life-jackets, life-raft etc.) in case of emergency.

The general arrangement of the modified SRL-34 is shown in Figure 4.



The modified SRL-34

Fig. 4 General arrangement of SRL-34 (final version)



MAIN PARTICULARS

Length Overall	:	10.4 m
Beam		3.10 m
DraftDWL	:	0.85m
Material	:	FRP
Engine Type	:	Diesel
Power		25 HP Continuous rating
Speed	:	7knots
Fuel Tank Capacity	:	240 lit.
Freshwater Capacity	:	200 lit.
Fish Hold Capacity-Fish		1.5 tons
Crew	:	4
Navigation Equipment	:	Compass

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In the light of the experience with SRL-34 and a few months of trials, from April to September 1986 and totalling 74 days of operation, it was realized that the original idea, to emphasize the use of this boat for day-trips with sail and a small engine, was not feasible and, not acceptable to the offshore fishermen. The fishermen engaged in offshore fisheries were too used to more, powerful Yanmar engines and not familiar enough with sail. There was a need in the SRL-I5 for a larger, insulated fish-hold amidship, a larger cabin for better comfort of crew, replacement of the Farryman engine with a more popular make of engine (Yanmar) and an easy-to-instal-and-use dipping lug sail rig for emergency before multiday commercial fishing trials could be started with this boat.

The main changes were :

- Replacement of the original 16 hp diesel engine with a 20 hp continuous rating Yanmar diesel engine for better reliability, easy hand-start, higher speed and better availability.
- A new, larger, better-insulated fish-hold located amidship to keep at least 1200 kg of fish in ice or chilled seawater.
- A larger, offset deckhouse for better crew comfort and facilities.
- An increased storage of fuel and freshwater under deck for longer endurance at sea (2-3 days) and a range of operation of about 100 n miles.
- A new electric system for crew accommodation, improved navigational safety and better illumination on deck.
- A new, simpler and cheaper emergency sail rig (dipping lug of 22m^2).

The mould was also modified to include a straight keel to permit easier hauling of the boat from the sea, a bilge keel to reduce rolling, improve crew comfort and permit installations of a wider range of engines in the boats to be built. The general arrangement of the modified SRL-15 is shown in Figure 5.

The SRL-I5, find version

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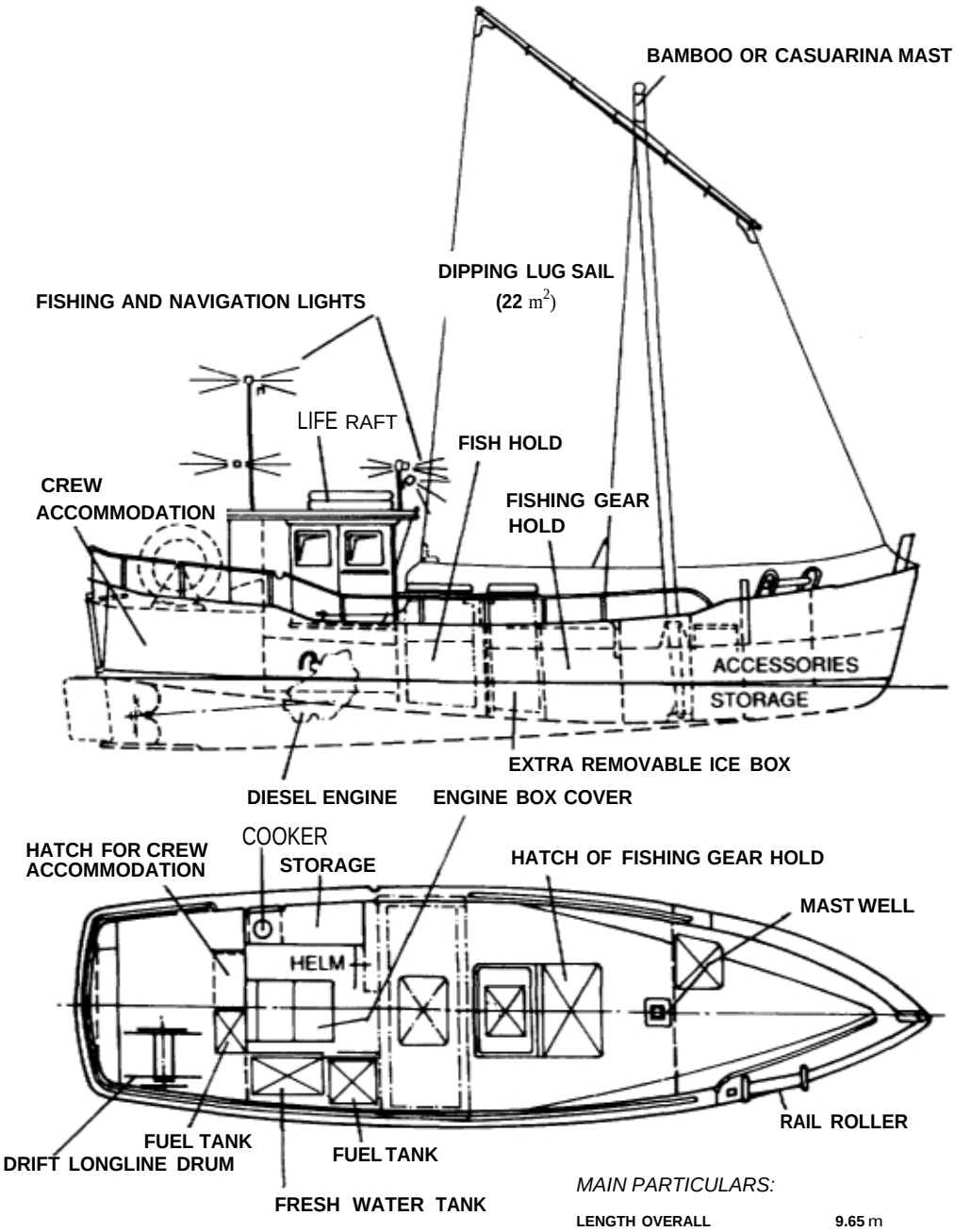
Fig. 5 General arrangement of SRL-15 (final version)



MAIN PARTICULARS:

LENGTH OVERALL	9.65 m
BEAM	2.70 m
DRAFT DWL	0.90 m
MATERIAL	FRP
ENGINE TYPE	YANMAR 2 TDG
POWER	(CONTINUOUS) 25 hp
SPEED	7.5 KNOTS
FUEL TANK CAPACITY	3001
FRESHWATER CAPACITY	2001
FISH HOLD CAPACITY	1.5—2 TONS OF FISH IN ICE
CREW	4 PERSONS
NAVIGATION EQUIPMENT	COMPASS
POSITIONING EQUIPMENT	RADIO TRANSISTOR USED AS DIRECTION FINDER

2.6 Fuel consumption

In 1986, fuel consumption tests were conducted with the new diesel engines fitted in the SRL-l5 and SRL-34 and with aregular 3½-tonner as well. The Ministry of Fisheries, enginesuppliers and BOBP personnel worked in close collaboration during these tests.

