# Bay of Bengal Programme

## Fishing Technology

**EXPLORATORY FISHING FOR LARGE PELAGIC SPECIES IN SOUTH INDIAN WATERS**

**BOBP/WP/81**

FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS

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BAY OF BENGAL PROGRAMME BOBP/WP/81
Small-Scale Fisherfolk Communities GCP/RAS/1 18/MUL

# Exploratory Fishing for Large Pelagic Species in South Indian Waters

by

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**BAY OF BENGAL PROGRAMME**
**Madras, India**
**1992**

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Despite the substantial increase in the traditional small craft fishing fleet of Tamil Nadu, India, production has remained more or less constant in the last few years, indicating that fisheries resources within the range of this fleet have been fully exploited.

From the Sixties, however, introduced small fishing craft in neighbouring Sri Lanka have been operating in deep sea waters and reporting good catches of large pelagic species, particularly shark. Although Tamil Nadu is geographically well placed for the exploitation of these resources, the potential has not been realised.

In order to introduce fishing for large pelagic species in Tamil Nadu by demonstrating the experience in Sri Lanka, a subproject for fishing demonstrations in Tamil Nadu was established in 1989. The executing agency was the Tamil Nadu Department of Fisheries with technical and financial support from the Bay of Bengal Programme (BOBP), which had played a part in this development in Sri Lanka.

A 10 m FRP boat (SRL *15)* tested in Sri Lanka's commercial offshore fisheries was selected for the exploratory fishing trials from a base in Tamil Nadu, the Chinnamuttain fishing harbour near Cape c'omorin. The results and the conclusions of these trials are reported in this paper.

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



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*SRL-15 at sea*

*SRL-15 on the beach*

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## I. *BACKGROUND*

The state of Tamil Nadu, India, has a 1000 km long coastline, a continental shelf that is 41 000 $km^2$ in extent and an Exclusive Economic Zone of 197,000 $km^2$.,.\lniost all its fish catch until noss has been taken within a depth range of SOm in an area of only 23,000 $km^2$

The present fishing fleet consists of' about 43,000 fishing craft, of whtch 4,000 are mechanited boats of size 7.5-13,5 rn in length. Of the 39,000 or so indigenous craft, abotit 3,000 are niotori ed; the remaining 36,000 are powered by oars or sail. Most of the 9-13.5 iii mechanized boats have been concentrating on shrimp trawling, but they are increasingly trawling for food fish and sqtiirl. The traditional motorized and non-motorized craft operate boat and beach seines, gillnets and hook-and-lines in the coastal waters up to 10-IS km.

Both sectors of the fishing fleet, the non—motorized and the motorized, have grown at ati estimated rate of more than 6.5 per cent during the Eighties. But since production of' fish has remained niore or less constant during this period, it would appear that the fishery resources within the range of the existing fleet have been fully exploited. Sonic areas, or sonic resources, may even he overexploited.

On the other hand, there are clear indications of substantial, largely underexploited resources of large pelagic species in the offshore areas. The results of Tuna longlining surveys carried out h the Fishery Survey of India from October 1983 to March 1988 and seasotial commercial longlining by chartered vessels iti the deep sea area show good catch rates of Tuna, Shark atid Bilifish in the deep sea areas off the Coromandel Coast, and south of Cape Comorin. Small Sri Lankan fishing boats that have been operating in the deep sea area south of Cape Comorin have, in recent years, had good catches of these large pelagic species, particularly of Shark. Furthermore, offshore fishing trials along the east coast of India, using heachlanding craft operating large mesh driftnets, drift longlines and trolling lines, have produced encouraging results,

Although Tamil Nadu is geographically well placed for the exploitation of these resources, the potential has, until now, not been realized, The low demand for, and price of, large pelagic species in the Indian market has been a disincentive to exploiting these resources. Howeser, with stagnation in production and increasing fish prices, the picture is changing. Obstacles for commercial development of the offshore fisheries are

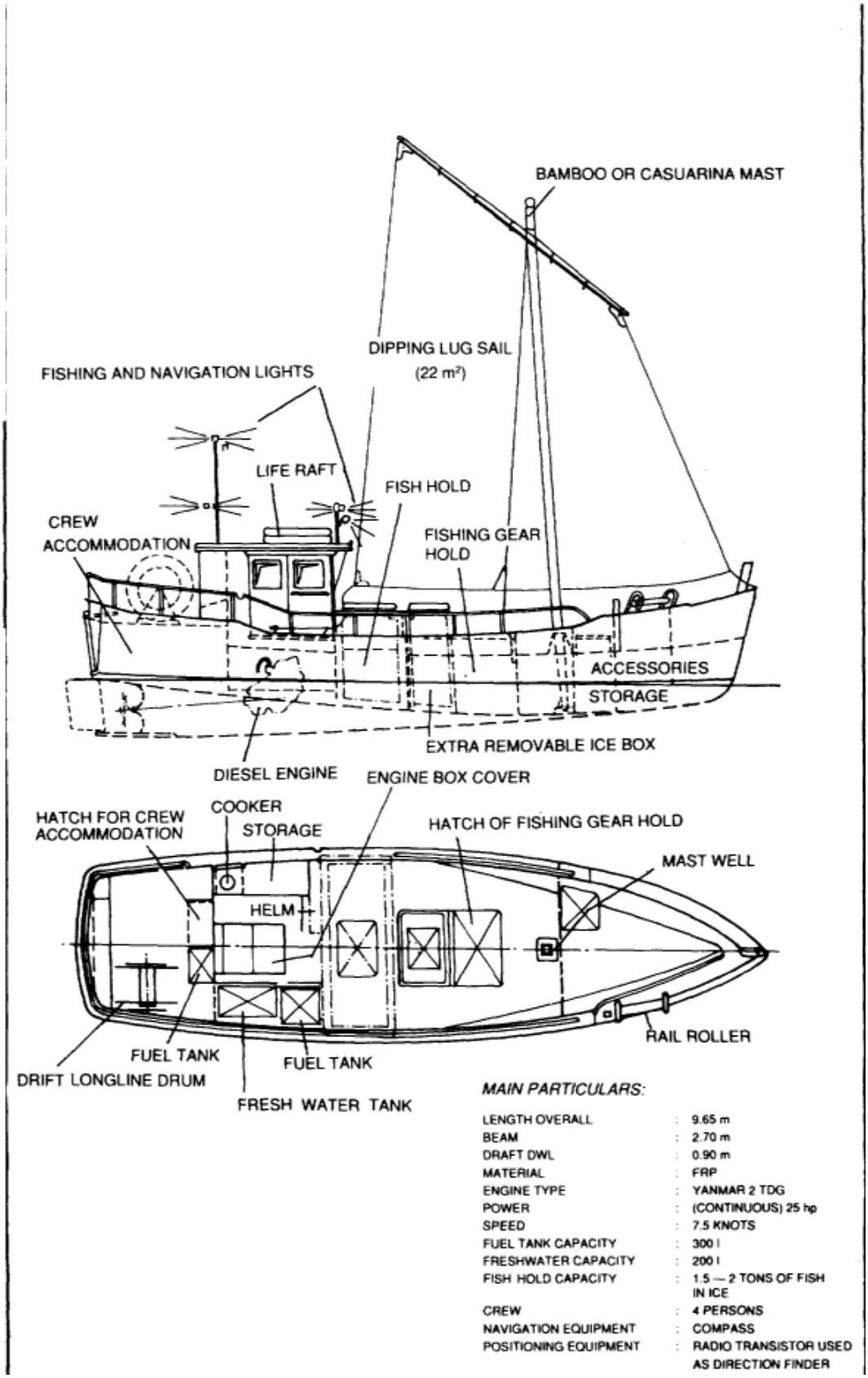
- the absence of suitable craft, and
- lack of experience and
- consequent lack of skill on the part of the fishermen.

