# Artisanal Deep-Sea Fishing in Kerala: Prospects and problems

**Titto D'Cruz S**

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## Abbreviations

| | |
|---|---|
| **CIFT** | Central Institute of Fishing Technology |
| **CPUE** | Catch Per Unit Effort |
| **DSF** | Deep-Sea Fishing |
| **DSFP** | Deep-Sea Fishing Policy |
| **DSGF** | Deep-Sea Going Fishermen |
| **FAO** | Food and Agricultural Organisation |
| **FSI** | Fisheries Survey of India |
| **GOI** | Government of India |
| **IAS** | Indian Administrative Service |
| **IBE** | In Board Engines |
| **ISF** | Inshore Fishing |
| **KSCFFD** | Kerala State Co-operative Federation for Fisheries Development Ltd (Matsyafed) |
| **MFPI** | Ministry of Food Processing Industry |
| **MPEDA** | Marine Products Export Development Authority |
| **MSY** | Maximum Sustainable Yield |
| **NGO** | Non Government Organization |
| **NFF** | National Fishworkers Forum |
| **OAL** | Over All Length |
| **OBM** | Out Board Motors |
| **SIFFS** | South Indian Federation for Fishermen Societies |

# Artisanal Deep-Sea Fishing in Kerala: Prospects and Problems

Titto D'Cruz S

## 1. Introduction

In the context of the emerging global scenario of opening up of markets and structural adjustment policies, the eco-system people like fisher folk who form the borderline communities are also getting exposed to the market forces. These communities are much less equipped to deal with market forces than other segments of society.

In India exploitation of deep-sea fishery resources has gained added importance with announcement of the Deep-Sea Fishing Policy (DSFP) by Government of India (1991). The policy aims at exploitation of 1.64 million tonnes of deep-sea fishery resources through technology-intensive joint ventures deploying foreign fishing vessels.

Following the promulgation of the DSFP, licences were issued to 129 foreign deep-sea vessels to exploit the widely scattered and unexploited deep-sea fishery resources in Indian seas. But, the experience in India and abroad reveals that market-oriented, centralised and capital-intensive fishing fleet over-exploit deep-sea resources wherever they operate, whether temperate or tropical seas. According to the FAO of the UN, "the global marine fish catch

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has stagnated around 85 million tonnes after 1989, led to a crisis, particularly, in the distant water fishing industry all over the world". Kurien (1995) observed that deployment to other less exploited fishing area is therefore the only solution, to continue in business.

Responding to protests and agitations by fish workers all over the country against the DSFP, Government of India (GOI) appointed a commission headed by Sri Murali to examine the issue. The commission recommended that issuing license to foreign vessels must be stopped and indigenous potential for exploiting deep-sea fishery resources should be assessed and promoted. Accordingly, the Government stopped issuing new licences and emphasised the need to search for indigenous means of harvesting the unexploited deep-sea resources of India.

However, the decision-makers and the academic community seem to be in the dark about the 2000 small-scale fish workers of the border fishing village of Kanyakumari (Tamil Nadu) and Trivandrum (Kerala) districts who have been engaged in migratory deep-sea fishing for the past two decades covering the entire coast of India from Okhasea in Gujarat to the Andaman Sea in the Bay of Bengal.

Kerala contributes a large share to national fish production. During the past decade, the fishing pressure in inshore waters has been steadily on the rise primarily due to the increase in fishing capacity of units in general and of artisanal ring-seine units, in particular. Diversification of exploitation to new resources is an inevitable consequence of rising fishing pressure.

It is in this context that a study to assess the performance and to understand the problems and prospects of the small-scale fish workers engaged in deep-sea fishing in the south west coast of India, assumes significance. The results of such an exercise may indicate sustainable and more people-centred alternatives to exploitation of deep-sea fishery resources.

India is the seventh largest fishing nation of the world with an Exclusive Economic Zone (EEZ) of 2.02 million sq. km. Sudarsan and others (1991) estimated a resource potential of 3.92 million tonnes from the Indian EEZ. Of this, the inshore water (0.50m), 10 percent in area of the EEZ, possesses an estimated exploitable potential of 58 percent (2.28 million tonnes). The rest, 1.64 million tonnes, are scattered over a very large area of (89 percent of EEZ) offshore waters (50-500m). [Table 1.1].

**Table 1.1 Fishing Area Available in Indian EEZ**

| Zone | Depth (in metre) | Area (million. sq. km.) | Distribution (%) |
|---|---|---|---|
| Inshore | 0 – 50 | 0.02 | 10.2 |
| Offshore | 50 – 500 | 1.81 | 89.8 |
| Total | 2.02 | 100.0 | |

Source: Sudarsan and others, (1991) FSI.

The level of exploitation in the inshore waters has already reacted the Maximum Sustainable Yield (MSY) level whereas only 31.46 percent of offshore waters are exploited. There is scope for further exploitation of 1.25 million tonnes of deep-sea resources. Resource availability, level of exploitation, and scope for further exploitation are shown in Table 1.2.

**Table 1.2 Fishery Resources in Indian EEZ**

| Zone | Resource Potential (million tonnes) | Level of Exploitation (%) | Availability (Million Tonnes) |
|---|---|---|---|
| Inshore | 2.28 | 96.8 | 0.07 |
| Offshore | 1.64 | 31.46 | 1.125 |
| Total | 3.92 | | |

Source: Sudarsan and others, (1991) FSI.

The 1.64 million tons of deep-sea resources comprise 45.25 percent pelagic stock, 39.8 percent demersal stock, and 15 percent of oceanic species (Sudarsan and others, 1991). The major fish groups are the threadfin breams, yellow fin tuna, pelagic sharks, cephalopods, carangids, and shrimps in the order of abundance. Of the offshore resources, 1.125 million tonnes is available for further exploitation. The new Deep Sea Fishing Policy (1991) seeks to facilitate the exploitation of these resources, but without considering the indigenous potential particularly that of the artisanal deep-sea-going fish workers and the likely adverse impact of welcoming foreign investment to exploit these resources.

**Deep-sea trawling in India**

The catch per unit vessel (CPUV) shows a declining trend since 1986, when the number of units increased from 75 in 1985 to 180 by the year 1991. The majority of the units were running at a loss (Table 1.3).

The performance of the deep-sea fishing fleet has been disappointing all through the period, particularly since 1987. Yet the Government of India has been attempting to promote deep-sea fishing through several measures of which the new deep-sea fisheries policy was the most controversial.

**Scope of the study**

The study is based on the experience of fishermen who inhabit the border fishing villages of Thiruvananthapuram and Kanyakumari districts. They fish at different ports such as Vizhinjam, Kollam, and Kochi in Kerala and at distant ports in other States in the country. Around 320 fishing units are engaged in deep-sea fishing over the entire West Coast of India. They have highly specialised and advanced of skills. They challenge the deep-sea on their small crafts to land relatively unexploited resources. The fishing trip is extended and spread over almost the entire coastline in the West Coast of the country. The risks involved are manifold. It has become possible for them to face the risks due to the incremental and innovative improvements that they have evolved and accumulated through trans-generational processes. A clear understanding of these processes is likely to generate better options in managing the multifarious issues of survival and sustainability of artisanal fishing units.

**Table 1.3 Annual Landings by Deep-Sea Trawlers**

| Year | Fleet Strength | Catch | Catch/trawler (Tonne) |
|---|---|---|---|
| 1981 | 59 | 1649 | 27.9 |
| 1982 | 68 | 1715 | 25.2 |
| 1983 | 68 | 1638 | 24.0 |
| 1984 | 68 | 2381 | 35.0 |
| 1985 | 75 | 1419 | 18.9 |
| 1986 | 85 | 1861 | 21.9 |
| 1987 | 100 | 1050 | 10.5 |
| 1988 | 131 | 1058 | 8.1 |
| 1989 | 157 | *757 | 4.8 |
| 1990 | 168 | *437 | 2.6 |
| 1991 | 180 | 1565 | 8.7 |

Source: Giudeicelli, (1992), FAO; * Fishing operations were hindered by strikes in 1989-‘90

### Definitions

In this study, artisanal deep-sea fishing is defined as exploitation fishery resources of the deep sea (beyond the depth range of 0-50 metres) by means of passive methods of fishing and appropriate fishing gear in combination with mechanised boats of overall length (OAL) below 43 feet. Mechanical energy is used only to reach the fishing ground and not for shooting and hauling of gear, which is achieved by manual effort.

Appropriate technology implies the body of techniques by which the common people would be able to have access to and control and freedom of managing resources in a decentralised mode of production for improving the quality of their life, rather than for accumulation of wealth to a few through centralised and high technology-intensive mode of production.

Sustainable fishing is defined as harvesting of fishery resources in such a way that the rate of harvest should not exceed the rate of biological renewal.

**Conceptual framework**

Conventional growth-centred development puts economic growth ahead of people and the ecology on which their well-being depends (Korten, 1992). A broader perspective is essential to accommodate an alternative vision for the well-being of the people and the ecosystem. The conceptual framework for the study is formulated from such a perspective, is shown in the following chart.

**EXPLOITABLE DEEP-SEA RESOURCES**
(1.125 million tonnes)

3

Alternatives For Harvest

| Parameters 3 | Licences to foreign Vessels 3 Features | Promotion of Indigenous DSF Trawlers 3 Features | Empowerment of Small scale artisanal DSF 3 Features |
|---|---|---|---|
| Investment | Capital-intensive | capital-intensive | small scale |
| Technology | High tech | medium tech | appropriate tech |
| Mode of fishing | Centralized | centralized | decentralized |
| Target fish resource | all fishes | targeted for shrimp | selective fishing |
| Infrastructure | require harbour facilities | require harbours | harbours not essential |
| Motivation | access to new resources | access to subsidy and loan | survival and access to new resources |
| Economic implication | accumulation of wealth | running on loss | livelihood |
| Employment potential | no employment generation | employment for trained personnel | employment for more fishermen |
| Sate support | incentives of GOI | incentives of GOI | no support from Government |

Development is envisioned as (Korten, 1992) "a process by which the members of a society increase their potential and institutional capacities to mobilise and manage resources for sustainable improvements in their quality of life consistent with their own aspiration". The process should lead to the inclusive and sustainable well-being of individual, thereby – families, local communities, States, Nations – and ultimately of the global community". It is therefore appropriate to support the decentralised, participatory, and sustainable developmental process initiated by the artisanal fish workers to harvest the deep-sea resources.

**Problem**

The study is in the nature of an exploratory exercise. No literature, which directly deals with aspects of deep-sea-going artisanal fisher folk exists. As a preliminary step to formulating the problem, the available literature on the subject were scanned, discussions were conducted with experts, and a few deep-sea-going fishermen, merchants dealing with the deep-sea produce and other knowledgeable persons. The major questions that required investigation were found to be the following.

(1) Is the socio-economic status of the deep-sea-going artisanal fish workers better than that of persons fishing in coastal waters?

(2) Is artisanal small-scale deep-sea fishing economical and ecologically sustainable for exploiting deep-sea resources?

(3) To what extent would control over the forward and backward linkages and diversification within the system benefit deep-sea-going artisanal fishermen?

**Objectives**

The broad objective of the study is to assess the problems and prospects of artisanal deep-sea-going fish workers.

The following are the specific objectives:

1. Assessment of the socio-economic conditions of the artisanal deep-sea-going fish workers in small scale fishing units in comparison with those fishermen fishing in inshore waters;
2. Analysis of the present status of exploitation of fishing stock in order to suggest necessary diversification for sustainable harvesting of unexploited stocks of deep-sea resources by small-scale fishing;
3. Study of incremental changes in technology and social organisations and their impact on the work system, particularly on issues caused by shift of fishing ground from native place to distant ports and from territorial waters to national and international waters;
4. Suggestion of policy measures on the basis of findings of the study.

## Location

The major locations of the study were Vizhinjam and Kollam – where deep-sea-fishing units are concentrated. Data were collected also from Kochi. Information about inshore fishing units was collected from the Pozhiyoor-Thoothoor belt for making comparisons with deep-sea-fishing.

## Methodology

### *Sources and types of data*

Both primary and secondary sources of data have been used in this study. Secondary sources consisted of government publications, committee reports, journal articles, and other literature. For collection of primary data, field surveys, semi-structured interviews, and group discussions were employed.