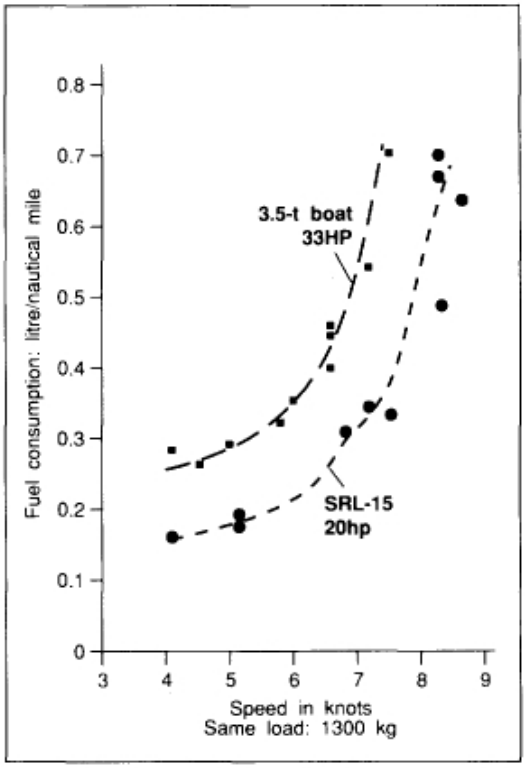
The fuel consumption tests carried out with the SRL-l5 fitted with the 20 hp 2QM20GY Yanmar diesel engine and a standard 3½-tonner fitted with a 33 hp 2SME Yanmar diesel showed that the SRL-15 engine was considerably more fuel-efficient. The results of the tests are given in Figure 6 and show that, at a cruising speed of 7 knots, the SRL-15 has 40 per cent less fuel consumption. The fuel saving was achieved on account of

- Refined hull design;
- A higher gearbox reduction ratio of *2.5:* as against 2.1 : 1;
- A better propeller;
- A better engine.

The fuel consumption tests carried out with the SRL-34 and its new 25 hp 2TDGG Yanmar diesel engine and with a standard 3½-t boat fitted with a 33 hp 2SME Yanmar diesel engine showed similar results. The SRL-34's new engine was much more fuel-efficient and consumed 30 per cent less fuel than the 3½-tonneron account of

- A higher reduction gearbox ratio (3 : to 1) for the 2TDGG engine as against 2.1 : 1 for the 2SME engine;
- A larger and better propeller;
- The new, direct fuel injection system.

Fig. 6 Fuel consumption tests with 3½-tonner and SRL-15



These tests and demonstrations created an awareness of the possible fuel-saving which could be achieved by introducing a new, direct injection diesel engine with a higher reduction gearbox ratio.

In early 1987, a request was made by Brown & company, the Yanmar diesel marine engine agents, for inclusion of the Yanmar marine diesel engine of the same 2TDGG series with direct fuel injection systems and gearbox ratio *2.5* : 1 in the subsidy schemes of the Ministry of Fisheries. This was approved for subsidy and introduced through bank schemes that year and is the most common type of engine in use today.

2.7 Results of fishing trials

After the final version of the SRL-34 and SRL-15 were readied for offshore multiday fishing, commercial fishing trials were carried out with them by selected fishermen. The basic data on catch, costs and earnings were collected over the following periods

SRL-34 : May 15-November 30, 1987, operating from Beruwala.[1]
SRL-15 : November 1, 1987-October 30, 1988, operating from Galle.[2]

[1] This boat was sold in September 1987 to a fisherman-boat-owner who had participated in the trials.
[2] This boat was transferred to India for fishing trials in 1989.

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The boats were equipped with 40 pieces (500 meshes) of driftnet, 20 bundles of drift-longline (shark) and 2 or 3 trolling lines each. The number of driftnets and bundles of drift-longlines used did not vary much from trip to trip.

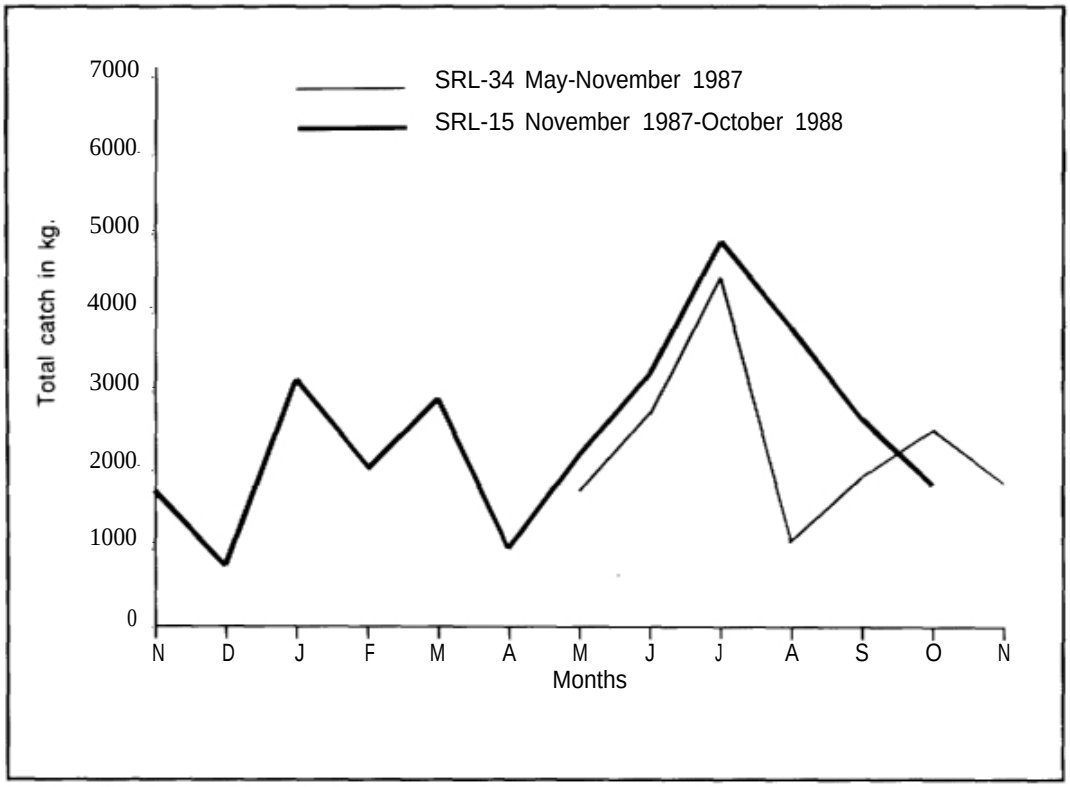
The performance is summarized in the table alongside and details are given in Appendices II and III.