In order to initiate offshore fishing for large pelagic species in Tamil Nadu by utilizing the experience of the offshore fisheries development in Sri Lanka, a subproject for fishing demonstrations was established in 1989. The executing agency was the Tamil Nadu Department of Fisheries with technical and financial support from the Bay of Bengal Programme (BOBP).

In Sri Lanka, small-scale offshore fishing for large pelagic species has been carried out since the Sixties, stimulated by the high demand for Tuna species. In the mid-Eighties, the fishing changed from one-day to multiday operations, increasing the area of operation considerably, boosting the production and accelerating the technical development of fishing boats. The yearly production is now estimated at about 20,000 t from a fleet of about 650 boats.

The boats built in Sri Lanka vary in overall size from 9 to 10.5m and 3.5 to 16t; they are powered with inboard diesel engines of 25-5 5 hp. The new boats are mostly of fibre glass construction and have insulated fishholds to preserve fish in ice, water and fuel tanks, sleeping and cooking facilities etc. Fishing trips by multiday boats are normally of 4-6 days. But on the larger boats the duration

**Fig 1. SRL-15 fishing boat**




*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 | : | 300 l |
| FRESHWATER CAPACITY | : | 200 l |
| 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 |

goes up to ten days and the range of operation is, at times, more than 200 n miles from base. The fishing gear employed are driftnets, drift longlines, trolling lines and handlines.

The BOBP had played a part in these developments in Sri Lanka and the subproject now sought to use this experience.

## 2. *PURPOSE AND TARGETS*

The purpose of this Tamil Nadu DOF subproject was to demonstrate the technical and economic feasibility of small-scale offshore fishing for large pelagic species using driftnets and longlines. The intended beneficiaries were fisherfolk who operate beachlanding craft and similar, or larger, harbour-based boats. Successful demonstration would lead to commercial development, producing higher earnings for the fisherfolk and increased fish production from underexploited resources.

The intention was to transfer a suitable boat (SRL-l5) from Sri Lanka and use it for commercial fishing demonstration for at least one year, during which seasonal variations in weather and availability of fish would be experienced. The fishing started in the middle of 1989 but had to be terminated after a few trials because of a major engine breakdown. A second boat of the same type was ordered and put into operation in July 1990. Regular commercial fishing began with the secønd boat and, later, in January 1991, with the first boat, which returned after overhauling. A review of the subproject was undertaken after completion of one year of continuous fishing operation. The result of that review is presented in this report.

## 3. *THE FISHING CRAFT*

A 10 m FRP boat (SRL-15) tested in Sri Lanka's multiday offshore fisheries was selected for the commercially oriented exploratory fishing off the Tamil Nadu coast. The main particulars, deck layout and general arrangement of the boat are shown in Figure 1 (see facing page).

The SRL-15 is about the smallest boat capable of carrying out such fishing operations. It is also fuel-efficient because of its design and low engine powcr. It has most of the features of larger boats used in Sri Lanka and is, in addition, equipped with an efficicnt emergency sail rig in case of engine breakdown. The boat is not equipped with radio equipment for boat-to-boat and boat-to-shore communication; the Government of India did not grant permission to import a VHF radio. The boat has a fishhold for *1.5-2* t of fish in ice.

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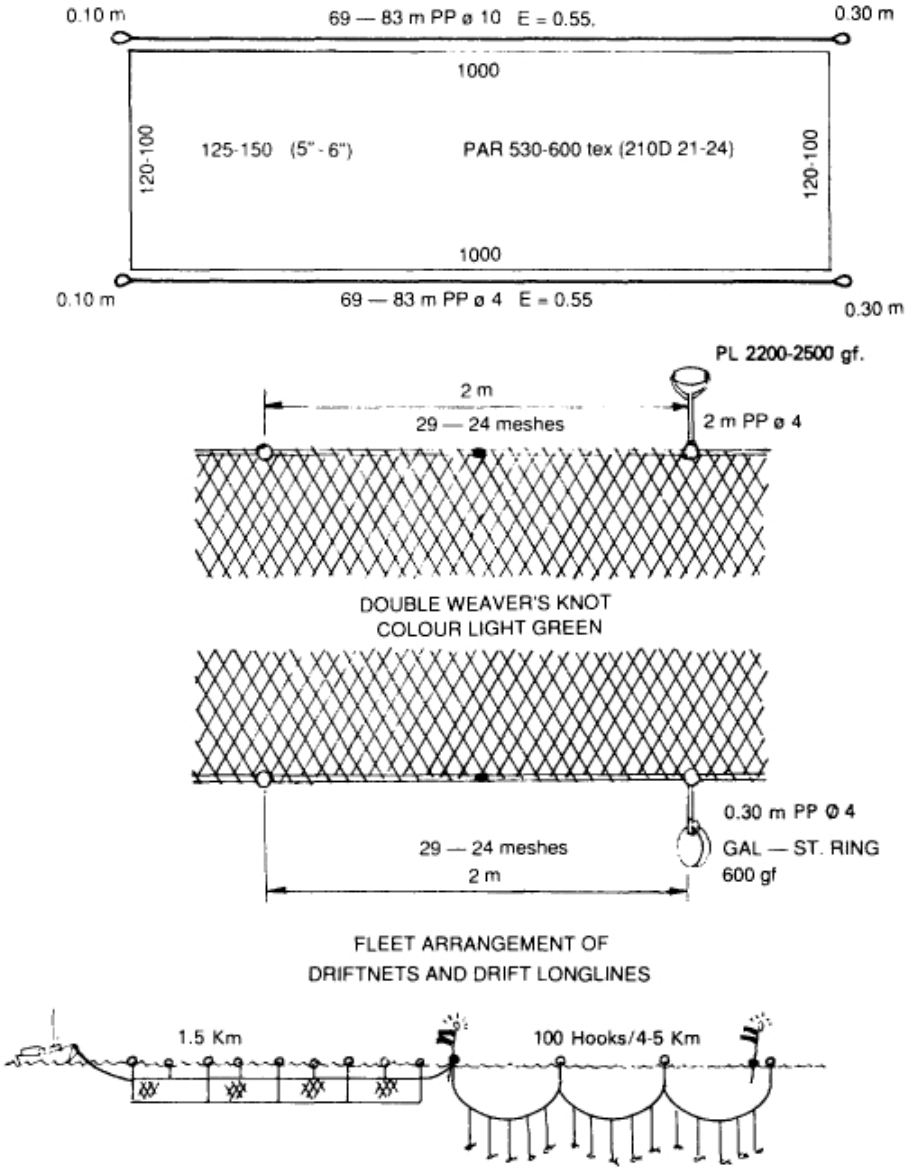
*SRL-15 I and II in Chinnamutlam*