Detailed information relating to households of DSFUs and ISFUs was collected through pre-tested household interview schedules. Information on fishing trips of DSFUs was also collected through the use of interview-schedules. Interviews were held with fishing units immediately after return from fishing, both from DSFUs and ISFUs. Separate schedules were used for the different categories to accommodate for differences in fishing grounds and fishing techniques.

Investigation on the marketing of shark, the species landed, the prices received, the modes of marketing of the produce, and the role of middlemen and merchants was done through careful observation.

Case studies of a few gillnet fishermen who had met with accidents while at sea were also conducted. Life histories of a small number of selected fishermen were prepared to understand incremental changes in fishing technology and the work culture over the past few decades. Semi-structured interview with elderly fishermen with long experience and great skills in fishing have been used for the purpose.

Investigations for the study commenced with a population survey of artisanal deep-sea-fishing units. Almost all the available boats as well as the households concerned were contacted. The database on the target group was prepared by the census method with the help of an enumerator. Information on the development of shark-fishing was gathered through interview with knowledgeable and senior fishermen. The database on the population contained the following information.

1) Name of the boat;
2) Name and address of the owner;
3) Crew size;
4) Name and address of the crew;

5) Ports in which fishing were done during the previous year; and
6) Months spent in each port during the past one year.

Interviews using a checklist were also conducted on a selective basis with experienced fishermen who were working in different fishing ports of India to arrive at the macro-picture on various aspects.

Migratory deep-sea fishing units of about 320 numbers doing week-long fishing based at Kollam, Vizhinjam, and seasonal migratory fishing from major ports of India were the target population of the study (Table 1.4).

**Table 1.4 Deep-sea / Inshore Fishing Units of the Study Area**

| Place | Fishing ground | Craft | Propulsion | Gear | Pop. size |
|---|---|---|---|---|---|
| **Deep Sea Fishing Units (DSFUs)** | | | | | |
| Thoothoor Belt | 1. Deep sea (Migratory) | Mechanised boat (OAL 30-43 feet) | Diesel engine (55-75HP) | Long line gillnets and hand lines | * 320 |
| **Inshore Fishing Units (ISFUs)** | | | | | |
| Thoothoor Belt | 2. Inshore (Non migratory) | Motorised boat (OAL 26-32 feet) | OBM (9.9-25 HP) | Gill nets | ** 110 |

Sources: *DSFUs by field survey and ** ISFUs form Census of SIFFS, 1991 (pp.117)

In all 110 units of non-migratory inshore fishing gillnet units in the Pozhiyoor-Thothoor belt engaged in daily fishing constituted the population identified for comparative assessment. The two categories are inhabitants of the same locality but doing fishing at different depths, inshore and deep-sea waters, respectively.

**Survey of households**

Household survey was conducted by selecting representative samples. Simple random sampling was adopted to obtain samples from the population database that was already prepared. Relevant information on socio-economic aspects was obtained by household survey of the selected samples. A sample size of 100 households was selected from about 2000 deep-sea-going fishermen residing in about 1600 households. From the sample size of 100, 50 were selected from among boat-owners belonging to about 320 households and the other half from the fishing crew. Considering the important role of trade in the fishing sector and the presence of about 20 merchants in the study area, 10 households – selected in addition – were subjected to qualitative investigation on socio-economic aspects. This facilitated the comparison of socio-economic parameters between the three segments of the population (Table 1.5).

**Table 1.5 (a) DSFUs Sample Frame of Households**

| Village | | Owner | | Crew | |
|---|---|---|---|---|---|
| | | Population | Sample | Population | Sample |
| V1 | Puthenthura | 59 | 9 | 236 | 9 |
| V2 | Chinnathura | 91 | 15 | 388 | 15 |
| V3 | Thoothoor | 86 | 13 | 344 | 13 |
| V4 | Poothura | 16 | 3 | 64 | 3 |
| V5 | Vallavila | 62 | 10 | 248 | 10 |
| | **Total** | **320** | **50** | **1280** | **50** |

**Table 1.5 (b) ISFUs: Sample Frame of Households**

| Village | | Owner | | Crew | |
|---|---|---|---|---|---|
| | | Population | Sample | Population | Sample |
| V1 | Puthenthura | 0 | 0 | 0 | 0 |
| V2 | Chinnathura | 0 | 0 | 0 | 0 |
| V3 | Thoothoor | 3 | 2 | 9 | 2 |
| V4 | Poothura | 30 | 13 | 90 | 13 |
| V5 | Vallavila | 77 | 35 | 231 | 35 |
| | **Total** | **110** | **50** | **330** | **50** |

In order to compare socio-economic parameters of artisanal deep-sea-going fishers with those of in inshore waters, 100 households, out of the population of 440 households were selected by simple random sampling. As in the case of DSFUs, 50 households each were selected from the categories of owners of boats and the crew.

**Information on fishing trips**

Since the fishing units in the two categories engaged in DSF and ISF have distinct characteristics and assessment of their unit level performance was essential to reach meaningful conclusions on questions of appropriate levels of technology, resource potential, and sustainability. The DSFUs are engaged in seasonal fishing for catching a variety of fish using different combinations of fishing methods – mostly gill netting during monsoon, combination fishing with gillnetting and long-lining during post monsoon, and long-lining and hand-lining during pre-monsoon seasons. Therefore, monitoring of fishing trips for an entire year was found necessary.

During the census of DSFUs, the migration pattern and distribution of boats at different fishing ports were investigated. The distribution pattern of DSFUs during the year 1998 reveals that the fishing boats were operated from 25 major and minor ports / landing centres starting from Chinnamuttom in Kanyakumari to Okha in Gujarat and that each of the 320 boats migrate from one to seven ports in a year. The month-wise and port-wise migration pattern of fishing boats over the 25 ports/landing centres during 1998 revealed that a majority of fishing trips (92.6 percent) took place from nine major ports. Of the total trips Cochin accounted for the maximum number of boats (36.04 percent) followed by Thoothoor, Vizhinjam (26.77 percent) [during monsoon, the boats anchored at Vizhinjam and during non-monsoon season at Thoothoor]. Thus both Cochin and the Vizhinjam-Thoothor belt accommodated more than half (62.81 percent) of DSFUs throughout the period during the year 1998.

As more than half of the DSFUs (62.81 percent) are based in Cochin and Thoothoor-Vizhinjam, these two centres were selected as the major source for the sample survey of fishing trips at the beginning. More attention was given to Cochin for collecting data during monsoon (July-August). But later, just after the monsoon, more boats moved to Kollam. Finally data were collected from Kollam and Thoothoor, and Vizhinjam because more boats were based at these two ports, though many of them left and other boats arrived in these two ports during the remaining period of data collection (September-May).

Based on the information collected on the month-wise, port-wise distribution of fishing trips during the previous year, one enumerator each was engaged at Cochin and Thoothoor, and another at Kollam. The DSFUs are engaged in week-long fishing trips beginning from Sundays or Mondays. Landing takes place mostly towards the end of the week. It could be on Thursdays, Friday or Saturdays depending on the catch. Of the total number of boats gone for fishing about 50 percent returned on Thursday, 30 percent on Friday, and 20 percent on Saturday. As the fishermen are Christian, Sunday is treated as holiday. Out of the three landing days two were selected by simple random sampling method.

The enumerators were asked to collect weekly data on the total number of units that went for fishing from and returned to a particular port.

**Species identification**

Long-line, a variety of hand-line, and gill-nets are the gear employed during the different seasons for catching different varieties of this fish. During the interviews, care was taken to collect the local names by which the different fish species are known with the major purpose of identifying sharks at the species level and other fishes at the species or the genus level by using FAO species identification sheets (Fisher and Bianchi, 1984). The data on species caught have been compared with FSI deep-sea resource data to reinforce the fact that artisanal DSFU normally fish in the deep-sea.

**The discussion group**

Personal interviews were conducted with knowledgeable persons for cross-checking the information collected through field survey and to draw additional information, Semi-structured interviews and group discussions at the office of deep-sea going shark-catching Fishermen's Association, were also held. A workshop was conducted at PWD rest house, Thycaudu in which planners, researchers, administrators, social activists, fishermen's trade union leaders, and representatives of the fishermen participated and shared the findings of the study.

**Limitation**

The present study has the following limitations: The sample survey of the landing centres of DSFUs were limited to Kollam and the Vizhinjam-Thoothoor areas. Therefore, all the generalisations on bio-economic aspects, particularly species composition, made in the report, need not be valid for the whole population of DSFUs in the country.

Section 2 discusses the interventions of three different fishing groups for development of Indian deep-sea fishing viz. Indian-owned DSF trawlers, foreign DSF fleet, and artisanal DSF groups. This Section also describes the incremental changes in technology and social organisations brought about by artisanal deep-sea-going fishing groups. The techno-economic status of the artisanal-fishing group is compared with that of the ISF units, in Section 3. In Section 4, the socio-economic indicators of artisanal DSF fish workers operating small-scale fishing unit are compared with those of their counterparts fishing in inshore waters. The issues arising from the shift of fishing ground from native places to distant ports and from territorial waters to national and international waters are also discussed in this Section. In Section 5 the major conclusions findings and suggestions for policy interventions are reported.

## 2. Evolution and Growth of Deep-sea Fishing in India

The Government of India has consistently attempted since the 1950s for the development of deep-sea fishing in the country. Import of trawlers for exploitation of deep-sea resources by private fishing companies and State Government Corporations was permitted and assistance in various forms on attractive terms was extended to them. Chartering of vessels, formation of the Shipping Development Fund Committee (SDFC), which provided large number of soft loans, setting up of Foreign Investment Promotion Board to take up foreign investment in various activities including deep-sea fishing and single-window clearance of requests for permission for investments were some of the other types of major interventions. Formulation and implementation of the new deep-sea fishing policy in 1991, which envisaged by the Government during the past five decades for development of deep-sea fishing in India. This Section attempts an evaluation of the various efforts imitated by the GOI and their results as well as of the processes initiated by unorganised fishermen on their own with emphasis on the unique features and the incremental change process in fishing practices of the artisanal deep-sea fishing groups.

The First Five Year Plan (1951-'56) "sought to encourage the introduction of mothership operations and chartering of fishing grounds for deep-sea fishing operations" (Anon, 1993). The second Five-Year Plan envisaged the construction of fishing harbours and exploratory fishing operations. In order to exploit the deep-sea resources, shrimp trawlers were imported from Japan and Mexico during the third and the fourth Five-year plans (1961-'74). These vessels were handed over to Private Fishing Companies and *[*] Government Corporations and they operated initially from the West Coast. On depletion of the shrimp resources in that region the operations shifted to the East Coast with the identification of new shrimp fishing by the early 1970s. The vessels were based at Vishakapatnam in Andhra Pradesh operating mostly off the coast of Andhra Pradesh, Orissa, and West Bengal.

Shipping Development Fund Committee (SDFC) extended soft loans to deep-sea trawlers of OAL 23-m, fitted with 450 HP IBM, a policy which triggered a steep increase in the number of trawlers from 59 in 1981 to 180 in 1991. The FAO consultant Giudeicelli (1992) stated thus: "the year-wise shrimp production of these trawlers has been decreasing drastically and stagnated around 1000 to 1500 tonnes". Of the deep-sea vessels owned by 96 enterprises, only about six of them proved financially sound. About 40 vessels were in non-operational conditions and a majority of them remained under conditions of poor maintenance due mainly to poor returns.

The Technical Committee on The Deep-Sea Fishing Industry in India (1993) reported thus: "SDFC had sanctioned loans amounting to Rs 132 Cr to 85 companies and only 4 to 5 companies responded to the repayment of loans. The total arrears was Rs 7286.98 lakh, which include principal outstanding of Rs 5977.84 lakh, over dues interest Rs 1673.29

[*] The three trawlers handed over to Matsyafed in 1984 by the Kerala Fisheries Corporation under this Scheme were dismantled due to incremental losses incurred over a course of years.

lakh, penal interest Rs 318.73 lakh, and other charges of Rs 174.54 lakh". The outcome of 'planned development' of deep-sea fishing in India has been the following:

1. Over-fishing and signs of depletion of shrimp resources;
2. Idling of a large number of deep-sea trawlers as a result of low catch and uneconomic returns; and
3. Heavy financial loss to the public exchequer due to non-repayment of loans by deep-sea-fishing companies.