	SRL-34	SRL-15
Fishing days per month	13.8	14.5
Fishing trips per month	6.9	4.4
Trip duration (days)	2.0	3.3
Catch per month (kg)	2500	2524
Catch per fishing day (kg)	184	174
Catch per trip (kg)	36S	571

The catch rates (kg/day) achieved by the two boats are very similar as is the fishing intensity (about 14 days/month). The monthly catches are almost identical and correspond to a yearly catch of 30 t per boat. The only difference in the fishing pattern is that SRL-15 has made fewer trips of longer duration.

The highest catches were obtained in July, which is the peak season for driftnetting for tuna. The monthly variations are shown in Figure 7.

Fig. 7 Monthly catch of SRL-34 **and SRL-15**



The bulk of the fish, as much as 84 per cent in the case of SRL-15, was caught in the driftnets.

The dominance of the large-mesh driftnet is attributed to the higher fishing effort exercised with this fishing gear (soaking time, amount, gear use frequency). While driftnets were used every fishing day, drift-longlines were only occasionally used and in too few numbers, that, too, during the lean driftnet fishing season. A boat equipped with a manually-operated drift-longline drum could use up to 50 bundles of drift-longlines and significantly increase its catch and earnings. It should also be noted that in the case of the SRL-15, the drift-longlines and trollinglines contributed 35 per cent of the catch during the lean driftnetting season. The good catch with drift-longlines in July by the SRL-34 reinforces the view that more intensive use of this fishing gear is possible.

Fishing gear	SRL-15		SRL-34	
	Tonnes	%	Tonnes	%
Driftnet	25.53	84	11.34	68
Drift-longline	3.22	11	4.13	25
Trollingline	1.56	5	1.10	7
Total	30.31	100	16.57	100

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2.8 Economic evaluation

The price of a new SRL-15 built in 1988 was SLRs 490,000[3] (Rs 290,000 for the hull and Rs 200,000 for the 25 hp engine).

The price of fishing gear was :

40 driftnets	Rs. 170,000
20 drift-longlines (baskets)	Rs. 20,000
Total	Rs. 190,000

The total investment was, thus, SLRs 680,000.

The following table gives the estimated annual costs and earnings (in Rs) for the SRL-15, based on the data gathered from the trials with the SRL-15 and SRL-34 (Appendices II and III).

I GROSS INCOME			
31 t at 20.50 Rs/kg		635,500	635,500
II FIXED COSTS			
Depreciation of hull (20 yrs)		14,500	
Depreciation of engine (10 yrs)		20,000	
Insurance 1.74% on boat, 5% on gear		18,000	52,500
III VARIABLE COSTS			
a. Fuel		49,000	
b. Food		39,000	
c. Ice		34,000	
d. Misc. exp.		16,000	
e. Crew share (50% of net income)		249,000	
Gross income (I)	635,500		
Variable costs (II a-d)	138,000		
Net income (I-II a-d)	497,500		
f. Hull repairs & maintenance (3%)		9,000	
g. Engine repairs & maintenance (6%)		12,000	
h. Fishing gear repair/replacement (25%)		48,000	
i. Tax (5% of gross revenue)		32,000	488,000
IV TOTAL COST (II + III)			540,500
V PROFIT (I – IV)			95,000

The rate of return based on the total investment is about 14 per cent. This is just below what would be considered the minimum acceptable rate for a commercial bank.

3 US $ 1 = SLRs 40 appx. (1988)

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However, the Government at present gives 35 per cent subsidy on the boat and the engine. The cost of investment is then reduced from Rs. 680,000 to Rs. 508,000. And the rate of return then increases from 14 per cent without subsidy to 19 per cent with subsidy.

The economic return in the future will be dependent on :

- The manner in which the boat is used. Increased fish prices and reduction of investment depends on market forces and cannot significantly contribute to a higher rate of return. That can best be achieved by increasing the yearly catch through intensification of drift-longlining and driftnetting in new fishing grounds where a higher catch rate is possible. This type of boat could be operated with twice the amount of drift-longlines used during the trials.
- The SRL-34 would have a slightly lower rate of return because of the more expensive hull. On the other hand, the SRL-34 is a much larger boat and would have the capacity to carry more gear and carry more fish which would very easily compensate for the higher cost.
- Whether the present crew share of 50 per cent of net income is maintained or a share of 40 per cent for the crew is adopted, as is common when investment per crew member increases. The higher crew share represents a higher percentage of the annual variable cost and is the same for smaller boats with lower investment. The earning per crew member per year would be Rs. 50,000 (4man crew), which is very good by Shri Lankan standards, and the annual rate of return would then be 21 per cent and high enough to attract investment without subsidy.
- Government subsidy.

2.9 Reactions of the private sector

In 1983, the SRL-34 was the only small multiday offshore boat in Beruwala to have an insulated fish-hold and other necessities for multiday offshore fishing. The demonstration and fishing trials carried out till 1987 had been for a long enough period and had convinced some fishermen and boat-owners on the advantages of this class of multiday boats. The fishermen/boat-owners mainly appreciated the following features :

- The built-in insulated ice **box** located forward of the fishing gear-hold. Till then, insulated ice boxes had been prefabricated from plywood, FRP and polystrene and installed in the 3½-tonners.
- The under-deck storage of fishing gear. (This, however, was appreciated only in Beruwala and other fishing centres of the south coast; the fishermen of Negombo and other fishing centres of the west coast were reluctant to practise this and maintained their tradition of storing their fishing gear on deck.)
- The centrally installed deckhouse. (Despite better utilization of space, the fishermen were reluctant to have the deckhouse offset on the port side.)

The space available on the existing 3½-t boats restricted the size of the ice box, the quantity of driftnets and drift-longlines that could be carried, not to mention fuel, freshwater and space for the crew to rest. The new boats constructed were therefore of a larger size and have increased in size still more during the last few years. They carry more fishing gear, make longer trips and even fish beyond the EEZ of Shri Lanka where the availability of large pelagic species is better.

Table 2 gives the characteristics of some of the boats used in 1989 in the offshore fishery.