**Fig 2. Driftnets used on SRL-15**

*All dimensions in mm unless otherwise stated*



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## *4. FISHING METHODS AND GEAR*

### 4.1 *Fishing gear*

To exploit large pelagic species with small fishing boats, driftnetting and drift longlining are fishing methods whose suitability have been proven in Sri Lanka. Trolling is a complementary method used to and from the fishing area. Each boat was therefore equipped with the following gear

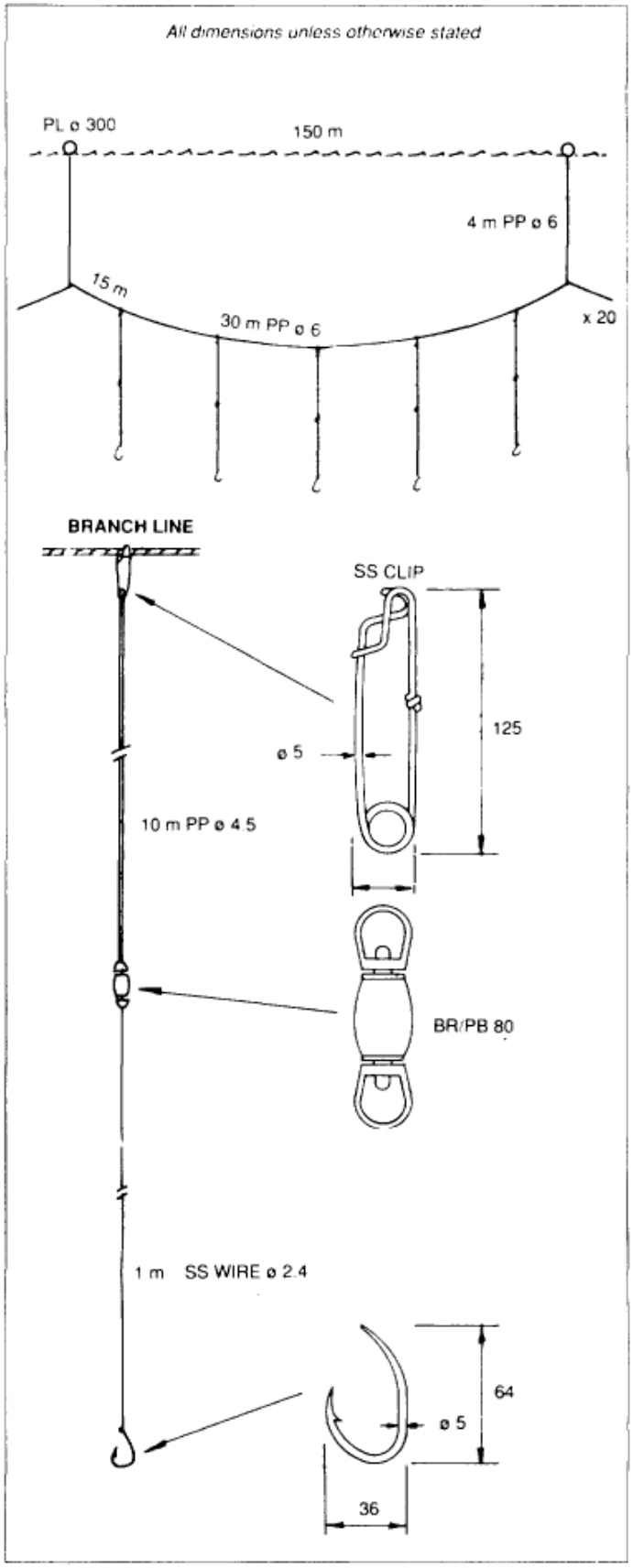
- Ten driftnets, 1000 meshes long, 120 meshes deep and of 125mm mesh size (Figure 2, facing page);
- Ten driftnets, 1000 mesh long, 100 meshes deep and of 150 mm mesh size (Figure 2);
- Twenty bundles of drift longlines with five hooks each (Figure 3, alongside); and
- Four trolling lines (single and multihook).

Supply and quality of bait fish are very important for the success of drift longlining. For Shark drift longlining, cut pieces of fresh 'blood' fish (Tuna) are prime quality bait. In small boats like the SRL-15, bait is kept in ice, or may be collected daily from the catch of driftnets and of trolling lines whert combined fishing operations are carried out. The four single and multihook trolling lines were used during the day, while sailing to and from the fishing area or when moving between fishing areas.

### 4.2 *Fishing operations*

The driftnets are attached one to another so as to form a long stretch of nets floating close to the surface and hanging vertically in the water. The drift longlines are also attached one

**Fig 3. Drift longlines used on SRL-15**



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to another to form a long string of lines and hooks. On reaching the selected fishing area, driftnets or drift longlines are put out for fishing, generally, before sunset. If drift longlines and driftnets are simultaneously used, the drift-longlines are shot first and attached to a buoy from which the laying out of the line is done. The driftnets are then attached to the nearest end of the drift longlines.