The study conducted by FAO suggested that if the existing deep-sea vessels could diversify into exploitation of resources other than shrimp from the existing grounds they could fetch better returns. Accordingly Marine Product Export Development Authority (MPEDA) attempted to revitalise the existing deep-sea trawlers by incorporating diversified fishing methods like long-lining and gill-netting. Even then the domestic companies owning deep-sea trawlers were not able to survive. Around 40 trawlers continue deep-sea fishing. They may be able to survive at this level if more units are not lured into this line of fishing.

**Chartered foreign vessels**

During 1977-'78, some companies were allowed to charter foreign vessels from Thailand in the guise of 'transfer of technology' for development of deep-sea fishing. This was followed by the announcement of three different charter policies in 1981; Indian citizens were permitted to charter foreign vessels. The characters were required to acquire the same number of vessels indigenously as they had operated under charter though this stipulation could not be achieved. As against the required number of 272 vessels to be acquired as fulfilment of charter obligations, the total number of valid charter permits prevailing till 1995 was only for 40 vessels (MFPI, 1995).

**Foreign deep-sea fishing vessels**

The new deep-sea-fishing policy was announced in March 1991, particularly in the context of collapse in the Indian deep-sea-fishing industry. It envisaged introduction of deep-sea-fishing vessels under three schemes – joint ventures with equity participation by foreign companies, leasing and test fishing. Accordingly, the ministry of food Processing issued 31 permissions on 17 May 1995 for operation of 180 fishing vessels in the Indian waters. The Government offered several liberal measures such as subsidies, concessions, and incentives, to the license holders of deep-sea fishing vessels. Some of these benefits are mentioned below:

1. Supply of diesel (HSD) at international prices;
2. No customs duty charged on imported fishing vessels;
3. Fifty-one percent foreign equity generally allowed; exceptions also considered;
4. High sea transfer of catch and mid-sea bunkering permitted;
5. Services of foreign crew may be availed.
6. Third party export permitted;

7. Payment of royalty / commission is allowed;
8. Cent percent customs duty exemption for imported capital goods, spares, raw materials, and consumables.

This policy made it possible for the foreign vessels to avail the diesel at the rate of Rs 2 per litre whereas domestic fishermen had to pay Rs 7.62. The price was Rs 11.75 per litre during the study period. Permission for high sea transfer of catch enables foreign vessels to trade from high seas on which the Government of India has no control in terms of amount of fish and value, thus causing great loss to the country. The basic constitutional right for knowing the status of exploitation of common resources is denied by the enactment of DSFP of 1991. The provision to avail services of foreign crew has created the situation in which almost all the personnel in these joint ventures could be foreigners. A glaring omission in the policy is that nothing is mentioned about the role or contribution of existing fishermen and other segments in the fisheries sector for the development of deep-sea-fishing industry of India. "A wider look at joint ventures on world scale indicates that, it sometimes creates some lucrative combinations for financiers and merchants; they often fail to create independent and genuine national fisheries enterprises" (FAO, 1992).

The opinion from different quarters, particularly of those who strongly oppose the DSFP of Government of India 1991, is taken from a view-point that fishermen working either with mechanised or with traditional fishing units are capable of exploiting resources in the deep sea (EEZ). With modifications such as diversification of fishing by introducing necessary equipment and obtaining new gears, they would be able to catch a large variety of fishes other than shrimp.

Deep-sea Fishing operations in the country at present may be grouped under three categories: the Indian-owned deep-sea trawlers including Chartered Vessels with the valid permits, Joint Venture vessels that come under the purview of DSFP of 1991 and the Artisanal deep-sea-going units. The fleet strength of each category is given in Table 2.1.

**Table 2.1 Deep-sea Fishing Vessels Operating in Indian Waters**

| Group | Category | Fleet Strength |
|---|---|---|
| I | Indian owned deep-sea vessels | @ 180 |
| II | Charted Vessel with valid permits<br>Joint Venture vessel (under DSP) | $ 40<br># 180 |
| III | Artisanal Deep-sea fishing boats | * 320 |

Sources: $ and # Ministry of Food Processing Industry (1998)
@ Giudeicelli (1992) * Field Survey (1998)

According to the Ministry of Food Processing Industry (MFPI), all the 400 deep-sea fishing vessels, which have valid permits to operate in Indian waters, are not operating due to a variety of reasons. Of the 180 Indian-owned deep-sea trawlers only around 40 are in operation. Of the 40 chartered vessels, only six are operating. In the case of 180 Joint Venture Vessels, only 29 are operating (MFPI, 1995). According to the National Fish Workers Forum (1995) "those vessels that are not operating now, can come at any time and start their operations as long as they have valid permits". On the other hand, all the 320 small-scale deep-sea going vessels owned and run by artisanal fishing groups over the past 20 years were found to be operating all the year round during the time of this study. On the average each boat made 35 weekly fishing trips in the year 1998-'99.

**Development of artisanal deep-sea fishing**

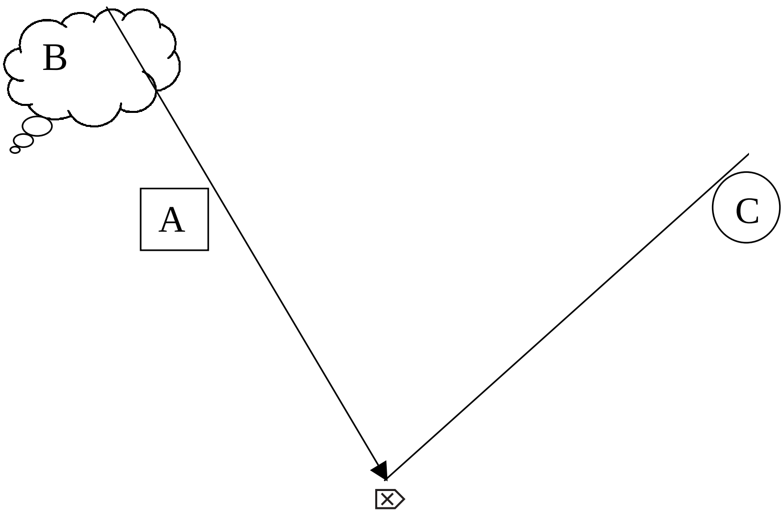
The lower south-west coast of India has unique ecological features such as the long stretch of sandy bed with rocky outgrowth, steep sloping continental shelf (40 to 54 km in the belt as against 69 km further north), and the intensively surf ridden sea especially during the monsoon (Achari TRT, 1987). Catamaran with sail, landing a wide variety of colourful reef fishes caught with hook and line, is a unique fishing method of this region (D' Cruz T, 1995). An investigation was conducted with the help of a group of senior fishermen selected from the population of this study to gather information on the development of shark fishing, the incremental changes in their fishing practices are discussed in this section.

Fishermen belonging to the fishing villages of Kadiyapattanam, Eneyam, and Thoothoor in Kanyakumari district of Tamil Nadu have been masters in hook-and-line fishing from time immemorial (Fernandex J, 1994). The Kadiyapattanam and Eneyam fishermen continued to build on their expertise to innovate and develop artificial baits from time to time to improve the efficiency of hook-and-line fishing. The fishermen of Thoothoor have been masters in shark fishing with hook-and-line and bottom-set gill-nets on catamaran with sail. They have been improvising on the development of fishing gears for catching sharks, a species which enjoyed a good local market. As these fishermen migrate towards Kerala for fishing some of them have settled in the fishing villages of Thiruvananthapuram and Kollam after marrying girls from the localities concerned. They continued with their highly specialised fishing techniques of hook-and-line with artificial baits.

Shark fishing with hand-line and bottom-set gill-nets was also prevalent in some fishing villages such as Poonthura and Puthiathura in Thiruvananthapuram district. Hand-line with large-sized locally made hooks baited with tuna meat was the simple gear used by these fishermen. Bottom-set gill-net known locally as thathu vala, which has very big mesh size (250 mm) made with thick twine was also in use. This unique practice involved setting up shark gill-nets at the sea bottom and leaving them there for a couple of days. Thereafter they would locate the net at the open sea by a very special traditional method of position-fixing at sea. Visual triangulation technique is the method, which is more or less similar to that of navigational methods adopted by commercial ships.

Position-fixing at sea is essential to locate the high-yielding fishing grounds such as natural reefs, cuttlefish-fish grounds, shipwrecks and so on. It is essential to locate the bottom-set gill-nets left at sea also. Fishermen usually ignore lighthouse for position-fixing at open sea; instead they use landmarks like peak of mountains, towers of churches, and other elevated marks for the purpose. By staying on the craft and looking at the land they locate a number landmarks of which any two, which are in transit (same line) are selected as one side of the triangle as shown Fig. 2.1. Similarly, two other landmarks in line would be selected to get the other side of the triangle. The two sides of the triangle would meet at a single point, which is the position of the craft, and underneath the water column would be the reef or high-yielding fishing ground, or the net left at the sea-bed they would be searching for. The fishermen term this technique as kaniyam or kanicham which means position.

**Fig. 2.1 Visual Triangulation Technique for Position-Fixing**




The senior fishermen in a fishing unit form a geographical map in mind and keep the mental map as a secret. Continuous interaction with the sea enables them to set the net safely on high-yielding fishing grounds using this mental map. This traditional in-transit visual triangulation technique has certain limitations too. It could be used only within the visibility range of the naked eye, that is, within the distance at which fishermen can see the landmarks. Similarly night hours and bad weather render it difficult to resort to this technique. Commercial ships used to overcome the limitation by referring to the lighthouses, specific frequency and time intervals of the beam. Experienced fishermen overcome the limitation with the aid of celestial bodies – positions of sun, moon, and stars. Electronic equipment such as Global Positioning Systems are now in use by a few DSF fishermen who have imported them through their relatives working in the Middle-east. But even today, elderly fishermen do not use wrist watches but rely solely on the position of the sun and length of shadows during the day and position of stars during night, for position-fixing. Almost all the senior fishermen rely on the position of stars to fix the time for setting forth for fishing during night.  Most of the senior fishermen had begun their career with hook-and-line fishing in catamaran. Gill-netting had been the other fishing method in which a larger group had been engaged. Long-lining, shore-seining, shark-lining with single hook and crab-fishing were the fishing methods by which a few groups had earned their living prior to coming to DSF (Table 2.2).

**Table 2.2 Fishing methods in use prior to rise of shark-fishing (in percentage)**

| Category | Fishing method | | | | | | |
|---|---|---|---|---|---|---|---|
| | H&L on catamaran | Gill netting | Long lining | Shore seining | Shark lining with single hook | Crab fishing | Total |
| DSF Owner | 32 | 12 | 2 | 0 | 2 | 2 | 50 |
| DSF Crew | 26 | 18 | 2 | 4 | 0 | 0 | 50 |
| Total | 58 | 30 | 4 | 4 | 2 | 2 | 100 |

During the mid-Seventies, fishermen with long experience of fishing in central and north Kerala switched over to mechanised gill-net boats with an overall length (OAL) of 32 feet fitted with in-board engine (IBE) of 50 to 60 HP. Mechanised gill-net boats enabled fishermen to widen their reach to greater depths for operation of long-lines as well as gill-nets. Later, high prices that shark and shark products enthused them to reduce fishing with long-line. They continued with shark hunting till late 1980's occasionally, using hand-line to make use of opportunities which opened up during the fishing season.

The development process of artisanal DSF also provided opportunity for the emergence of some degree of division of labour among fishermen. A considerable section among the DSF fishers became owners of the means of production. Similarly, a minority emerged as merchants to sell the marine produce of this migratory group. A major chunk of them continued as the crew. Among the three different categories, the owners and the crews (8 percent each) started shark fishing during the mid-Seventies. A majority of fishermen (60 percent) started shark-fishing during the mid 1980's and the 1990's (Table 2.3).

**Table 2.3 Year of entry into shark fishing (in percentage)**

| Category | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | < 76 | 76-80 | 81-85 | 86-90 | 91-95 | 96-98 | Total |
| DSF Owner | 8 | 4 | 6 | 18 | 10 | 4 | 50 |
| DSF Crew | 8 | 2 | 6 | 16 | 16 | 2 | 50 |
| Total | 16 | 6 | 12 | 34 | 26 | 6 | 100 |

**Evolution of artisanal deep-sea-fishing**

Information on incremental changes in fishing practices over the four decades since 1960 is given in Tables 2.4a, 2.4b, 2.4c, and 2.4d. Table 2.3a covers incremental changes during the decade 1961-'70. The owners as well as the crew of the present DSFUs had been working mostly on catamaran with an entirely different combination of fishing gears. About three-fifths worked with hook and line and gill-net. Nearly 10 percent did shark-fishing using hand-line on catamaran (Table 2.4a).