Table 2 : Characteristics of present multiday boats

	Length overall LOA	*Beam moulded B*	*Depth moulded D*	*Cubic number LOAxBxD*	*Draft maximum T*	*Fish-hold inside volume*	*Displacement ½ load*	*Engine power*	*Power-displacement ratio*
	(m)	*(m)*	*(m)*	*(m^3)*	*(m)*	(m^3)	*(t)*	*(hp)*	(hp/t)
34 ft Abu Dhabi	10.4	3.73	1.54	60	1.35	7.5	15.1	56	3.7
SRL-15	9.75	2.67	0.90	23	0.98	2.1	5.9	20	3.4
Neil Marine, 32 ft	9.75	3.12	1.08	33	0.90	2.6	6.0	30	5
Neil Marine, 34 ft (Superfine)	10.4	3.12	1.08	35	0.90	4.0	N.A.	45	N.A.
Blue Star Marine, 32 ft	9.7	3.44	1.22	41	1.20	5.7	N.A.	45	N.A.
New offshore boat	11.0	3.25	1.15	40	1.00	5.0	10.0	39	3.9

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The most popular size of boats ordered at that time were the 32-34 ft ones. Though proven more economical, the SRL-15 was considered by boat-owners to be too small for this type of operation. The 34-ft Abu Dhabi boat was too costly in investment and operation and, therefore, was also not feasible. They, thus, opted for boats of a size between that of the SRL-15 and the Abu Dhabi. The trend has been to carry more fishing gear (a minimum of 50 driftnets and 40 bundles of drift-longlines), increase the fish-hold capacity of 4-5m^3 and carry more fuel and water for trips up to 6 days.

However, many of these boats have not shown an optimum utilization of space and safety. The most common faults have been:

- Loads positioned too forward, resulting in bow trim with loaded fish-hold;
- Fishing gear, fuel and freshwater carried on top of the deck, resulting in low stability in light conditions and proving to be a safety hazard;
- Crew accommodation not satisfactory; and
- No suitable emergency sail.

The improved characteristics and general arrangements of a proposed offshore boat resulting from a techno-economic evaluation of offshore boats carried out in 1989 are presented in BOBP/REP/47 : ' Exploratory Fishing for Large Pelagic Species in-Shri Lanka.

2.10 Extension materials

A video film on the development of new small offshore multiday boats was produced for BOBP by an NGO, World View International, in 1989 and distributed within and outside Shri Lanka. It is difficult to evaluate the impact of such video films, but in the light of the demand for this film shown during seminars in Shri Lanka and India, it certainly has created an awareness beyond the shores of Shri Lanka of the possibilities of small-scale offshore fisheries.

3. OTHER INPUTS

3. I Search-and-rescue

With the fast development of multiday offshore boats and the expansion of the offshore fishery in the '80s, an increasing number of boats and crew were reported missing from the distant fishing grounds. Only about half the offshore boats reported missing were found – either at sea or, more often; in foreign countries after days, weeks and even months of ordeal for the crew.

The loss of boats and fishermen was, to a great extent, attributed to

- Inadequate safety,
- Lack of communication equipment on board the boats to warn shore stations of their distress, and
- No established search-and-rescue services.

During the 12th Advisory Committee Meeting of BOBP in January 1988, it was recommended that assistance be provided for preparation of a project report on developing safety-at-sea facilities in Shri Lanka for its fishermen.

In early 1988, BOBP engaged a national consultant to study this problem in Shri Lanka and outline various options for the establishment of a Fisheries Search and Rescue (SAR) service. His report, submitted to the Ministry of Fisheries in November 1988,

- Provided information about the present fishing fleet in Shri Lanka;
- Indicated the probable causes for accidents to fishing boats;

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- Presented the current status of SAR Services in Shri Lanka, their organization, facilities, equipment, systems and training, and
- Proposed establishment of a Fisheries Search-and-Rescue Service as an integral part of a united Maritime SAR Service.

The cost of the proposal was estimated at Rs. 260 million and was composed of :

- Restructuring, reorganizing and refurbishing the existing establishment within the Ministry of Fisheries to meet the requirements of a full-scale service for the fisheries sector;
- Acquisition of various kinds of equipment, fast rescue boats and a long range aircraft; and
- Domestic and foreign training programmes for officers and personnel involved in SAR operations.

The proposal was too costly, ambitious and unrealistic, and, so, required a fresh evaluation. In July 1988, BOBP engaged an international consultant of the National Swedish Administration of Shipping and Navigation who had been closely associated with IMO on this subject. His brief was to review the proposal made for the establishment of an SAR Service for fishermen in Shri Lanka, particularly with regard to

- Establishment,
- Cost-effectiveness of equipment components,
- Operational feasibility,
- Training needs, and
- International cooperation.

In the course of this review, the deliberations of a national working group, that had already been set up by the Shri Lanka Ministry of Fisheries, were given due consideration.

The outcome of the study differed from the earlier report prepared by the national consultant. Instead of advocating new hardware, the report emphasized better utilization of the already existing structure, training of personnel and introduction of relevant legislation.

The main recommendations of the review were :

- SAR Services for fishermen through a well-coordinated effort by existing organizations for which coordination a permanent SAR Committee should be established with representations from all relevant Ministries and Departments.
- Education and training of skippers and fishermen on preventive measures, to enable better safety and, thereby, reduce search-and-rescue.
- Formulation of legislative measures and Government policy objectives so as to ensure ready availability of facilities from various sources, installation of required equipment and implementation of safety measures for the boats.
- International training of SAR officers.
- Making EPIRBs operational on the established international frequency for distress calls, followed by their entry into satellite systems.

The report was submitted to the Government of Shri Lanka in November 1989.

3.2 Information seminar on offshore fisheries development

As the offshore fisheries took a remarkable turn in the mid-1980's, small 3X-t day-boats were hurriedly converted to venture up to 100 n miles from shore on fishing trips lasting three or four days. Innovation and changes followed in various areas, such as boatbuilding, fish preservation and marketing, thus opening new opportunities. But they also brought in new problems.

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In an effort to take stock of these developments, as well as identify constraints, solutions and remedial measures, the Ministry of Fisheries and Aquatic Resources, with the support of BOBP, held a two-day information seminar in February 1990. It brought together about 90 national and a few international participants from different groups and interests to discuss various and, sometimes, complex aspects of the offshore fishery and the direction it should take. Ideas, proposals and some recommendations emerged from the seminar, of which the most important are summarized below.

RESOURCES

* The offshore resources potential has not been fully exploited and, therefore, some 400 more offshore boats could still enter this fishery upto 1995.