When the laying of the drift longlines andy or driftnets is completed, the lines or nets at the tail end are attached to the boat and kept adrift (see Figure 2). The soaking time is 6-12 hours, depending on the fishing conditions, bitt it never exceeds eight hours for the driftnets and twelve hours for the drift longlines.

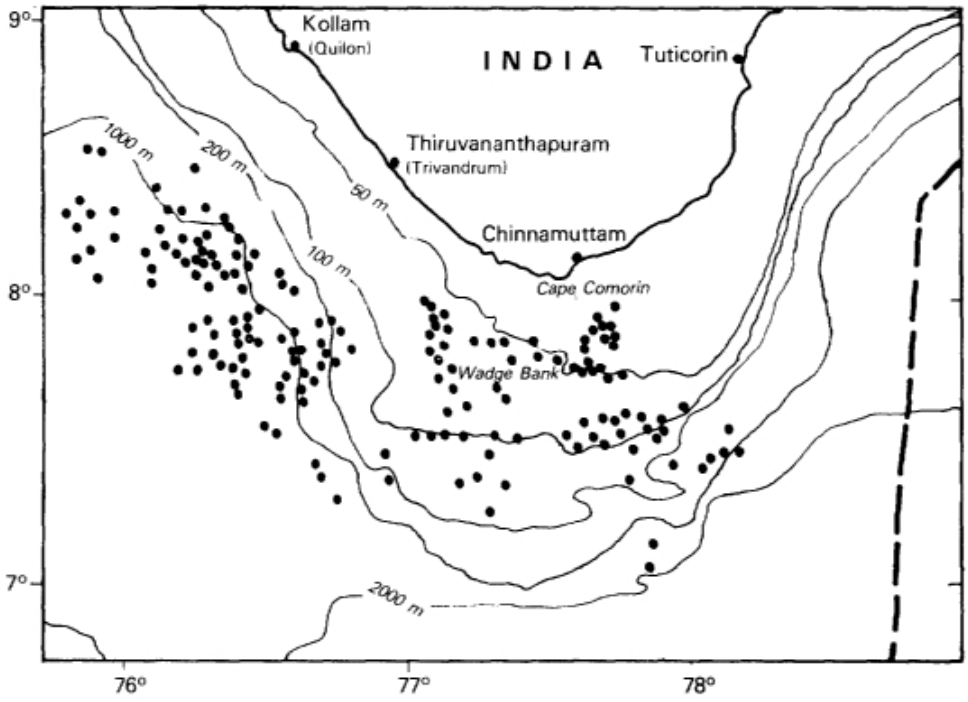
Hauling in is done in the res erse directior. As the driftnet or drift longlines are hauled aboard, the fish are removed from the nets, or hooks, prior to restacking the gear for shooting again. The fish are kept in a deck bin till the hauling operation is completed and then transferred to the fishhold for preservation in ice.

## *5. OPERA TIONA L A RRA NGEMENTS*

### *5.* 1 *Operational base and facilities*

Chinnamuttam, a fishing harbour located near Cape Comorin, was the base of operation. It provides direct access to the Gulf of Mannar eastward and to the Arabian Sea westward (see Figure 4).

**Fig 4. Map of area fished by SRL-15 II**




Chinnamuttam is a fishing harbour that has not been fully developed; it is underutilized because supplies and services are not available within the harbour. Supplies of ice, fuel and water, store/office facilities and repair services were organized with local entrepreneurs.

The catches were sold to a fish merchant at fixed prices that were adjusted monthly.

### *5.2 Area of operation*

Fishing operations were conducted from July 1990 to August 1991, covering the offshore areas south and west of the southernmost tip of India. In the beginning, the fishing was confined to a range of 40-60 n miles, but it was later extended up to 100 n miles from the base. The dots in Figure 4 show the approximate location of each fishing operation using driftnets and drift longlines.



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### *5.3 Crew*

Four fishermen manned each boat. They were traditional fishermen from the area, used to co4stal fishing with *kattumaram,* driftnetters and trawlers. None of them had experience in multiday offshore fishing with driftnets and drift longlines. Extensive training in navigation and positioning **of** the boat, manoeuvring the boat during fishing operations, operation of driftnets and drift longlines and maintenance of the boat and engine was imparted by the BOBP Masterfisherman. Initially, he aIso participated in the fishing on a full-time basis, but, thereafter, his participation was intermittent.

Given the commercial nature of the fishing, the crew worked on a catch share basis, *i.e.* **40 per cent** share of the net revenue (after deduction of operational costs from the gross revenue). As an incentive to operate in offshore areas regardless of the catch, each crew member was paid a minimum monthly wage of Rs. 1500, thus ensuring them a monthly income on par with **commercial boats.**

### *5.4 Records offishing operation*

BOBP staff, when onboard the boats, trained the fishermen's leader to make observations and record data on the fishing operations, thus enabling monitoring. On shore, the national subproject staff in charge of operations kept records of expenditure and earnings.

## 6. *RESULTS*

The second boat, SRL-15 II, was operational from July 1990, but a lot of time during the first two months was spent on training the crew and organizing the shore services. Commercial data on it are therefore available only from September 1990.

The first boat, SRL-15 1, was fully engaged in commercial fishing from April 1991. The two boats worked together from that time with very similar results. Therefore, only the results of SRL-15 II are presented in this report.

### **6.1** *Fishing time*

During one year of operation, September 1990-August 1991, SRL-15 II made 75 trips and achieved 166 fishing days (Table 1). Considering that offshore fishing was new to the fishermen and local project staff, this was a satisfactory number of fishing trips and days.