**Table 2.4a Evolution of craft and gear for shark fishing (1961-'70) (in percentage)**

| | **Craft & gear type** | | | | |
|---|---|---|---|---|---|
| | Cat. + Sail + Hook & line | Cat. + Gill-net | Cat. + Shark line | Others | Total |
| DSF Owner | 19 | 19 | 8 | 25 | 71 |
| DSF Crew | 11 | 11 | 2 | 5 | 29 |
| Total | 30 | 30 | 10 | 30 | 100 |

Hook-and-line fishing on catamaran with sail is a fishing practice unique to this belt. Catamaran is a very special craft made with four logs of softwood. Its stability over the waters is low and it is prone to capsize. Raft-type catamarans with six logs are operated in the coast east of Kanyakumari where surf is more and the boat-type catamarans with four logs operated in the lower West Coast of India are unsuitable. Propulsion of catamaran by using sail requires very special skills. The crew of two to three persons who operate a catamaran should have the minimum skill of balancing the craft while sailing with the aid of sail. The crew need to respond to every event causing imbalance to the craft by high velocity winds and surf, particularly during bad weather and turbulent conditions. But catamarans have the advantage that they would remain afloat even after capsize and are easily set right to resume sailing. The confidence level of fishermen to use them during adverse weather conditions is quite high. It is considered that learning on catamarans would impart a high degree of skill to fishermen and enable to brave any hazard at sea. Fishermen on catamarans used to travel to in depth waters of 35 to 45 fathom during the 1960s.

Fishermen operating catamaran used a variety of hook-and-lines. Hand-line is intended for catching a variety of fish available at different niches of water columns, including pelagic medium-size fishes like tuna and seer, small-size column fishes of carangid species like scads and a wide variety of bottom-dwelling medium-size reef fishes, comprising reef cod and thread-fin bream. A considerable segment of fishermen used to fish for shark on catamaran by using hand-line. It involved high risk since the gear consists of a single large hook, baited mostly with tuna meat. Whenever a shark got entangled, fishermen had to manage it directly, by staying on an unstable and easy-to-capsize catamaran. If the shark has great energy fishermen release the reserve line and move along with shark till it gets exhausted. Once they realise that fish is exhausted, the line is hauled gently to avoid breakage of line. When it draws close to the catamaran, fishermen ensure that the fish is dead before hauling it to the craft. A big-size barbless hook was used for the purpose. Quite often, the line may tear off if the fish is too big and energetic. Fishermen avoid the risk of catching big-size shark by selecting a line of reasonable thickness allowing the bigger and the more energetic ones to break the line and escape.

The changes that came about during the decade 1971-'80 indicate that a considerable portion of the fishermen working on catamarans (28 percent) during the earlier decade had shifted to mechanised boats. Mechanised boats for operation of gill-nets were observed in many villages during this period. This group also followed the common trend of acquiring mechanised boats for gill-netting. Out of the total crafts used by this group, 48 percent were mechanised boats and 32 percent boats operated with gill-nets. Migratory fishing with mechanised gill-nets became prevalent. Subsequently, considering the advantages of mechanised boats for long-stay fishing in deep waters, a significant proportion (16 percent) moved to shark long-lining with gill-net boats. The boats used were smaller with an average OAL of 18-feet (Table 2.4b).

**Table 2.4b Evolution of craft and gear for shark-fishing (1971-'80) (in percentage)**

| | | Craft and gear type | | | | |
|---|---|---|---|---|---|---|
| | Cat. + Sail + Hook and line | Cat. + Gillnet | Mechanised 18 footer + gillnet | Mechanised 18 footer + shark line | Others | Total |
| DSF Owner | 14 | 8 | 19 | 8 | 10 | 59 |
| DSF Crew | 6 | 4 | 13 | 8 | 10 | 41 |
| Total | 20 | 12 | 32 | 16 | 20 | 100 |

During the decade of the Eighties, more of catamaran fishermen (about 15 percent) changed their crafts and started using mechanised boats. As more and more fishermen moved to mechanised boats, their proportion to total crafts increased from 48 percent to 70 percent. Among the owners of mechanised boats, 35 percent preferred comparatively larger size boats (32-feet). Medium-size fishing crafts like dug-out canoes fitted with OBM were used by about 7 percent. The shifts in fishing practices during the decade of the 1980's are given in Table 2.4c.

**Table 2.4c Evolution of craft and gear for shark-Fishing (1981-'90) (in percentage)**

| | Craft and gear type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Cat + sail + Hook and line | Cat+ Gill net | Dug out+ OBM | Mechanised 18 footer gillnet | Mechanised 18 footer shark line | Mechanised 32 footer shark line | Mechanised 32 footer shark line + gillnet | Others | Total |
| DSF Owner | 3 | 1 | 3 | 12 | 6 | 6 | 12 | 4 | 4 |
| DSF Crew | 8 | 5 | 4 | 15 | 2 | 10 | 7 | 2 | 53 |
| Total | 11 | 6 | 7 | 27 | 8 | 16 | 19 | 6 | 100 |

During the period 1991-'98, the entire deep-sea units shifted from catamarans and canoe with OBM. The race was on to increase OAL of crafts (32 to 43-feet) and to increase their horsepower proportionately. Alternative fishing methods were also attempted. From the early 1990's surface-long-lines were introduced for catching pelagic deep-sea sharks with the initiative of SIFFS and the technical support of CIFT. The initiative was based on the stock estimation made by FSI 1991, that pelagic sharks were under-exploited. Though the organisational effort was not successful, fishermen developed pelagic-long-lines on their own by modifying their existing demersal-long-lines. Poor returns experienced due to non-availability of demersal sharks, acted an inducement for change. Combination-fishing with gill-nets and long-lines targeting pelagic sharks and tunas intensified during this period. Seasonal fishing with combination of pelagic and demersal long-lines, hand-lines, and gill-nets was the latest development noticed in the evolutionary process.

Increase in the number of hooks in long-lines (from 200 to 450), combination fishing with long-lines and gill-nets, use of demersal and pelagic long-line according to the availability of sharks, incorporation of electronic equipment (GPS) and fish-finders are also noticed in artisanal DSF during the 1990s (Table 2.4d).

**Table 2.4d Evolution of craft and gear for shark fishing (1991-'98) (in percentage)**

| | Craft and gear type | | | | | |
|---|---|---|---|---|---|---|
| | Mechanised 18 footer + sharkline | Mechanised 32 footer + sharkline | Mechanised 32 footer + sharkline+ gillnet | Mechanised 43 footer+ sharkline+ gillnet 12 | Others | Total |
| DSF Owner | 6 | 11 | 8 | 3 | 3 | 31 |
| DSF Crew | 9 | 20 | 11 | 14 | 15 | 69 |
| Total | 15 | 31 | 19 | 17 | 18 | 100 |

### *Skill and education*

Use of modern technology like GPS has been a recent interesting development. Formal education is considered a pre-requisite for using electronic devices. The enquiry on the educational status of these fishermen shows that 30 percent of the total and 20 percent of the owners had formal education of only up to seventh class. On the contrary, 26 percent were illiterate and 24 percent had gone through schooling barely up to the fourth standard. A small proportion studied up to the $10^{th}$ standard (6 percent) and a very few (only 2 percent) up to the plus two level (Table 2.5).

**Table 2.5 Educational status of fishermen of DSFs (in percentage)**

| Category | Educational Status | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Illiterate** | **1-4** | **5-7** | **8-9** | **10** | **12** | **Total** |
| DSF Owner | 6 | 14 | 20 | 6 | 4 | 0 | 50 |
| DSF Crew | 20 | 10 | 10 | 6 | 2 | 2 | 50 |
| Total | 26 | 24 | 30 | 12 | 6 | 2 | 100 |

In comparison to the educational status of other fishermen the deep-sea going fishermen have higher educational status. Access to higher education (presence of St. Jude College within the village) has influenced the overall educational environment of this belt. Fishermen have the culture of participative fishing, irrespective of education and status. And children are trained in the basics of fishing even from a very young age.

Skills evolve and are perfected, by acting on the basis of knowledge. Fifty-two percent of the fishermen acquired the skills of shark-fishing on their own; 44 percent get them from their fathers, and 4 percent from other relatives (Table 2.6).

**Table 2.6 Acquisition of skills for deep-sea fishing for shark (in percentage)**

| | **Self** | **Father** | **Brother** | **Uncle** | **Total** |
|---|---|---|---|---|---|
| DSF Owner | 22 | 26 | 0 | 2 | 50 |
| DSF Crew | 30 | 18 | 2 | 0 | 50 |
| Total | 52 | 44 | 2 | 2 | 100 |

Unlike in formal occupations, informal learning of fishing begins very early. In the case of shark-fishing, 32 percent started fishing between seven and twelve years of age and a majority, (52 percent) between the years thirteen and seventeen; 16 percent started their occupation at the prescribed age of 18-20 years (Table 2.7).

**Table 2.7 Age at entry into DSF units (in percentage)**

| | Age class | | | |
|---|---|---|---|---|
| | **7-12** | **13-17** | **18-20** | **Total** |
| DSF Owner | 18 | 22 | 10 | 50 |
| DSF Crew | 14 | 30 | 6 | 50 |
| Total | 32 | 52 | 16 | 100 |

In general, fishermen have accumulated skills, inherited from generation to generation. Unfavorable ecological features, particularly rough-surf ridden sea and stiff competition for survival with limited resources, compelled them to innovate and improvise on fishing techniques in a continual process. About one-third of deep-sea-going fishermen were literate but without any formal training in deep-sea fishing. However, their early entry in fishing, comparatively fair educational status, and acquisition of skills in a trans-generational process have enabled them to venture into deep-sea fishing with confidence.

***Migration***

Among the artisanal fishermen of India, the deep-sea-going fishermen of Thoothoor are the 'champions' in migratory fishing. They have been fishing through the entire West Coast of India. During the monsoon, the majority of boats would fish within the Kochi-Vizhinjam belt. After the monsoon, they migrate to the north. Malpe is another area favoured with high-yielding fishing grounds and facilities. Goa and Maharashtra are the other States with fishing grounds quite familiar the fishermen from the south. A considerable proportion of the boats migrate further north up to Okha in Gujarat during pre-monsoon season. During the monsoon the boats return to Kochi and Vizhinjam. Some other boats move to the eastern coast and berth at Chinnamuttom.

The lower southwest coast of India is an area of very high population density*. Naturally, therefore, the fishing pressure in this area is also higher than in the northern coast. Seasonal migration to areas of comparatively low fishing pressure reduces local pressure as well as improves the economic returns of the migratory units. Thus migration has come to be adapted as a survival strategy.

Migration for fishing has a long history in the State. Ninety-two percent of the fishermen in the sample were reportedly seasonal migrants to other States. The fishing methods

* The fishing village Karumkulam, which is reported to have the highest density of population place in the world, is situated in this belt.

adopted for migratory fishing (even during periods prior to the beginning of long-line shark-fishing) were gill-nets (74 percent) and hook and lines (14 percent) with catamarans (Table 2.8).

**Table 2.8 Fishing methods employed for traditional migratory fishing (number)**

| Category | Fishing method | | | | |
|---|---|---|---|---|---|
| | H&L on Catamaran | Gillnetting | Long lining | Shark lining with single hook | Total |
| DSF Owner | 8 | 38 | 0 | 0 | 46 |
| DSF Crew | 6 | 36 | 2 | 2 | 46 |
| Total | 14 | 74 | 2 | 2 | 92 |

Most fishermen migrate towards the northern districts of Kerala and some to the East Coast of Tamil Nadu. Senior fishermen said that even their parents used to travel to distant places for fishing. The period of commencement of migratory fishing by the present DSFUs are shown in Table 2.9.

**Table 2.9 Year of commencement of migratory fishing by DSFUs (number)**

| Category | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 65-70 | 71-75 | 76-80 | 81-85 | 86-90 | 91-95 | Total |
| DSF Owner | 4 | 10 | 14 | 10 | 4 | 0 | 42 |
| DSF Crew | 0 | 6 | 2 | 8 | 22 | 6 | 44 |
| Total | 4 | 16 | 16 | 18 | 26 | 6 | 86 |

**DSFUs – Boat and Gear**

The boats of DFSUs have an OAL ranging between 30 feet and 43 feet fitted with IBF5 of 60 to 90 HP. The minimum equipment and facilities required such as radio-telephone; insulated fish hold, buoys and navigational flags are not found in many of these boats. Wheelhouse is constructed in a crude manner and protected by means of temporary roof. Even without the essential equipment and facilities, these fishermen locate high-yielding fishing grounds correctly and operate gear manually at any depth. Cases of men missing at sea and accidents have been reported once or twice in a year but are the numbers are much lower than loss of life among ISF fishermen caused in similar circumstances.