* In view of the capabilities of the small-scale fishing sector, it is important to ensure that resources within 100 n miles are not exploited on an extensive scale by large-scale foreign operators.

* To arrive at a better estimate of the large pelagic resources available for exploitation and for a more rational development and management of the large pelagic fishery, collection of statistics should be improved.

* The importance of exploiting large, deep water tuna within the EEZ limit was stressed, even though there are problems connected with obtaining the whole bait supply necessary for this fishery.

DESIGN AND CONSTRUCTION OF BOATS

* Capsizal, leaks, swamping, fire, explosions and similar accidents, causing loss at sea of boats and lives, could be considerably reduced if boats are better designed and built to higher standards for offshore fishing operations than at present.

* Guidelines on design and standards for construction of offshore boats less than 12 m in length should be introduced and strictly enforced.

* Basic safety equipment should be mandatory for all offshore boats.

* All offshore boats should be licensed so as to ensure that minimum standards are met by all boats and to control the fleet.

FISHING GEAR AND THEIR OPERATIONS

* While no significant improvements to driftnets seem feasible, there is scope to further improve drift-longlines and their operation.

* Given the scope of development for tuna drift-longlining at greater depths, priority should be given to ensuring supplies of good quality whole bait fish.

* Deck layout and equipment should be improved for better handling of the fishing gear and for more comfortable working conditions of the crew.

SAFETY OF OFFSHORE FISHING BOATS

* Continued reports of boats drifting and of losses of boats and crew are a matter of concern. Safety measures should be taken regularly.

* Communication between the Ministry of Fisheries, the Navy and the Air Force should be strengthened for more efficient search-and-rescue of fishing boats in distress.

* The possibility of financially assisting fishermen so that they could obtain basic safety and communication equipment should be looked into by the Ministry of Fisheries.

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PRESERVATION OF FISH

* The use of ice to preserve fish on board and ashore is still below acceptable standards. Better handling practices should be promoted.

* Preservation of fish in chilled seawater has been satisfactory on board small offshore boats. It should be looked into with a view to extending this practice.

* To further improve the preservation of fish in ice, the cost-effectiveness of a refrigeration system for offshore boats should be studied.

TRAINING OF FISHERMEN

* There is an acute shortage of trained crew for the growing needs of the offshore fishery.

* The Ministry of Fisheries should coordinate its training programme with other agencies.

* To improve safety, boat-owners, skippers and fishermen should be made aware of the need for better design, construction, equipment and operation of offshore boats and should be trained in all aspects of operation, safety and rescue.

CREDIT AND SUBSIDY

* Loan recovery has been poor, with the result that only about 30 per cent of the funds released by the Central Bank have been repaid by the two State banks.

* The selection of beneficiaries should be the sole responsibility of the bank and should be on the basis of eligibility and trust.

* Banks favour the issue of loans to borrowers who have experience and are trained in the management of fishing enterprises.

* Better knowledge on the economic viability of offshore fishing operations should be made available to bankers so that they could assess better the issue of loans and ensure their repayment.

* With the renewal of village-level fisheries cooperatives being proposed in the Fisheries Development Plan, all future State financial assistance to fisherfolk should be channelled through these societies.

* The State banks have, as recommended, formulated a credit scheme whereby cooperative society members can acquire boat and fishing gear for the offshore fishery.

INSURANCE

* The procedures for assessment and payment of claims should be improved. Difficulties have been experienced in assessing the genuineness of claims for loss of fishing gear, resulting in delays.

* Though the insurance corporation is losing with the 3½-t offshore boats, profit/loss should not be the primary criterion, as an offshore fishery is a high-risk investment and many small-scale fishermen are involved in it.

* Insurance of offshore boats and fishing gear is being reviewed by a parliamentary subcommittee and its recommendations are expected to be implemented.

INFRASTRUCTURE FACILITIES

* Lack of facilities for berthing and servicing offshore boats is still an obstacle to further development of offshore fisheries.

* Priority should be given to studying the present and future requirements of the offshore fishing fleet.

It was recommended that the Ministry of Fisheries set up several technical committees to examine the ideas/proposals and recommendations which emerged from the seminar and define the future strategies for offshore fisheries development. Necessary legislation should follow.

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3.3 *Safety at sea*

Like most countries in the past, the Government of Shri Lanka backed away from the challenging task of imposing regulations on small fishing boats less than 12 m in length.

Except for the larger boats introduced through foreign financing schemes, it has generally been the owners of boats who decide on the level of safety they wish to have. Many, in the process, adversely affect the standards of construction. However, continuing high accident rates with small offshore boats, involving loss of life, has forced Government to take a closer look at the safety aspects of offshore boats.

Of an estimated 1000 boats engaged in offshore fishing, around eight craft and 35 fishermen are lost at sea every year with no indication of their fate. That represents about half the total number reported drifting every year. Among the drifters, the larger and better-equipped boats (11 - 15 t) have been less in distress.

The establishment and enforcement of safety guidelines for improvement of design, construction and safety of fishing boats less than 12 m in length was one of the points on which most of the participants in the information seminar agreed. Therefore, at the request of the Government of Shri Lanka, BOBP made available the services of a consultant, closely associated with Norske Veritas, to prepare the Guidelines. The Safety Guidelines (Regulations) suggested in this report could serve as a basis for establishing regulations for the offshore fishing boats. It was also recommended that the Ministry of Fisheries and Aquatic Resources should be fully responsible for implementation of the recommendations, including the following :

- Finalization and publication, as soon as possible, of new regulations that will apply to boats being manufactured.
- Inspection at least twice, on site, of boats under construction.
- Technical surveys of new boats upon completion, including the following :
  - Complementary survey of construction and compliance with approved drawings.
  - Stability control, by inclining and rolling tests.
  - Sea trials, including emergency sailing.
  - Survey and functional check of mandatory safety equipment.

  Based on a survey report, stating that all requirements have been complied with, a seaworthiness certificate would be issued by the Ministry. This certificate would be reviewed every second year, based upon further surveys of the condition of the craft.
- Regulations governing mandatory safety equipment to be carried by all boats, new and existing, and approval of such equipment.
- Mandatory licensing, insuring of crew and marking of boats, including the marking of safety equipment.
- These regulations to also apply to existing multiday offshore boats, with the exceptions mentioned in the Guidelines.
- Making use of the existing training facilities and resources in Shri Lanka for a practical course for skippers to enable them to operate their craft in a safe manner. Certificates of competency to be issued by the local authority to the participants, upon successful completion of the course. At least one person with such a certificate must be on board every offshore boat when it is at sea.
- Only persons with technical competence should serve in key technical positions concerned with the safety of fishing boats. The Ministry should ensure such competence.