**Table 1. SRL-15 II: Record of fishing time**

| *Month/Year* | *90 Sept* | *Oct* | *Nov* | *Dec* | *91Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishing trips (no) | 9 | 16 | 6 | 6 | 2 | 6 | 5 | 3 | 5 | 5 | 6 | 6 | 75 |
| Timeatsea(d) | 19 | 21 | IS | 12 | 6 | 18 | IS | 8 | 14 | 7 | 15 | 16 | 166 |
| Fishing time (d) | | | | | | | | | | | | | |
| Driftnets | 19 | 21 | 15 | 12 | 6 | 18 | 15 | 8 | 14 | 7 | 15 | 16 | 166 |
| Drift longlines | 5 | 4 | 6 | 2 | 2 | 3 | 8 | 5 | 5 | 2 | 7 | — | 49 |
| Soaking time of gear *(Pt)* | 188 | 170 | 181 | 106 | 79 | 157 | 155 | 87 | 85 | 83 | 143 | 119 | 1553 |
| Fishing time (h) | | | | | | | | | | | | | |
| Driftnets | 132 | 123 | 109 | 75 | 45 | 127 | 121 | 68 | 65 | 60 | 143 | 119 | 1187 |
| Drift longlines | 56 | 55 | 82 | 20 | 21 | 30 | 99 | 53 | 60 | 26 | 88 | — | 590 |
| Sailing time (h) | | | | | | | | | | | | | |
| Engine | 148 | 193 | 225 | 178 | 69 | 258 | 216 | 121 | 254 | 119 | 212 | 176 | 2169 |
| Engine + Sail | — | 20 | 22 | 24 | 4 | 35 | 16 | 10 | 57 | 23 | 44 | 40 | 295 |
| Sail | — | — | — | — | — | — | - | 18 | -- | — | — | — | 18 |
| Trolling while (d) | 6 | 4 | 11 | - | 4 | 10 | 10 | 5 | 5 | 7 | 9 | 10 | gg |
| Sailing (h) | 26 | 23 | 84 | 48 | 28 | 71 | 74 | 41 | 37 | 45 | 63 | 74 | 614 |



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Driftnets were used for 67 per cent of the fishing time and at an average of 7.2 h/fishing day. The drift longlines were used only for 33 per cent of the total fishing time and at an average of l2h/fishing day. It would appear that the driftnets have been efficiently used. A longer soaking time would lead to quality deterioration of the fish.

The drift longlines were used too little. Non-availability of cut pieces of bait fish and the reluctance of the cresv to use both gear simultaneously are the main reasons for the poor use of the drift longline.

The following reasons were given for there being no fishing

| | | *Days* |
|---|---|---|
| Boat/engine maintenance and repair | : | 19 |
| Fishing gear maintenance and repair | : | 9 |
| Bad weather | : | 21 |
| Holidays | : | 51 |
| Turnround | : | 99 |
| | | 199 |

Too many days appear to have been used for maintenance and repair of boat, engine and fishing gear. More of this work could, perhaps, have been done during turnround days in the harbour.

Most of the days lost due to bad weather were recorded in June, during the Southwest Monsoon. Lack of trained crew and long sailing hours (10-12) to reach the fishing ground were reasons for staying some extra days in the haibour.

The days lost because of festivals and weekly holidays are rather high for multiday fishing. However, there was improvement on this count during the latter part of the first year. During the early months, fishermen were reluctant to leave the base on a Saturday, even when the boat was ready for sailing.

Turnround days between fishing trips were more than expected. This is mainly attributed to the above reasons and to the lack of supplies and service facilities within the harbour.

## 6.2 *Catches*

The total catch of SRL-15 II over one year was 28.71, valued at IRs.297,l53 ·- A detailed record is given in Table 2, while Figure 5 (on facing page) illustrates the monthly variations.

Nearly 90 per cent of the catch, both in terms of weight and value, came from the driftnets. If the drift longlines had been used to full capacity — that is, about twice as much — the total revenue would have gone up by 10 per cent and the longline share to about 18 per cent, assuming no change in the catch rates.

' US $1 = IRs 2t appx. (1990-91)



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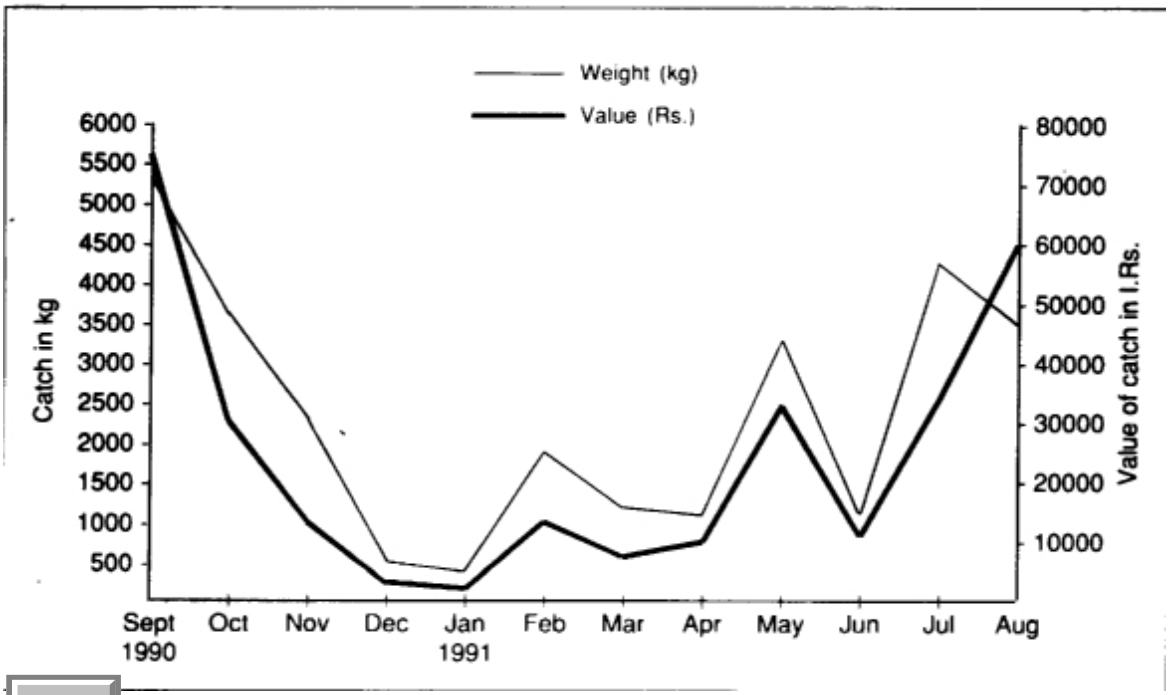
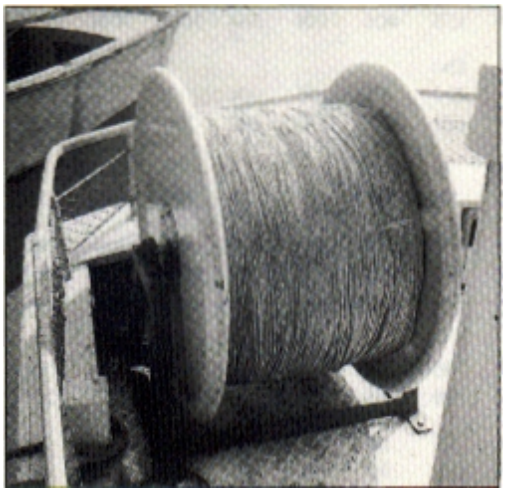
## Table 2. SRL-15 II : Monthly catches by gear and species