Though shark-fishing started off with smaller mechanized boats of OAL 18 feet, larger boats are preferred for reasons of safety and capability for trips of longer duration. The smaller boats (OAL <32 feet) constituted only 10 percent of the total while 45 percent of the boats were of the medium size of OAL 34 feet. Almost one-third is comparatively large boats (36 to 40 feet) as may be seen in Table 2.10.

**Table 2.10 Boat Size: DFSUs**

| **Boat Size (Ft.)** | **32** | **32** | **34** | **36** | **38-40** | **Total** |
|---|---|---|---|---|---|---|
| No. of Boat (%) | 10 | 10 | 45 | 20 | 15 | 100 |
| Engine (HP) | 60 | 68 | 70 | 88 | 90 | |
| No. (%) | 56 | 22 | 11 | 6 | 5 | 100 |

The means of propulsion is correlated with the size of boat, 60 HP IBEs were installed in 56 percent of the boats. About one-third were fitted with IBE of 68 to 70 HP and 11 percent with comparatively large 88 to 90 HP IBEs.

The bottom and surface long-lines, a variety of hand-lines and gill-nets constitute the major gear. Use of suitable combinations of gear during different fishing season is one of the major recent innovations. The bottom surface long-lines were the principle gears intended for catching demersal and pelagic sharks, respectively. Some boats have two separate long-lines for pelagic and demersal operations whereas the majority have only one long-line for both, with seasonal modification in the gear.

Almost all the boats do combination-fishing with long-line and gill-net. The size of the long-line depends on the number of hooks, the distance between two hooks being 1.8 metres. Forty-four percent of the boats used long-lines with 4000 hooks with a line in length of about 7 km. Twenty-seven percent used less than 300 hooks with a line length of about five km. Only 5 percent of the boats used larger long-lines with a length of about 10 km. The extent of use of the line varied from season to season and with changes in the depth of the fishing ground. During monsoon, fishermen deploy lower number of hooks whereas almost all the reserve lines are used during calm weather conditions. Similarly, the number of hooks deployed while fishing in shallow ground are lower and while fishing in great depths, higher. The details of gears used for artisanal DSF operation are given in Tables 2.11 a and 2.11 b.

**Table 2.11 a DSFUs Fishing Gear: Hook-and-line (in percentage)**

| **Number of Hooks** | **<300** | **350** | **400** | **500** | **600** | **Total** |
|---|---|---|---|---|---|---|
| No. (%) | 27 | 18 | 44 | 6 | 5 | 100 |
| Length (Km) | <5 | 6.3 | 7.2 | 9 | 10.8 | |
| Gill-net (kg) | <400 | 400 | 500 | 600 | >600 | 100 |
| No. (%) | 21 | 14 | 15 | 29 | 21 | |

The quantity of netting for gill-nets varies from 400 to > 600 kg. Half the boats used higher quantities (29 percent 600 kg and 21 percent >600 kg). Twenty-one percent of the units use much less than this quantity. Twine size ranges from 210/3/6 to 210/3/8 with a mesh size of 80 to >110m.

**Table 2.11b DSFUs Fishing Gear: Gill-nets**

| Twine Size (No.) | | | | Mesh Size (mm) | | |
|---|---|---|---|---|---|---|
| <6 | 6 | 8 | >8 | 80 | 90 | >110 |
| 10 | 251 | 63 | 9 | 22 | 132 | 20 |
| 3% | 75% | 19% | 3% | 13% | 76% | 11% |

**Fishing methods**

Unlike in the ISFs, duration per fishing trip in the case of DSFs lasted for three to six days. The duration of trip depends on the catch. Usually fishermen start fishing on Monday morning at 4 am and reach at bait-fishing ground, preferably a natural reef, by sunrise. After bait-fishing they propel further to deeper waters and reach the shark ground (100-150 fin) by sunset. While propelling towards the shark ground, the line is baited and kept ready for shooting. Soon after reaching the destination they set the line at sea. Hauling of line is carried out by about 5 O'clock early next morning and the operation is completed in two or three hours. The shooting and hauling are repeated for the next two to six days, depending on the catch. In the case of combination-fishing (long-lining and gill-netting) shooting and hauling of gill-nets is carried out together with those of long-lines. Gill-nets are operated during the day also. The net is shot in the morning and hauled in the evening.

Hand-lining is another fishing method performed for catching bait-fish and for kalava fishing. This has become the exclusive fishing method during the kalava-fishing seasons (December-April) in some of the boats. Natural reefs are the major fishing grounds for hand-line operations and a variety of reef-fishes are caught during the fishing season. Different combinations of hand-lines such as surface and mid-water and bottom lines are used to catch fishes, which inhabit various niches of the water column. Trolling line is also operated while propelling towards the fishing ground. Some fishermen operate long-lines for carangids at the vicinity of natural reefs.

During the monsoon months, gill-nets for tuna, seer fish, pomfret, and catfish are often used. Owing to the process of up-welling during monsoon, almost all the species, such as pelagic, mid-water and demersal, move to the surface layer of the sea, irrespective of their home zones.

Combination-fishing using gill-nets and long-line is the fishing method mostly followed during the post-monsoon season. Fishermen set the gear in such a way that gill-nets are attached in-between the long-line and the boat. It gives an elastic effect to long-lines preventing the line from tearing off under high stretch caused by water currents and rough winds. By adopting suitable combinations of fishing methods during different seasons fisherman land a wide variety of fishers throughout the year ensuring regular income, and economic viability of the units.

**Other DSF Plywood Artisanal Fishing Groups**

***Deep-sea-Going Plywood-Boat Fishermen of Elathoor***

Elathoor, a fishing village in Kozhikode district, is famous for shark-fishing. Sharks are caught with long-lines locally known as Vepu (means bottom-set long-line). Before the introduction of out-board motors in 1980, these fishermen used to catch sharks by using dug-out canoes with sail. After the introduction of OBMs they moved to plywood units fitted with OBM and began catching sharks from waters of 100 to 150 feet in depth.

Cotton is that material used for the preparation of long-line. The locally made Elathoor hook is famous in the whole of the Kerala and has good demand. The quality is good and the price low compared to those of imported hooks. It costs Rs 10 per hook as against Rs 50 per imported Norwegian ‘mustard hook’. Fishermen from the south also use Elathoor hooks, which are available at local shops of Thiruvananthapuram and Kanyakumari districts. Two families in Elathoor village have been producing the Elathoor hook and the manufacturing technique is kept as a trade secret.

During the study period, about 40 plywood boat units fitted with OBM were doing deep-sea shark lining in this village. The OAL of the craft varies from 30-35 feet. These boats were fitted with 9.9 HP for 25 HP Suzuki OBMs.

The crew of the DSFUs form the most skilled of the fishermen in the country. The fishing methods are most resources-friendly, sustainable, and focused on underexploited resources. There is a world of difference between the DSFUs and the ISFs. The knowledge base spills over to the neighbouring communities and to the more skilled of fishermen in these villages. The expertise could be located to a lesser extent in some of the neighbouring fishing villages also. Poonthura in Thiruvananthapuram district is such a case where a group of fishermen is highly skilled in fishing with hook-and-line in deep waters. Pulluvila is another fishing village where the fishermen do weeklong hand-lining on natural reefs. Some fishermen from Vizhinjam fish at great depths with hook-and-line and gill-net, almost on a daily basis in plywood boats fitted with two OBMs. Incidents of men missing and accidents while fishing at deep-sea are reported quite often. A few cases are mentioned in Annexure I.

Anjengo in Thiruvananthapuram and Pallithottam in Kollam are two other villages where fishermen are engaged in line-fishing. The natural reef located off Kollam and Thiruvananthapuram is the fishing ground. Kattoor in Alappuzha is another village where the fishermen go farther from the coast for hook-and-line fishing. They too have the capability to harvest deep-sea resources.

The general trend is for ISFUs to move beyond the traditionally exploited depths to deeper waters mainly because of the increasing fishing pressure in inshore waters. The pressure appears to be more due to increase in fishing capacity per unit rather than increase in the number of fishermen. There has been a steady increase in the size of the units OAL of craft, horsepower of OBM, and the use of Gear. Higher investment also exerts pressure for earning higher returns. Intense competition among ISFUs that too for the exploitation of resources, which are already exploited at MSY, is the major factor that necessitates redeployment of excess fishing units to deep-sea fishing. This is easier said than done precisely for the complexities and skills involved in the process. A feasible alternative may be to begin with comparative longer staying fishing (for 2 to 3 days) with IBE fitted to a medium size stable craft equipped with iceboxes. The IBE in use now in some pockets such as Kochi has been a recent innovation by local fishermen. What is required in addition is encouragement for long-stay fishing in deeper waters.

## 3. Techno-Economic Status of Artisanal Deep-Sea Fishing

A comparison of the functioning of DSFUs with ISFs was found necessary to ascertain their relative techno-economic status. A group of inshore fishing (ISF) gill-netters was selected as the control group. The group stated several reasons for their not participation in deep-sea fishing which included life style problems, inability to mobilise adequate capital, and family problems. Requirement of comparatively higher capital, of the order of Rs 10 to 15 lakh, was the major bottleneck. Lower priority was attributed to skill requirements and risk factors. The control group was requested to report features of deep-sea fishing which distinguished it from artisanal fishing.

ISF groups engage in daily fishing whereas DSF groups go for week-long fishing. ISF units confine their fishing to swallow waters by restricting most of their fishing trips (40 percent) to the 26 to 30 fathom depth range. Four percent of ISFs fished in very shallow waters (<16 fathom) and another five percent in comparatively deep waters (36-40 fathom). Those who fish in deeper waters are more susceptible to accidents. A few cases of gill-net units meeting with accidents while engaged in deep-water fishing are given in Annexure 1. The depth range of operation of DSF and ISF units during the period of the study is given in Table 3.1.

**Table 3.1 Depth Range of Operation: DSF and ISF Units**

| | Depth Range (in fathom) | | | | | | |
|---|---|---|---|---|---|---|---|
| **ISSF Units** | **<16** | **16-20** | **21-25** | **26-30** | **31-35** | **36-40** | **Total** |
| No. of Operation (%) | 4 | 12 | 28 | 40 | 11 | 5 | 100 |
| DSF Units | | 0-50 | 50-100 | 101-150 | 151-200 | 201-500 | |
| No. of Operation (%) | | 10 | 23 | 19 | 22 | 26 | 100 |

The depth of operation DSF units reveals that a majority of them (90 percent) fished in deep waters. Nearly half of them fished at depths ranging from 150 to 500 fm. The continental slope of the ocean floor is the fishing ground for sharks. Sometimes the fishing operation may extend to the dysural plane, the fishermen operating their gear quite often in the oceanic trenches (Table 3.2).

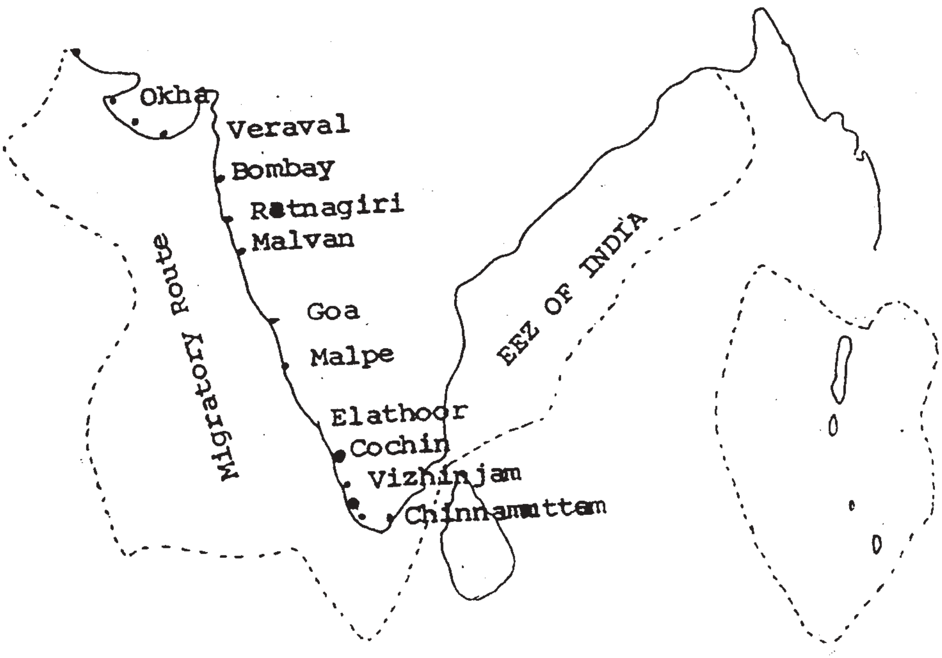
The deep-sea going fishermen were not found to be reluctant to make use of shallow water fishing grounds particularly of natural reefs. During the rough monsoon months (July-September) they avoid fishing in great depths, but during fair weather (January-April), they venture out to deep seas. Similar to the seasonal shifting between shallow water and deep water fishing, there also exists a pattern of spatial shifting among them, from home villages to distant fishing grounds northwards up to Okha in Gujarat and eastwards to the Andaman Sea (Figure 1).