The report on the Safety Guidelines, including risk and hazards analysis, was discussed at length during a consultation held in Negombo in October 1990 and a review of the report, arising out of the consultations, was submitted to the Government of Shri Lanka.

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If safety regulations for offshore fishing boats are to be successfully enforced, both fishermen and boat-owners must be convinced that the regulations are of benefit to them. An illustrated Safety Guide has, therefore, been prepared by BOBP to help the fishermen and boat-owners better understand and accept these regulations (BOBP/MAG/16).

4. FUTURE DEVELOPMENT CONSIDERATIONS

4.1 Resources

Resources of large pelagic species in the offshore are highly migratory and, hence, have a very wide range of distribution covering the EEZ of more than one country. Without precise estimates of production or the size of the stocks of the species available within the EEZ, and with the exploitation of other components outside the EEZ, by other nations, it would be risky to plan the introduction of 400 more multiday offshore boats.

During the last few years, there has been an increase in the production of large pelagic species. It is considered that this was contributed more by catches on the west coast made outside the EEZ than within. However, it is the same stocks that are being fished both inside and outside the man-made EEZ boundaries. There is scope for developing this offshore fishery on the east coast also.

Besides surface driftnetting, subsurface drift-longlining for larger tuna can be undertaken inside and outside the EEZ, right around the island. The deep swimming large tuna in the central equatorial region surrounding Shri Lanka are at present caught with drift-longlines by distant nations. In view of the importance of developing this offshore fishery, investigations are essential on the viability of diversifying and expanding the fisheries for the offshore large pelagics.

4.2 Offshore fishing boats

Despite various problems, multiday offshore fishing operations are well established in Shri Lanka, accepted by the local fishermen and will continue to grow. New multiday boats will be constructed and these may include larger boats for greater endurance at sea, thus making possible 10-15day trips to fish well beyond the EEZ of Shri Lanka. Seizure of many boats, and their crew being kept in custody for months in India and the Maldives, has not as yet deterred Shri Lankan fishermen.

The boatbuilding industry in Shri Lanka has reached a relatively high level of competence. Boats have been exported to Europe, West Asia and East Africa for many years now. The boatyards are therefore capable of manufacturing larger and better offshore boats without assistance from outside. It is only in the area of safety that Government intervention is required (see Section 4.5).

The development of the offshore fishery has been stimulated by incentives provided by the Government. Offshore boats have been subsidized by 35 per cent of the cost of the boat (hull and engine). It appears that the fishery is sufficiently buoyant to manage without subsidies. They may not be needed and may, in the long run, be counterproductive since they would contribute to overexploitation of the fishery resources.

While the construction of 3 ½-t offshore day-boats ceased some years ago, mainly because of their relatively high capital and running costs, some 18-ft FRP boats, extended by 2-3 ft and propelled by 15-25 hp outboard motors, have been built with much lower investment and are being employed in the offshore fishery. But the running costs of these open boats are very high and the safety and comfort of crew very low when operating offshore. The question is whether another intermediate boat type could be developed at low investment and operating costs so as to be profitable for offshore day-fishing by small-scale fishermen.

The 8.5 m FRP beachlanding craft, IND-20, introduced on the east coast of India, may be one possibility. The cost of the hull is significantly less than that of the 3 ½-tonner. The engine required for this type of boat is a marinized horizontal cylinder water-cooled diesel engine of 10- 12 hp. Such engines are available in Shri Lanka much more cheaply than marine engines because they are mass-produced. This type of boat can also operate from shallow water outlets and beaches.

The IND-20 can carry enough large-mesh driftnets (l km) and drift-longlines (5 km) in a gear-hold and as much as 250 kg of fish in an insulated, built-in fish-hold.

In addition to offshore driftnetting and drift-longlining, the IND-20 is appropriate also for trolling, flyingfish gillnetting and other fishing methods in offshore areas. It might be worthwhile for the Government, in cooperation with boatyards, to test the feasibility of such an alternative craft by providing subsidies for the introduction of a limited number of boats.

4.3 Fishing gear and their operation

During the last few decades, driftnets and drift-longlines have been increasingly used near the surface by small offshore boats. Drift-longlines have been mainly used at greater depths by foreign vessels fishing for the large tuna species. No significant improvements to these efficient fishing gear appear possible.

However, should the larger multiday boats being introduced by local boat-owners continue to use more fishing gear and also start using drift-longlines for larger tuna, there will be need for deck equipment to facilitate their operation. Existing boats could also use more longlines if mechanical gear-handling devices were installed. Manual operation of more drift-longlines than at present would take too long and be too strenuous for the crew. A hydraulic drift-longline drum driven from the power take-off of the main engine would be appropriate to store and operate 40-80 baskets of drift-longlines or more.

Such equipment would be a necessity for operation of deepwater longlines for large tuna, which might be the next step in the exploitation of the available resources.

4.4 Fish preservation

The use of ice to preserve the catch will continue to be crucial to the offshore fishery. With the increase in size of offshore boats for 10-15 day trips, effective preservation on board is a necessity. These boats do not preserve fish in chilled sea water. To reduce consumption of ice, with or without seawater, better insulated fish-holds and the installation of refrigeration units are essential. Fishermen also need to be trained in fish preservation as required by the market.

4.5 Safety at sea

The main reasons for accidents and distress situations at sea are defects in design and construction of boats, lack of safety equipment on board and the fishermen's limited knowledge of navigation and basic engine maintenance/repairs.

As far as design, construction and safety equipment are concerned, the Government need to establish regulations and a suitable enforcement mechanism. This should be done in close consultation with fishermen and boatyards. Such regulations are available in developed countries and may serve as guidelines. However, they would be far too strict for the prevailing conditions in Shri Lanka and must be suitably modified. The approach should be to introduce, step by step, affordable safety regulations of practical value which are acceptable to the fishermen and the boat-owners.

Urgent measures may be required for the 3½-t multiday boats. The significantly higher loss of these boats compared to larger craft may raise the question whether the design permits multiday offshore fishing with a heavy load of nets and a highly placed fish-hold. The lack of stability may be the main reason for accidents.

More effort needs also be devoted to education and training of fishermen in all aspects of safety at sea, *i.e.* load and stability of boats, navigation, maintenance and simple repair of engines, use of safety equipment, including sail, survival measures in distress situations and on facilities for search-and-rescue and the implications of such operations.