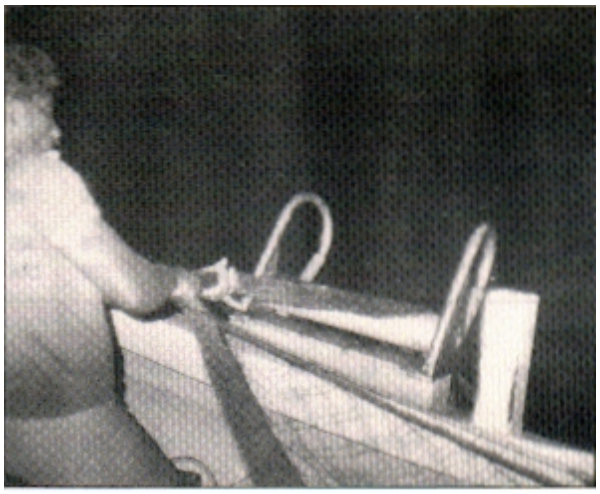
| Year/Month | | '90 Sept | Oct | Nov | Dec | '9/ Jan | Feb | Mar | Apr | Map | Jun | Jul | Aug | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **By gear** | | | | | | | | | | | | | | |
| Largemesh driftnent | wgt : kg | 5336 | 3569 | 2164 | 523 | 365 | 1667 | 982 | 699 | 748 | 941 | 3912 | 3282 | 25188 |
| | val Rs | 74903 | 29643 | 12364 | 3323 | 2289 | 11704 | 6576 | 4828 | 1532$ | 9984 | 31099 | 58738 | 260779 |
| Drift longline | wgt : kg | 2 | 55 | 117 | 35 | 21 | 205 | 12w-p81-7 | 418 | 395 | 150 | 70 | — | 2695 |
| | cal: Rs | 14 | 480 | 936 | 305 | 89 | 845 | 225 | 480! | 16740 | 800 | 2040 | — | 30375 |
| **Trolling line** | **wgt : kg** | **20** | **8** | 47 | 20 | 7 | 28 | 89 | 73 | 114 | 9 | 174 | 184 | 783 |
| | cal Rs | 300 | 27 | 213 | 80 | 88 | 24 | 576 | 679 | 585 | 45 | 1752 | 1530 | 5999 |
| Total | **wgl : kg** | **5358** | **3632** | 2328 | 578 | 403 | 1900 | 198 | 1190 | 3257 | 1100 | 4256 | 3466 | 28666 |
| | cal: Rs | 75217 | 30150 | 13513 | 3708 | 2566 | 3673 | 8377 | 0308 | 32653 | 11829 | 34891 | 60268 | 297153 |
| **By species** | | | | | | | | | | | | | | |
| Small Tuna | wgt : kg | 08 | 1689 | 119 | 59 | 5 | 379 | 85 | 71 | — | 146 | 2021 | 1021 | 5813 |
| | val : Rs | 540 | 5067 | 476 | 636 | 60 | 1516 | 340 | 355 | — | 730 | 10105 | 6126 | 25951 |
| Yellowfin | wgt : kg | — | — | 640 | 108 | 30 | 249 | 326 | 160 | 164 | 37 | 145 | — | 1859 |
| | val Rs | — | — | 3200 | 540 | ISO | 1245 | 1630 | 960 | 984 | 222 | 870 | — | 9801 |
| Skipjack | : kg | 68 | — | 702 | 55 | 7 | 78 | 145 | 325 | 685 | — | 496 | — | 2571 |
| | val : Rs | 340 | — | **2808** | 220 | 68 | 312 | 580 | 625 | 3425 | — | 2480 | — | 11858 |
| Shark | wgt kg | 225 | 91 | 366 | 92 | 78 | 1048 | 382 | 572 | 2329 | 833 | 973 | 79 | *1168* |
| | val : Rs | 575 | 717 | **3268** | 564 | 688 | 9432 | 3628 | 6744 | 27612 | 9996 | 0632 | 790 | 76646 |
| Bilifish | kg | 3 | 66 | 293 | 22 | 63 | 43 | 07 | — | 79 | 27 | 63 | 5 | 971 |
| | val Rs | 15 | 330 | 1738 | 154 | 1141 | 1144 | 856 | — | 632 | 216 | 504 | 45 | 6775 |
| Seeruish | wgt : kg | 4305 | 1313 | 6 | 3 | 15 | — | — | — | — | — | 320 | 2077 | 8039 |
| | sal: Rs | 64482 | 19695 | 08 | 60 | 300 | — | | — | — | — | 7680 | 49848 | 142173 |
| Others | **wgt kg** | 649 | 473 | 202 | 39 | 85 | 3 | 53 | 62 | — | 57 | 238 | 284 | 2245 |
| | vat Rs | 8265 | 4341 | 1915 | 534 | 159 | 24 | 1343 | 624 | — | 665 | 2620 | 3459 | 23949 |
| Tolal | wgt kg | 5358 | 3632 | 2328 | 578 | 403 | 900 | 1198 | 1190 | 3257 | 1100 | 4256 | 3466 | 28666 |
| | val : Rs | 75217 | 30150 | 13513 | 3708 | 2566 | 13673 | 8377 | 0308 | 32653 | 11829 | 34891 | 60268 | 297153 |