**Table 3.2 Depth Range of Operations: DSFUs (in Fathom)**

**Distribution of Boats (in percentage)**

| **Depth range** | **0-50** | **50-100** | **101-150** | **151-200** | **201-500** |
|---|---|---|---|---|---|
| July | 52 | 30 | 0 | 7 | 11 |
| Aug | 41 | 45 | 5 | 5 | 5 |
| Sept | 20 | 70 | 10 | 0 | 0 |
| Oct | 0 | 7 | 7 | 7 | 80 |
| Nov | 0 | 18 | 9 | 0 | 73 |
| Dec | 13 | 38 | 38 | 0 | 13 |
| Jan | 0 | 11 | 44 | 33 | 11 |
| Feb | 0 | 8 | 25 | 42 | 25 |
| Mar | 0 | 0 | 40 | 30 | 30 |
| Apr | 0 | 8 | 8 | 67 | 17 |
| May | 27 | 18 | 9 | 36 | 9 |

**Figure 1 Migratory Route of Shark-hunting of fishermen**



The migrant fishermen travel in small groups each group comprising of 10 to 20 boats. The groups fish together searching for high-yielding fishing ground, disposing of the catch by transferring them to boats which return earlier and joint marketing of produce. Income is not pooled together but is aggregated on the basis of fishing units, the income of each unit being kept separate.

Crew strength in the case of long-liners varies from 5 to 9 persons per boat. One-third of fishing trips is conducted with seven member crew, about half the fishing trips (48 percent) and conducted with six-member or eight-member crew. Crew size of gill-net units is found to be on the average, four members; it is three in a few cases and five in a few others (Table 3.3).

**Table 3.3 Crew Size: ISF and DSF Units**

| **Crew Size** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|
| Long Liners | 9% | 28% | 35% | 20% | 8% |
| **Crew Size** | **3** | **4** | **5** | | |
| Gill-netters | 15% | 79% | 6% | | |

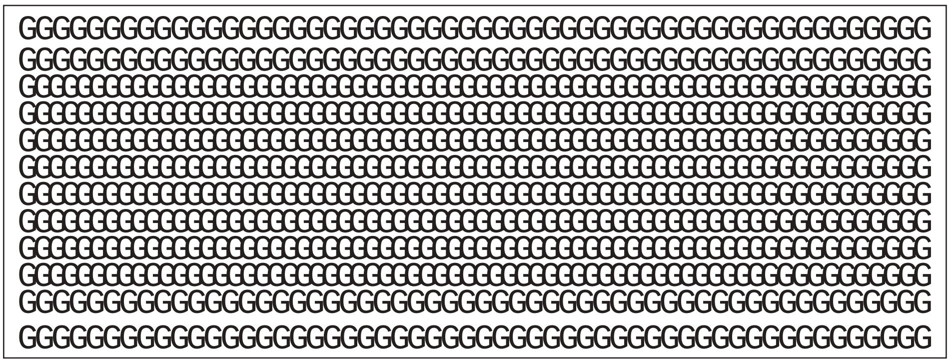
**ISF and DSF Fishing Gear**

Gill-nets is the mechanism used in ISF and DSF for gilling and angling, which are the two different processes of this fishing gear. Gill-net have mesh openings in which fishes with body girth more or less equal to the mesh size would get gilled. Those with smaller body girth pass through the meshes. Similarly, fishes with body girth more than the mesh size and those with external morphological features like crab, lobster, and other sluggish fishes get entangled in the gear, instead of getting gilled.

The single-walled tangle-net loosely hangs on a head rope and without foot-rope, facilitates tangling. Though the gear lacks foot-trope and stone weight, it sinks in water because of higher density of webbing. The webbing made with PA multi-filament has density higher than water (1.14gm per centimetre cube as against 1). However, sinkability depends on water current and behaviour of available fish. Stones are used as weights in the netting itself, at intervals, say one stone for every ten floats. In ISF units fishermen use two kinds of gill-nets, one for mackerel and the other for a variety of fish such as tuna and seer depending on the fishing season. Fig. 3.2 a and 3.2b give the design details of mackerel and tuna gillnets.

**Fig. 3.2a Design details of DSF and ISF gill-net**

No Selvedge



No Foot-rope

**Fig. 3.2.a Mackerel gill-net operated on ISF units**

700M PP/PE f 4-6 mm

19450 mesh

14 M G60 mm 300 meshes

PA 210/1/3 or

PA Mono 0.25 mm ➀

**Fig. 3.2b Tuna gill-net operated both in ISF and DSF units**

| 250 M | 400 M PP f 6 mm | 350M |
|---|---|---|
| 4000 | 6000 | 5375 |
| G 85 mm | G 90 mm | G 110 mm |
| 130 mesh 7.6HD | 130 mesh 8HD | 130 mesh 9 HD |
| PA 210/43 | PA 210/6/3 | PA 210/8/3 |

The gear has two-to-four pieces of netting made with differing mesh-sizes and tinge-sizes (75, 3/3, 85 mm 4/3, and 95 mm 6/3). They are joined one after the other. The selections of different combinations of netting depend on the age class, size of fish, availability of particular variety of fish at a particular fishing season, and its body girth. The gear is used for capturing comparatively large fishes such as tunas, seer, pomfret, and a variety of other fishes, differing in body girth. Considering variations in body size of fishes to be caught, fishermen also provide for gilling by avoiding the foot-rope for the tangling effect. The gear is operated on plywood boats fitted with OBM of 9.9 to 25 HP.

Gill-nets used in DSF units have more or less the same design specifications as those of ISF units. As the gear is meant for larger fishes, the nets are made with comparatively thick twine (210/3/8 to 3/12) and large mesh-size (95 to 10mm).

The shark long-line consists of a main line made with polyester (PES) to which 300 to 500 hooks are attached by means of branch lines made of steel wire. Sharks have very large mouth, sharp teeth, and some are man-eaters. The bait could be tuna meat, dolphin meat or meat of other fishes containing blood and flesh. Fishermen believe that bait with more blood would attract sharks better. Dolphin meat is preferred as bait for this reason though law prohibits killing of dolphins.

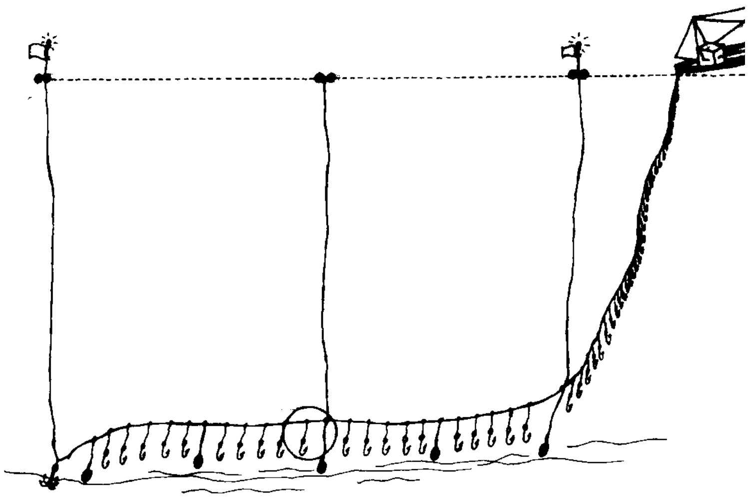
To prevent breakage of line by sharks with their sharp teeth, hooks are secured with steel wire of ‘T” shape. The steel wire prevents direct contact of shark teeth with the main line. Hooks are tied at intervals of 18 meters with flags at intervals of 40 to 50 hooks. Suitable weights such as stone or anchor provided at each flag mark keep the flags upright and keep the long line anchored firmly to the bottom. Depth of operation of the gear varies from 75 to 150 fathoms. The line would have an average length of about 5 km. Fig. 3.5 shows the design.

Surface long-lining for pelagic shark is a recent development. The line is positioned at the surface of the sea with floats. Combination-fishing with simultaneous operation of gill-nets and long-line was made possible with the introduction of surface long-lining. Fishermen are aware of the depletion of demersal shark (the size of demersal shark has been declining over time). Their immediate response to the situation was to reduce fishing effort by seasonal usage of demersal and pelagic long-lines alternatively.

A variety of fishing techniques such as demersal and pelagic long-lining, gill-netting, hand-lining, and troll-lining are employed by DSFUs. Similar to the selection of suitable combination of nets with varying thickness and mesh-size in gill-net fishing, a suitable combination of fishing techniques is adopted for catching a variety of fish available at different fishing seasons, depths, and fishing grounds.

A total of 758 sample trips were recorded to investigate gear combinations during the period of the study. Of the 758 trips, 742 trips were with long-lines of which 428 were operated with surface long-lines, 208 with bottom long-lines, and 106 with both surface and bottom long-lines. Gill-netting was another fishing technique widely used in 598 sample trips. In combination-fishing of gill-net and surface long-line, the net was set in-between boat and long-line, particularly during rough weather. The elasticity of net enables avoidance of breakage of long-line due to rolling and pitching of boat during bad weather. Table 3.4 provides the different combinations of fishing employed by DSFUs during the period of the study.

**Figure 3.3 Design of Shark Long-line**



The trolling line, locally known as *otta-kayar*, is operated while propelling the boat to the fishing ground. Of the 758 sample trips, 452 trips used the trolling line. Other gears used include long-lines such as Cranax-set line and reef-set line, for carangids and a variety of reef-dwelling fishes respectively. Of the 758 DSF sample trips, 576 trips were made with a variety of hand-lines such as surface, mid-water and bottom hand-lines. The design of these gears has been documented in *Design Specification of Artisanal Fishing Gears of Kerala* (D'Cruz. T., 2000)

**Table 3.4 DSFUs: Gear Combination for Shark-fishing**

| Gear type | Pelagic long-line | Demersal long line | Both | Gill-net | Hand-line | Trolling line | Others | Sample trips |
|---|---|---|---|---|---|---|---|---|
| July | 26 | 48 | 18 | 72 | 64 | 82 | 4 | 102 |
| Aug | 40 | 32 | 14 | 88 | 64 | 76 | 2 | 106 |
| Sept | 18 | 42 | 16 | 30 | 48 | 56 | 0 | 56 |
| Oct | 26 | 14 | 0 | 70 | 52 | 2 | 2 | 70 |
| Nov | 16 | 8 | 4 | 52 | 52 | 8 | 4 | 62 |
| Dec | 22 | 4 | 4 | 48 | 44 | 34 | 0 | 48 |
| Jan | 66 | 0 | 0 | 62 | 56 | 50 | 0 | 62 |
| Feb | 50 | 0 | 0 | 46 | 44 | 34 | 0 | 64 |
| Mar | 66 | 24 | 18 | 54 | 64 | 50 | 0 | 76 |
| Apr | 50 | 28 | 24 | 40 | 50 | 42 | 2 | 54 |
| May | 48 | 8 | 8 | 36 | 38 | 18 | 0 | 58 |
| Total | 428 | 208 | 106 | 598 | 576 | 452 | 14 | 758 |

**Fishing time and CPUE**

Assessment of fishing time reveals the intricacies involved in deep-sea fishing. The trip time extends between 2 to 7 days. Less than half (50 percent) the boats return on the fifth day of departure and around one tenth each on the 2nd, 3rd and 6th days (Table 3.5).