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4.6 Search-and-rescue (SAR)

The Ministry of Fisheries may not be the best authority to mobilize and handle all technical inputs required for a complex, multidimensional and expensive operation needed to reduce casualties at sea. What most countries have is a separate SAR service of international standard, assisted by such organizations as the Air Force and the Navy, to meet the needs of all maritime interests.

The Ministry of Trade and Shipping of the Government of Shri Lanka is already recognized as a national SAR agency. Various types of facilities, vessels, aircraft, equipment and personnel are available with different agencies – ports, civil aviation, defence, broadcasting, telecommunication, police, meteorological department, fisheries department etc. A first step in the right direction would be to mobilize, and orchestrate the available national expertise and facilities. This must be brought about through comprehensive legislation, which would identify a responsible authority for SAR services as well as services to tackle maritime, aeronautical, pollution and natural calamities. It would be necessary to define the areas of responsibility of each service. The guidelines for cooperation among different services should also be spelt out. Apart from legislation, government policy directives for each service would also be necessary.

With the expansion of the offshore operations by many boats beyond the EEZ and in the territorial waters of India and the Maldives, it is also necessary to establish good communication links with the governments of those countries so as to obtain whatever support may be required from their search-and-rescue services.

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APPENDIX I

Chronology of activities and events

1982	
MAR	Techno-economic evaluation of fishing craft (by 0 Gulbrandsen, Naval Architect Consultant).
JUL	A new fishing boat, SRL34, fitted with a 21 hp diesel engine (Kubota), an insulated fish-hold and basic crew accommodation constructed (by Neil Marine Boatyard).
AUG	Start of fishing demonstration (driftnetting) with SRL-34 by fishermen at Beruwala.
OCTNOV	Modification and repair of SRL34
DEC	Fishing demonstration with SRL34 resumed, but only one-day trips made.
1983	
MAY	SRL34 starting to make two-day trips.
JUN	Design of an FRP fishing boat, SRL-15, with a low horsepower diesel engine (12- 15 hp).
1984	
MAY	Plug for SRL-15 constructed in Madras.
SEP	Mould for SRL-15 constructed in Madras.
OCT	Shipment of the SRL-15 mould to Colombo.
1985	
MAY	SRL-15 constructed in Colombo at the Ceynor Boatyard.
JUN	Launching and start of technical trials of SRL-15.
1986	
JAN-DEC	Modification of SRL34 and installation of a new Yanmar diesel engine (2 TDGG) 25 hp
MAR	Modification of the layout and general arrangement of SRL-15 completed.
APR-NOV	Fishing demonstrations with SRL-15 in Negombo.
DEC	SRL-15 laid up for installation of a new Yanmar diesel engine (20 hp).
1987	
MAY	Start of multiday fishing trials with the new SRL-34.
SEP	Sale of SRL-34 to a fisherman-boat-owner.
OCT	Technical trials of SRL-15 in Negombo.
NOV	Start of fishing demonstration (driftnetting) with SRL-15 in Galle.
DEC	SRL-34 'sails' for 38 days, after engine failure, and reaches Sumatera, Indonesia.
1988	
MAR	Study of Search-and-Rescue of offshore boats.
MAR	Modification of the SRL-15 mould to have a single keel.
OCT	Completion of fishing demonstrations (driftnetting) with SRL-15 in Galle.
JUN	An SRL-15 ordered by a fisherman participating in the trials.
DEC	Private SRL-15 constructed (by Blue Star Marine boatyard).
DEC	Technical and economical evaluation of the development of the new fishing boats.
1989	
SEP	A video film on small-scale offshore fisheries produced.
MAR	Transfer of SRL-15 to India for fishing demonstration.
SEP	SRL-15 mould modified for installation of a wider range of engines.
1990	
FEB	Information seminar on small-scale offshore fisheries in Negombo.
OCT	Preparation of safety guidelines and consultation held on safety of offshore fishing boats.
1993	
JAN	Transfer of SRL-15 mould to India.
APR	Completion of extension booklet on safety of offshore boats.

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APPENDIX II
SRL-34 Offshore Boat – Operational Data

		May 87	June	July	Aug	Sept	Oct	Nov	Total
No of fishing trips		3	5	7	9	8	8	5	45
Nooffishingdays		10	9	14	13	14	18	12	90
Gearwise **catch and** earnings:									
Driftnets	**kg**	1326	1653	2573	927	1214	2018	1629	11340
	Rs	26452	23410	48119	16615	21525	40315	***34250***	210686
Drift-longlines	kg	470	1129	2169	147	82	35	103	4135
	Rs	8672	19050	40039	3270	1795	700	2300	75826
Trollioglines	kg					639	458		1097
	Rs					12780	7855		20635
TOTAL	kg	1796	2782	4742	1074	1935	2511	1732	16572
	Rs	35124	42460	88158	19885	36100	48870	36550	307147

		May	June	July	Aug	Sept	Oct	Nov	Total
Cashflow									
Total **sales value**	Rs	35124	42460	88158	19885	36100	48870	36550	307147
Variable operational costs:									
Fuel		2392	3191	6270	3770	3478	4237	4028	27366
Food		1500	2500	3100	2500	2500	3200	2500	17800
Ice and Bait		2200	2960	3750	2220	2930	3720	2900	20680
Others		570		940	314	336	501	373	3034
TOTAL		6662	8651	14060	8804	9244	11658	9801	68880
Cashflow before payment to crew and boat-owner		28462	33809	74098	11081	26856	37212	26749	238267
Payment to crew members (50%)		14231	16904	37049	5540	13428	18606	13374	119133
Payment to boat owner (50%)		14231	16904	37049	5540	13428	18606	13374	119133

APPENDIX III
SRL-15 Offshore Boat - Operational data

		Nov87	Dec87	Jan 88	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
No of fishing trips		3	3	5	3	5	4	5	4	6	6	5	4	53
Nooffishingdays		14	12	16	15	16	16	11	14	14	15	16	15	174
Gearwise catch **and** earnings:														
Driftnets	kg	909	510	2545	1019	2049	592	2160	2675	4952	3906	2534	1682	25533
	Rs	19991	15271	57723	22893	49658	20889	46527	54440	72306	68401	43522	27591	499212
Drift-longlines	kg	949	227	422	249	443	220		526			189		3225
	Rs	15244	5006	8697	4833	8531	5795		10184			3475		61765
Trolliaglines	kg		36	161	730	452	182							1561
	Rs		1260	5000	21179	10841	6216							44496
TOTAL	kg	1858	737	3128	1998	2944	994	2160	3201	4952	3906	2723	1682	30283
	Rs	35235	21537	71420	48905	69030	32900	46527	64624	72306	68401	46997	27591	605473