## Fig 5. SRL-15 II: Weight and value of monthly catches





*The drift longline drum aboard a SRL-15*



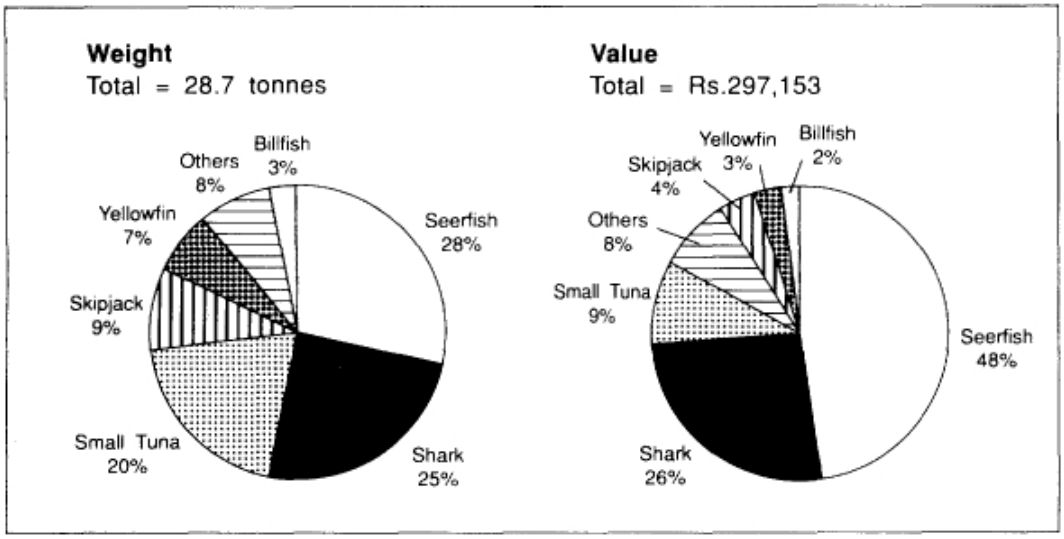
*Hauling in the net aboard a SRL-15*

*A part of the catch aboard a SRL-15*

*Loading the SRL-15 catch on a van to be taken to the market*

In terms of weight, Tuna species were the **most** dominant catch (36%) and comprised Small Tuna species (20%), Skipjack (9%) and Yellowfin (7%). Other important catches were Seerfish (281n0) and Shark (25%). The species composition in terms of eight and value is illustrated tn Figure 6.

**Fig 6. SRL-15 II: Species composition of catches by weight and value**




Seerfish was the most dominant species by value, contributing 48 per cent of the value of the total catch. The relatively high price makes the crew target it. Seerfish availability appears to be very high from August to November in an area 40-60 n miles off Trivandrum

As in the Sri Lanka small-scale offshore fishery, only one fishing operation per day (night) using driftnets, or a combination of driftnets and drift longlines, was carried out. Given the uncertainty in the record of fishing hours for each fishing gear and day, the fishing effort is defined in terms of fishing days to estimate the catch rate.

The monthly average catch rate (kg/day) for driftnets and drift loriglines were as tollows

| | *Sep* 90 | *Oct* | *Nov* | *Dec* | *Jan* 91 | *Feb* | *Mar* | Apr | *May* | *Jun* | *Jul* | *Aug* | Avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Drilinet kg d | 261 | 170 | 144 | 44 | 61 | 93 | 65 | 87 | 125 | 134 | 261 | 205 | 152 |
| Drili longline kg/ d | — | 14 | 11 | 18 | 11 | 68 | 16 | 84 | 279 | 75 | 24 | – | 55 |

20 pieces of driftnets (125 and 150 mm stretched mesh) were used for each fishing operation.

20 bundles (5 hooks) of drift longlines were used for each fishing operation.

The catch rate of driftnets was higher near the edge of the Wadge Bank, 40-60 n miles froni shore in sector areas 3-C-D-E-F, during May-November, while the drift longlines catch rate was higher in more offshore areas, 60-100 n miles from shore in sector areas 2B and 3C during April-June (Figure 4). However, it is too early to draw any conclusions about the seasonal availability of large pelagic species, considering the limited duration and geographical coverage of the trials.

## 6.3 *Performance of crew and boat*

The inexperience of the crew in small-scale multiday deep sea fishing resulted in loss of sea time and the limited range of the operation, particularly at the beginning of the trials. It would appear that at least one year is required for small-scale fishermen to adapt themselves to efficient multiday offshore fishing. This should be kept in mind when analyzing the commercial outcome of the trials.



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At least two fishermen leaders acquired sufficient skill in all aspects of the fishing to carry on with other fishermen, provided they are given direction and management support for shore-based services required for commercial fishing. A field officer of the Fisheries Department, who was throughout with the subproject. has been well trained in managing the operation of this type of boat and the project's activities.

Commercial fishing carried out with only one boat or even two boats, without any means of communication, resulted in loss of time searching for suitable fishing areas. This has affected the fishing time and overall catch. Offshore fishing by a fleet of small boats will result in better catch and earnings. The lack of radio equipment, to communicate with other boats and the shore, affected somewhat the confidence of the crew, and caused the fishing to be les.s effective.

The average catch per trip of SRL-15 II was 382 kg. Peak catches did not exceed 1.2 t per trip. Given the possibility of equipping the boat with an additional ice box in the aft of the fishing gear hold, there is adequate holding capacity to preserve fish in ice.

The Yanmar 2TDG 25 hp engine gave good service. No breakdown of it was experienced. The hand starter was useful, whenever the electric starter failed. This is a very important feature of the engine, from the point of view of safety of the boat and the crew. This engine has a direct fuel injection system, resulting in low fuel consumption. This contributed significantly to the low running cost despite the long sailing hours.

## 7. *ECONOMICS*

### 7.1 *Capital cost*

The total investment cost of SRL-15 11 as described in Sections 3 and 4 was Rs 370,000. The yearly cost of depreciation was estimated at Rs. 40.000. The main initial capital cost is the hull with all its fittings. The fishing gear, which requires replacement after every fourth year, becomes the single most expensive item in the long run. In addition to such regular replacement, experience has shown that additional expenditure on replacement of driftnets is required to offset losses caused by passing vessels. A relatively large working capital is provided to maintain liquidity for the various situations that could arise. The details are given in Table 3.

**Table 3. SRL-15 : Capital cost**

Schedule of in vestment cost — Project length in yearn 10

| *Item* | *initial cost* | *Average life* | *Annual depreciation* |
|---|---|---|---|
| Hull | 194297 | 16 | 12,144 |
| 2. Engine G Bx./S, Gear [2] | 88,000 | 8 | 1 |
| 3. Fishing Gear [3] | 68,438 | 4 | 17,110 |
| 4. Workino Capital [4] | 20,000 | | — |
| 5. **Total** [5] | **370,735** | | **40,254** |

Notes:

All price estimates base been adjusted with 10% yr. for inflation, so that all costs reflect 990 price lesels.

Engine costs are those of a Ruston 2YW Mark-4 water-cooled, electric start, 29 hp (@ 2000 rpm) engine, which would be the Indian engine comparable to the Yanmar engine in the Sri Lankan-built boat.

Fishine sear included a) ten panels of 125 mm mesh driftnet at Ri. 30,352, b) ten panels of 10 mm mesh drifinet at Rs. 31,710, c) twenty baskets of drift longline at Ri. 6210 and 1) fonr trolling lines at Rs. 166.