**Table 3.5 DSFUs: Duration of trips for shark fishing**

| Arrival days | 2nd | 3rd | 4th | 5th | 6th | 7th | Total |
|---|---|---|---|---|---|---|---|
| No. of boats arrived | 94 | 74 | 132 | 330 | 102 | 26 | 758 |
| (%) | 12 | 10 | 17 | 44 | 13 | 3 | 100 |

The total fishing time per trip for a multi-day fishing trip which makes use of more than one fishing ground is the sum of the time periods spent on each of the fishing activities such as bait-fishing, shark fishing, departure and arrival. On an average, a boat took five and a-half hours to reach the bait ground from port and bait fishing took on an average three hours and fifteen minutes. It took an average time of three and half-hours of propulsion to reach shark grounds. The long lines were operated every day for a period of 10.45 hours in the night. An average of nine hours was taken to reach the shark ground from port and 9.15 hours to return to port. Shooting and hauling process is repeated daily (Table 3.6).

**Table 3.6 DSFUs: Fishing time for long-liners (Port to shark ground and back)**

| | Port to bait ground | Bait-fishing time | Bait to Shark ground | Shark-fishing time | Hauling time | Arrival time |
|---|---|---|---|---|---|---|
| Time in hours | | | | | | |
| Avg. | 5.30 | 3.15 | 3.30 | 10.45 | 3.50 | 9.15 |

Gill-net units fishing in inshore waters took an average one way travelling time of 2.21 hours and utilised 10.12 hours for fishing. More than half the trips (57 percent) operated the nets at least twice and around one-third of the units (32 percent) shot the gear thrice. A few units (11 percent) operated the nets only once (Table 3.7).

**Table 3.7 ISFUs: Fishing time of gill-net units**

| Month | Travel time (Hrs) | Fishing time (Hrs) |
|---|---|---|
| Avg. | 2.21 | 10.12 |

The Catch per Unit Effort (CPUE) of ISFUs was assessed in terms of CPUE per man-hour of effort. Month-wise data shows fluctuation during the study period of eleven months. Catch per man- hour effort was the highest during the month July with 17 kg (worth Rs. 270) and the lowest during the month of January with only 0.68 kg (worth Rs 27.6); (Table 3.8).

**Table 3.8 CPUE of ISF gillnets (per man hour)**

| Month | Kg | Value |
|---|---|---|
| July | 17.33 | 270.75 |
| Aug | 7.18 | 179.25 |
| Sept | 3.65 | 111.33 |
| Oct | 1.03 | 41.52 |
| Nov | 1.49 | 83.24 |
| Dec | 3.79 | 75.52 |
| Jan | 0.68 | 27.60 |
| Feb | 1.34 | 51.56 |
| Mar | 2.27 | 55.41 |
| Apr | 3.00 | 76.29 |
| May | 1.16 | 35.23 |
| Avg. | 3.90 | 91.63 |

CPUE per fishing trip naturally reflects the same pattern of fluctuation in CPUE of man-hour effort. CPUE per trip was the highest during the monsoon months (July-September), very low during the fair weather season (January-March) and steadily increasing during the pre-monsoon season. On an average CPUE per trip during the study period was recorded as 69kg of fish (worth Rs 1958). Reciprocal fluctuation in value such as high price for per kg of fish during low landings and low price during good landings was also noticed (Table 3.9).

**Table 3.9 CPUE of ISF gillnets (CPUE /boat/trip)**

| Month | Kg | Value (Rs) | Avg. (Rs) |
|---|---|---|---|
| July | 173.25 | 2708 | 15.63 |
| Aug | 304.27 | 8420 | 27.67 |
| Sept | 142.69 | 4357 | 30.53 |
| Oct | 35.39 | 1420 | 40.12 |
| Nov | 62.42 | 3480 | 55.75 |
| Dec | 14.41 | 287 | 19.92 |
| Jan | 2.60 | 105 | 40.38 |
| Feb | 5.09 | 196 | 38.51 |
| Mar | 6.13 | 150 | 24.47 |
| Apr | 11.40 | 290 | 25.44 |
| May | 4.41 | 134 | 30.39 |
| Avg | 69 | 1958 | 31.71 |

Long-line catch comprises a variety of species of sharks. Catch by bottom-set long-line will be comparatively big sharks (60-75 kg). The size is smaller (40-50 kg) in the case of pelagic long-lines. A wide variety of sharks comprising 65 species including the largest animal in the world namely whale shark *Rhincodon typus* have been recorded as available from the Western Indian Ocean. DSFUs caught about 20 species of commercially important shark species of which 17 were identified at species or genus level as listed in the Table 3.10. If good catch were obtained within the first or the second day, the boat would return straight away. Otherwise, they would continue fishing for the next two to three days. Catches of the earlier days would be through boats that returned to shore or kept with themselves either in salted or iced form.

Fishermen have given catchy names to different species. They call the copper shark as *manasravu*, which is a delicious table fish among sharks. *Carcharhinus melanoptreus* and *Carcharhinus limbatus* (the *Me-sravu* and *Kakka sravu*) are the commercially important species. Leaf-scale gulper shark yields high quality body oil and tiger shark (*Galeocerda cuvieri*) is dangerous to fishermen. Saw shark, hammer-headed shark, and guitar shark possess interesting body features. The upper lip of the shark protrudes like a saw in the case of saw shark. The head looks like a hammer in the case of hammer-headed shark. Body has the appearance of a guitar in the case of the African angel shark.

**Table 3.10 Common shark species caught by long-liners**

| Local name | English name | Species name |
|---|---|---|
| *Kakka-sravu* | Black tip reef shark | *Carcharhinus melanoptreus* |
| *Pava-sravu, Chattithalayan* | Great hammer-head | *Sphyrna mokarran* |
| *Me-sravu* | Black-tip shark | *Carcharhinus limbatus* |
| *Nedum thalayan* | Spinner shark | *Carcharhinus brevipinna* |
| *Katta-sravu* | | *Carcharhinus sp* |
| *Achini* | | *Carcharhinus sp* |
| *Ola pava, madyan* | Smooth hammer-head | *Sphyrna zygaena* |
| *Val Sravu* | Thresher shark | *Alopias vulpinus* |
| *Peppadaku* | Big-nose shark | *Carcharhinus alyimus* |
| *Theevi sravu* | Graceful shark | *Carcharhinus amblyrhynchoides* |
| *Manasravu* | Copper shark | *Carcharhinus brachyurus* |
| *Keeri pallan* | Black spot shark | *Carcharhinus sealei* |
| *Puli sravu* | Tiger shark | *Galeocredo cuvieri* |
| *Thumban* | Milk shark | *Rhizoprionodon acutus* |
| *Guitar sravu* | African angel shark | *Squatina africana* |
| *Val-sravu* | Six-gill saw-shark | *Plioterma warreni* |
| *Enna sravu* | Leaf scale gulper shark | *Centrophorus squamosus* |

Unlike ISFUs, the DSFUs able to stabilise returns by employing a variety of fishing methods, responding to changes in availability of fish, with suitable combinations of gears and migration from place to place. The strategic approach to fishing techniques, selection of fishing grounds from deeper or shallow waters and exploitation of distant fishing grounds enable them to continue with regular fishing and assured returns.

The landings by DSFUs are more or less stable at around 1000 tonnes per month. Fluctuations are low during the monsoon months (July–September), remain at around 40 percent below average landings during post-monsoon season (October-December) and 40 percent above average during fair weather season (January to March). Fair weather season is supposed to be the best fishing season for hand-line fishing, particularly on natural reefs. The landings nearly half the DSFUs were based at a few landing centres during the study period, such as Vizhinjem, Kollam, and Cochin as shown in Table 3.11.

**Table 3.11 Fish production of deep-sea units**

| Month | Boat strength | Total trips | Catch/Month (Tons) |
|---|---|---|---|
| July | 100 | 428 | 894 |
| Aug | 147 | 630 | 1315 |
| Sept | 105 | 450 | 940 |
| Oct | 79 | 338 | 706 |
| Nov | 70 | 300 | 626 |
| Dec | 73 | 314 | 656 |
| Jan | 137 | 586 | 1224 |
| Feb | 182 | 780 | 1629 |
| Mar | 149 | 638 | 1332 |
| Apr | 93 | 398 | 831 |
| May | 94 | 404 | 844 |
| Total | 1230 | 5266 | 10995 |
| Avg. | 111 | | 999.5 |

**Species composition of landings**

Gear-wise species composition of deep-sea landings (e.g. fish caught with long-line, by hand-line, and gilled and tangled with gill-nets) is listed in the descending order in terms of quantity in Table 3.12 -3.16.

The species composition of long-line catch shows that the gear is very selective, catching only the targeted species and may be a few other large size species such as rays, marlins, and tunas. The species of *Carcharhinus melanoptreus* and *Carcharhinus limbatus* (which fishermen call *Kakka sravu* and *Me-sravu)* constituted 91 percent of total landings of sharks. The fins which have a broad base themselves fetch good price. Quite often fishermen target fishing operations for these high value species which form the predominant item among the shark landings by DSFUs. Hammer-headed shark, (*Sphyrna mokarran* and *S. zygaena)* come next in the order (Table 3.12).

**Table 3.12 Species composition of landings by long-line**

| Code | Local name | Species name | Wt. in tonnes | % to total wt. |
|---|---|---|---|---|
| K2 | *Kakka-sravu* | *Carcharhinus melanoptreus* | 73.174 | 82.56 |
| P6 | *Pava sravu* | *Sphyrna mokarran* | 8.528 | 9.62 |
| P5 | *Ola–pava* | *S. zygaena* | | |
| M4 | *Me-sravu* | *Carcharhinus limbatus* | 1.732 | 1.95 |
| K12 | *Katta-sravu* | *Carcharhinus sp* | 1.355 | 1.53 |
| A2 | *Achini* | *Carcharhinus sp* | 0.973 | 1.10 |
| | Others | | 2.869 | 3.24 |
| | **Total** | | **88.631** | **100** |

Note: Species of less than 1 percent is included under others

The landings by hand-lines comprise small variety fishes like scads, little tunnies, and *kalava* species. Of the total hand-line landings, half the share was contributed by scad species (*Selar crumenophthalmus).* Hand-line catches, particularly the little tunnies, were used mostly for baits in long-lines. The other species include Ayala, *(Rastrelliger kanagurta)*, Chemeen (*Nemepterus bleekeri* and *N. peronii)*, Vatta, (*Crangid sp*.) and *Pala-meen* (*Coryphaena hippurus)* in the order of abundance. Fish caught with hand lines was observed to be of poor quality and was disposed of at throwaway prices (Table 3.13).

**Table 3.13 Species composition of landings by hand-line**

| Code | Local name | Species name | Wt. in tonnes | % to total wt. |
|---|---|---|---|---|
| Kk | *Kannan kozhiyala* | *Selar crumenophthalmus* | 105.196 | 62.76 |
| K1 | *Kozhiyala* | *Decapterus sp.* | 23.425 | 13.98 |
| P7 | *Pollal* | *Auxis rochei* | 10.549 | 6.29 |
| C1 | *Kuttichoora* | *Auxis thazard* | 8.959 | 5.34 |
| K5 | *Kalava* | *Epinephelus areolatus E. bleekeri E. cholorostigma E. tauvina* | 5.462 | 3.26 |
| K3 | *Kera choora* | *Thunnus albacares* | 2.567 | 1.53 |
| | Others | | 11.458 | 6.84 |
| | Total | | 167.616 | 100 |

Note: Species of less than one percent are included under others

Catch composition of DSF gill-nets shows that the gear was able to target oceanic tunas available in Indian Ocean along with the pelagic shark. Yellow fin and Skipjak contributed more than half the deep-sea gill-net catch in terms of weight. The deep-sea black-tips shark also contributed to the high returns of DSF gill-net catch. Whenever gill-nets operated in shallow waters, the catch composition resembled that of the shallow water gill-net units. Therefore catch composition was the same as that of ISF units such as seer fish and medium-size tunas. Marlins and rays are the pelagic and demersal inhabitants respectively which were also caught occasionally in DSF gill-nets (Table 3.14).