		Nov87	Dec87	Jan 88	Feb	Mar	Apr	May	Jun	Jul	Aug	*Sep*	***Oct***	***Total***
Cashflow														
Total sales value	Rs	35235	21537	71420	48905	69030	32900	46527	64624	72306	68401	46997	27591	605473
Variable operational costs:														
Fuel		3984	3860	4923	4298	4620	3299	2391	4965	4257	3525	3920	3606	47648
Food		4500	4000	5000	3000	5000	3500	3450	2750	3750	3650	3300	3750	45650
Ice and Bait		2050	1600	2600	1600	2900	1900	2400	2200	3527	3621	3000	3295	30693
Others			500	4041	1500	3500	850	2350	2000	3669	3000	3500	2500	27410
TOTAL		10534	9960	16564	10398	16020	9549	10591	11915	15203	13796	13720	13151	151401
Cashflow before payment to crew and boat-owner		24701	11577	54856	38507	53010	23351	35936	52709	57103	54605	33277	14440	454072
Payment to crew members (50%)		12350	5788	27428	19253	26505	11675	17968	26354	28551	27302	16638	7220	227036
Payment to boat-owner (50%)		12350	5788	27428	19253	26505	11675	17968	26354	28551	27302	16638	7220	227036

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PUBLICATIONS OF THE BAY OF BENGAL PROGRAMME (BOBP)

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 BengalNews) 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.

Reports *(BOBP/REP/...)*

32. **Bank Credit for Artisanal Marine Fisherfolk of Orissa, India.* U. Tietze. (Madras, 1987.)

33. *Nonformal Primary Education for Children of Marine Fisherfolk in Orissa, India.* U. Tietze, N. Ray. (Madras, 1987.)

34. *The Coastal Set Bagnet Fishery of Bangladesh — Fishing Trials and Investigations.* S. E. Akerman. (Madras, 1986.)

35. *Brackishwater Shrimp Culture Demonstration in Bangladesh.* M. Karim. (Madras, 1986.)

36. *Hilsa Investigations in Bangladesh.* (Colombo, 1987.)

37. *High-Opening Bottom Trawling in Tamil Nadu, Gujarat and Orissa, India : A Summary of Effort and Impact.* (Madras, 1987.)

38. *Report of the Eleventh Meeting of the Advisory Committee,* Bangkok, Thailand, 26-28 March, 1987. (Madras, 1987.)

39. *Investigations on the Mackerel and Scad Resources of the Malacca Straits.* (Colombo, 1987.)

40. *Tuna in the Andaman Sea.* (Colombo, 1987.)

41. *Studies of the Tuna Resource in the EEZs of Shri Lanka and Maldives.* (Colombo, 1988.)

42. *Report of the Twelfth Meeting of the Advisory Committee.* Bhubaneswar, India, 12-15 January 1988. (Madras, 1988.)

43. *Report of the Thirteenth Meeting of the Advisory Committee.* Penang, Malaysia, 26-28 January, 1989. (Madras, 1989.)

44. *Report of the Fourteenth Meeting of the Advisory Committee.* Medan, Indonesia, 22-25 January, 1990. (Madras, 1990.)

45. *Gracilaria Production and Utilization in the Bay of Bengal Region: Report of a seminar held in Songkhla, Thailand,* 23-27 October 1989. (Madras, 1990.)

46. *Exploratory Fishing for Large Pelagic Species in the Maldives.* R.C.Anderson, A.Waheed, (Madras, 1990.)

47. *Exploratory Fishing for Large Pelagic Species in Shri Lanka.* R Maldeniya, S. L. Suraweera. (Madras, 1991.)

48. *Report of the Fifteenth Meeting of the Advisory Committee.* Colombo, Shri Lanka, 28-30 January 1991. (Madras, 1991.)

49. *introduction of New Small Fishing Craft in Kerala, India.* 0. Gulbrandsen and M. R. Anderson. (Madras, 1992.)

50. *Report of the Sixteenth Meeting of the Advisory Committee.* Phuket, Thailand, 20-23 January 1992. (Madras, 1992.)

51. *Report of the Seminar on the Mud Crab Culture and Trade in the Bay of Bengal Region,* November 5-8, Surat Thani, Thailand. Ed by C.A. Angell. (Madras, 1992.)

52. *Feeds for Artisanal Shrimp Culture in India — Their Development and Evaluation.* J F Wood et al. (Madras, 1992.)

53. *A Radio Programmefor Fisherfolk in Shri Lanka.* R N Roy. (Madras, 1992.)

54. *Developing and Introducing a Beachlanding Craft on the East Coast of India.* V L C Pietersz. (Madras, 1993.)

55. A Shri Lanka Credit Project to Provide Banking Services to Fisherfolk. C. Fernando, D. Attanayake. (Madras, 1992.)

56. *A Study on Dolphin Catches in Shri Lanka.* L Joseph. (Madras, April 1993.)

57. *Introduction of New Outrigger Canoes in Indonesia.* G Pajot, O Gulbrandsen. (Madras, 1993.)

58. *Report of the Seventeenth Meeting of the Advisory Committee.* Dhaka, Bangladesh, 6-8 April 1993. (Madras, 1993.)

59. *Report on Development of Canoes in Shri Lanka.* G. Pajot. O Gulbrandsen. (Madras, 1993.)

61. *Small Offshore Fishing Boats in Shri Lanka.* G. Pajot. (Madras, August 1993.)

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49. *Pen Culture of Shrimp by Fisherfolk : The BOBP Experience in Kiliai, Tamil Nadu, India.* E. Drewes, G. Rajappan. (Madras, 1987.)

50. *Experiences with a Manually Operated Net-Braiding Machine in Bangladesh.* B. C. Gillgten, A. Kashem. (Madras, 1986.)

51. *Hauling Devices for Beachlanding Craft.* A. Overa, P. A. Hemminghyth. (Madras, 1986.)

52. *Experimental* Culture of *Seaweeds* (Gtacilaria *Sp.) in Penang, Malaysia.* (Based *on* a report by M. Doty and J. Fisher). (Madras, 1987.)

53. *Atlas of Deep Water Demersal Fishery Resources in the Bay of Bengal.* T. Nishida, K. Sivasubramaniam. (Colombo, 1986.)

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60. *Pen Culture of Shrimp in Chiiaw, Shri Lanka.* D. Reyntjens. (Madras, 1989.)

61. *Development of Outrigger Canoes in Shri Lanka.* O. Gulbtandsen, (Madras, 1990.)

62. *Silvi-Pisciculture Project in Sunderbans, West Bengal : A Summary Report of BOBP's assistance.* C.L. Angell, J. Muir. (Madras, 1990.)

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