Working capital is roughls equal to three months' operating costs. includtng repairs or 25 per cent of driftnet cost.

iSine per cent of fishing gear will hose to he replaced annualls escept in those sears when all gear is replaced. This amount is equal to the salae of ten per cent of he driltnets, or one panel of each type This cost is not included here

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## 7.2 Operating costs

The recurring operating costs are estimated at Rs 196,000/year. They are dominated by the crew's remuneration. As is practice in the region, the four-man crew divides fifty per cent of the operation's catch-value after the running costs are subtracted. The boat owner retains the other fifty per cent to pay both the 'fixed' operating costs, such as repair, maintenance and insurance, as well as his capital costs. During the fishing trials, annual insurance costs were roughly 5 per cent of value. Repairs and maintenance costs were only incurred in the last seven months of the trial year. Thus, the average of these seven was calculated and multiplied by twelve to provide a realistic repair and maintenance cost for years 2-10 (Table 4).

**Table 4. SRL-15 II : Operating cost**

| Item | Initial Year | % of Total | Years 2-10 | % of Total |
|---|---|---|---|---|
| 1. Fuel | 37929 | 20 | 379229 | 19 |
| 2. lub/oil | 3455 | | 3455 | 2 |
| 3. Food | 15385 | 8 | 15385 | 8 |
| 4. Bait | 225 | 0 | 225 | 0 |
| 5. Ice | 7179 | 4 | 7179 | 4 |
| 6. Others | 3855 | 2 | 3855 | 2 |
| 7 C m | 91654 | 48 | 91654 | 47 |
| 8. Repair | 10744 | 6 | 18418 | 9 |
| 9. Insurance | 18000 | 10 | 18000 | 9 |
| 10. Total | 188416 | 100 | 196090 | 100 |

## 7.3 Revenue

The annual revenue is Rs. 297,000, which is an estimate based on the actual result of the commercial fishing trials. As previously noted, Seerfish was by far the most important species in the catch, significant by weight and highest by value. Seer commands roughly twice the price of other species, though Tuna, grouped into one category, would outweigh it by more than 2 t. Valuewise, however, the Tuna contributed only a third of what the Seer catch did. (See Table 5)

**Table 5. SRL-15 II : Schedule of revenues**

| Item | Annual Kg. | Ann. Revenue | Avg. Rs./Kg. | % Total Rev. |
|---|---|---|---|---|
| 1. Small Tuna | 5813 | 2595 1 | 4.46 | 9 |
| 2. Yellowfin | 1859 | 9801 | 5.27 | 3 |
| 3. Skipjack | 2571 | 11858 | 4.61 | 4 |
| 4. Shark | 7168 | 76646 | 10.69 | 26 |
| 5. Billfish | 971 | 6775 | 6.98 | 2 |
| 6. Seerfish | 8039 | 142173 | 17.68 | 48 |
| 7. Others | 2245 | 23949 | 10.67 | 8 |
| **8. Total** | **28666** | 297153 | 10.36' | 100 |

* Note : The average Rs./kg. of Rs.10.36 is a weighted average according to actual catch composition.

## 7.4 Financial analysis

The cash flow analysis of SRL-15 II is based on a ten-year projection, using the actual data from the first trial year. The result is a net present value (NPV), or present worth of Rs. 109,787, calculated at a 14 per cent discount rate. The internal rate of return (IRR) for the ten-year project would be 21 per cent.

If the investment cost of the project was to increase by 30 per cent, the IRR would dip to 13 per cent. A 50 per cent cost increase on the craft would bring the IRR down to 9 per cent, clearly not an acceptable investment.

If fuel costs, for example, were to increase by 50 per cent, the IRR would only be slightly reduced, to 18 per cent, due to the design of the crew remuneration system. Even a doubling of fuel costs would still allow the project to break even, retaining an IRR of 15 per cent. The point here is, the crew becomes a buffer for the owner and absorbs 50 per cent of the cost increase, as fuel is a shared running cost.

On the other hand, repair costs are borne strictly by the owner. A major breakdown or continued mechanical difficulties might double the repair costs. In such a case, the **IRR would** fall to 15 per cent, still an acceptable return.

Finally, revenue proves to be the most sensitive area concerning project viability. A mere 5 per cent decrease in revenue, such as 825 kg less of Seer, would bring the IRR down to 16 per cent. A 10 per cent drop in catch-value would make the project into a losing proposition with an IRR of 11 per cent. A 20 per cent loss of catch value, not an impossibility, would give a negative IRR.

### *7.5 Economic analysis*

The economic value of large pelagic fishing off India's coast to the Indian national economy, as carried out by SRL-l5 II, surely exceeds its financial value to the individual investor. The waters fished by the SRL-15 II were almost entirely untouched by Indian-based fishermen. Though some may contend that the craft's Seer-fishing is interactive, if not directly competitive with inshore Seer fisheries, the SRL-15 II has been unique as a small-scale Indian operation exploiting the outer portion of the Indian EEZ. While the operations have required scarce petroleum products., they have required far less than for trawler operations and have produced exportable Shark by-products.

Furthermore, the trials have generated economic benefits that have not shown tip in the financial analysis. Crew members have received unusually high wages, and consumers have received fish from the craft's ice box in better condition than they normally might have, at prices far below world market prices.

## 8. *CONCLUSIONS*

The inshore fishery resources of Tamil Nadu appear to he fully exploited. But there are clear indications of underexploited resources of large pelagic species in the offshore areas that are yet to he harvested by Indian fishermen.

A very advanced small-scale offshore fishery for large pelagic species has developed in Sri Lanka since the mid-Eighties, from which much can be learned for similar development in South India.

BURP started offshore fishing trials in July 1990 from Chinnamuttam in southern Tamil Nadu, employing two fishing boats (SRL-15s) acquired from Sri Lanka. The purpose of the trials was to demonstrate technical and economic feasibility of driftnetting and longlining for large pelagic species.

The performance and results of the fishing trials have been, on the whole, satisfactory. But they were not tip to full commercial standard because of the inexperience of the crew and the exploratory nature of fishing by one or two boats operating in isolation.

The financial viability of the off-shore operations has been demonstrated, generating an internal rate of return of 21 per cent and a Net Present Value (NPV) of Rs. 109,787 at a discount rate of 14 Per cent. This marginally profitable return, however, does not leave much incentive to offset the high risk involved in this or any other fishing operation. While relatively insensitive to increases in operating costs, the project is sensitive to plausible capital cost increases and extremely sensitive to decreased revenue A mere 5 per cent shortfall in catch-value almost reduced the project to a break-en en situation.

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