**Table 3.14 Species composition of DSF gill-net units**

| Code | Local name | Species name | Wt in tonnes | % to total wt. |
|---|---|---|---|---|
| K3 | *Kera choora* (Yellow fin) | *Thunnus albacares* | 125.00 | 36.48 |
| V2 | *Varayan* choora(Skipjack) | *Katsuwonus pelamis* | 73.00 | 21.31 |
| M4 | *Me sravu* | *Carcharhinus limbatus* | 46.50 | 13.57 |
| K2 | *Kakka sravu* | *Carcharhinus melanoptreus* | | |
| C1 | *Kuttichoora*<br>*Pollal choora* | *Auxis thazard*<br>*Auxis rochei* | 34.64 | 10.11 |
| N1 | *Nai-Meen* | *Scomberomorus commerson*<br>*Scomberomores lineolatus* | 20.89 | 6.10 |
| P1 | *Pallachoora* | *Euthynnus affnis* | 13.32 | 3.89 |
| V1 | *Vava choora* | Tuna | 9.65 | 2.82 |
| S1 | *Kutti sravu* | Small shark | 3.69 | 1.08 |
| T2 | *Thala* | *Istiophorus platypterus*<br>*Xiphias gladius* | 2.47 | 0.72 |
| T1 | *Therachi* | Ray | 1.88 | 0.55 |
| | Others | | 11.60 | 3.37 |
| | Total | | 342.64 | 100.00 |

Note: Species less than 0.5 percent is included under others

The species composition of catch ISF gill-net units shows that tuna and seer, constituted one-third (31 percent) of the total by weight. Scads and mackerel also form an equal proportion (33 percent). The remaining part comprises a mix of different species (Table 3.15).

**Table 3.15 Species composition of landings: ISF gill-nets**

| Code | Local name | Species name | Wt in tonnes | % to total wt. |
|---|---|---|---|---|
| | *Choora/Nai*-*meen* | *Tuna/Seer | 7.3 | 31.06 |
| K1 | *Kozhiyala* | *Decapterus sp.* | 4.0 | 17.02 |
| A1 | *Ayala* | *Rastrelliger kanagurta* | 3.9 | 16.60 |
| P2 | *Pala*-meen | *Coryphaena hippurus* | 1.2 | 5.11 |
| T3 | *Thedu* | *Arius jella*<br>*Arius thalassinus* | 0.6 | 2.55 |
| T1 | *Therachi* | *Ray* | 0.4 | 1.70 |
| S1 | *Kutti sravu* | *Small sharks* | 0.4 | 1.70 |
| N2 | Crab | *Portunus sanguinolentus*<br>*Charybdis cruciata* | 0.4 | 1.70 |
| M3 | *Motha* | *Rachycentron canadum* | 0.4 | 1.70 |
| T2 | *Thala* | *Istiophorus platypterus*<br>*Xiphias gladius* | 0.3 | 1.28 |
| | | *Others* | 4.6 | 19.58 |
| | | Total | 23.5 | 100 |

* Species composition of tuna and seer is shown separately

The ISF gill-net landings comprising tunas show the predominance of species *Auxis thazard and Auxis rochi* which together contributed to more than 60 percent of the total tuna landings. Medium size tuna (of *Euthynnus affnis and Thunnus albacares species)* contributed about one-fifth. However, it was seer fish which contributed a significant share in terms of weight but a major larger share in terms of value (the value of seer fish is 3 to 4 times that of tuna (Table 3.16).

**Table 3.16 Species composition of tuna in landings: ISF gill-nets**

| Code | Local name | Species name | Wt in tonnes | % to total wt. |
|---|---|---|---|---|
| *C1 | *Kuttichoora*<br>*Pollal choora* | *Auxis thazard*<br>*Auxis rochi* | 4.6 | 63.01 |
| *K3 | *Kera choora* | *Thunnus albacares* | 1.1 | 15.07 |
| *N1 | *Nai-Meen* | *Scomberomorus commerson*<br>*Scomberomores lineolatus* | 0.5 | 6.85 |
| *T4 | *Theevi choora* | *Tuna* | 0.4 | 5.48 |
| *V1 | *Vava choora* | *Tuna* | 0.4 | 5.48 |
| *P1 | *Palla chura* | *Euthynnus affnis* | 0.3 | 4.11 |
| | Total | | 7.3 | 100 |

## Catch Per Unit Effort (CPUE)

### *DSFUs*

Catch per Unit Effort for gill-nets for DSFUs and ISFUs was analysed separately. CPUE for trips and CPUE of crew were separately calculated. To isolate the role of shark landings in long-line catch, the CPUE of that gear was divided into two categories: CPUE of sharks landed by long-line and CPUE for other fishes caught by long-lining. The CPUE of sharks landed by long-line shows that, on an average, about seven sharks' worth Rs 16362 were caught per trip by DSFUs. As in the case of export species like prawns and cuttlefish, shark also fetched high price. The average value was Rs 54 per kg during the period of the study. Similarly one crew was able to catch at least one shark per member which was worth Rs 2916 per trip (Table 3.17).

**Table 3.17 CPUE: Sharks**

| | No. | Kg | Value (Rs) | Avg. Value/No. (Rs) | Avg. Value/Kg (Rs) |
|---|---|---|---|---|---|
| CPUE /boat/trip | 7.23 | 303 | 16362 | 2263 | 54 |
| CPUE /man/trip | 1.33 | 54 | 2916 | | |

CPUE for long-lines other than shark reveals that other big-size fish in small numbers such as rays and skates fetched low prices. Though long-lining is targeted for sharks, a small number of fish of similar sizes are also caught. On an average, 28 kg of other fishes (worth about Rs 404) were caught the unit value of which came only to Rs 14 per kg (Table 3.18).

**Table 3.18 CPUE: Landings other than Shark**

| Month | No. | Kg | Value (Rs) | Avg. Value/No. (Rs) | Avg. Value/Kg (Rs) |
|---|---|---|---|---|---|
| CPUE /boat/trip | 1.09 | 28.85 | 404.52 | 371.11 | 14.02 |
| CPUE /man/trip | O.15 | 4.12 | 57.79 | | |

A large number of small fishes were caught in trips using trolling line and a variety of hand-lines. On an average each fisherman was able to catch 157 fish (84 kg) but which fetched only a low price of Rs 7.87 per kg. Fishermen gave scant attention to the preservation of the quality of fish caught with hand-lines primarily because of their abundance, low beach price, and comparatively high cost of preservation. However at certain times, like while fishing near natural reefs for *kalava* (January to March), hand-line catches fetch good price (Table 3.19).

**Table 3.19 CPUE: Hand-lines and trolling lines**

| Month | No. | Kg | Value (Rs) | Avg. Value/No. (Rs) | Avg. Value/Kg (Rs) |
|---|---|---|---|---|---|
| CPUE /boat/trip | 1097 | 589 | 4635 | 4.22 | 7.87 |
| CPUE /man/trip | 157 | 84 | 661 | | |

The CPUE of DSF gill-nets is characterised by larger species than of ISF gill-nets. As DSF gill-netting which involved long-stay fishing using long lines, or independent operations, particularly during the monsoon, the average landings and their value were quite high: 1189kg and Rs 14327 per trip. However, the unit value was comparatively low, only Rs 12 per kg. The probable reason for low price of DSF gill-net catch was the large share of tuna in it; it was also probably due to the fact that long-stay fishing brought to the shore catches which may not be as fresh as those of daily landings from ISF (Table 3.20).

**Table 3.20 CPUE: DSF gill-net units**

| Month | No. | Kg | Value (Rs) | Avg. Value/No. (Rs) | Avg. Value/Kg (Rs) |
|---|---|---|---|---|---|
| CPUE /boat/trip | 259 | 1189 | 14327 | 55.31 | 12.05 |
| CPUE /man/trip | 37 | 170 | 2048 | | |

***ISFs***

ISF gill-net units caught comparably low quantities of fish per trip. While deep-sea trips were of longer duration extending between two to seven days, with the majority returning on the fifth day of departure, inshore fishing was done in one-day trip. Both patterns have merits and demerits. Though ISFUs caught 69kg of fish per trip, they were able to fetch a higher price for their catch. The unit value they were able to fetch was double that of the DSFUs (Rs 28.35/kg against Rs 12.05/kg). This was primarily the premium received for quality fish, which single-day fishing by ISFUS made possible; poor preservation facilities available in DSFUs led to deterioration of quality of their catch. Moreover, the presence of high-value table-fish like seer added to the unit price of ISF catch (Rs 53/kg). Though DSF gill-nets caught more than three times the catch of ISF gill-nets per day, the former received only less than half the unit value of ISF catch. The need for improving the fish preservation facilities in DSF units is obvious (Table 3.21).

**Table 3.21 CPUE: ISF gill-net unit**

| Month | No. | Kg | Value (Rs) | Avg. Value/No. (Rs) | Avg. Value/Kg (Rs) |
|---|---|---|---|---|---|
| CPUE /boat/trip | 84 | 69 | 1956 | 23.30 | 28.35 |
| CPUE /man/trip | 23 | 16.15 | 458 | | |

The CPUE of different fishing methods in DSF units was compared and analysed with that of ISF units. Group effort enables to catch at least one shark (worth Rs 2916) per trip. The hooking rate per trip of fishes other than shark caught with long-lines shows that entangling of these fishes was only occasional and did not contribute much to the total pool for division among the crew. In contrast, hand-line catch has much significance at the individual level performance. Each member of the crew was able to catch an average 157 numbers of fish per trip while gill-net fishing yielded 170kg fish to the individual crew worth Rs 2048 per trip. The fishing effort in each of these gears contributed the crew a yield of 312kg fish worth Rs 5683 (Table 3.22).

**Table 3.22 CPUE: Deep Sea and Shallow water fishing units (returns per man per trip)**

| | | | No. | Kg | Rs |
|---|---|---|---|---|---|
| Deep sea | Long-line: | Shark | 1.33 | 54 | 2916 |
| | | Other than shark | 0.15 | 4.12 | 57.79 |
| | Hand-line: | Hand line and trolling line | 157 | 84 | 661 |
| | Gill net | | 37 | 170 | 2048 |
| | | Total | *196 | *312 | *5683 |
| Shallow water | | | #23 | #16.15 | #458 |

Note: * CPUE for long-stay fishing extends from 2 to 7 days; # CPUE for single-day fishing

The CPUE per boat per trip shows wide difference between the different gear categories among DSF units and between DSF units and ISF units. Though gill-net contributed the largest share (57 percent) to DSF units in terms of quantity (1189 kg/trip), the long-line component of shark fishing plays leading role in terms of value (Rs 16362/trip) contributing to less than half the share (46 percent) to the total income of DSF units. Hand-lines contributed to 28 percent of the total quantity but only 13 percent of value. The fishes other than shark in long-line catches played accounted for a major proportion in terms of both quantity (Table 3.23).

**Table 3.23 CPUE: Deep Water and shallow water fishing units (returns per boat trip)**

| | | | Kg | Rs |
|---|---|---|---|---|
| | Long-line: | Shark | 303 (14%) | 16362 (46%) |
| | | Other than shark | 28 (1%) | 404.52 (1%) |
| Deep sea | Hand-line: | Hand line and trolling line | 589 (28%) | 4635 (13%) |
| | Gill net | | 1189 (57%) | 14327 (40%) |
| | | Total | ***2109** | **35728** |
| **Shallow water** | | | **#69** | **#1956** |

Note: Figures in parentheses are percentages to total

* Long-stay fishing extends between 2 and 7 days
\# Single-day fishing

The ISFUs operating with gill-nets and engaged in daily fishing were able to catch only 69kg of fish worth Rs 1956. The month-wise CPUE of ISF shows wide fluctuations. They had good catch during the monsoon months (July-September) and the post-monsoon period (October-December), but only poor catch during the fair weather season (January-March). In the case of DSF units, the fishermen were able to catch, by experience a different variety available during the different seasons using a combination of fishing techniques. They were also familiar with high-yielding fishing grounds over the entire West Coast of India at different depth zones. These features characterise artisanal deep-sea fishing as unique.

**Earnings**

An ISF unit is operated with four members. The plywood boat is powered with OBM of 9.9 HP or 15 HP or 25 HP. The main components of recurring expenses for fishing are cost of fuel and pocket money for the crew. On an average, gill-netters propel their craft for three to four hours in a trip with variations over the season. Kerosene and petrol are the fuels used. On an average 22 litres of kerosene and 2 litres of petrol were consumed per trip costing Rs 250/trip. Bata for the crew, and expenses on food were the other components of recurring expenditure for each fishing trip. The average expenditure on food allowances for the crew of three to five fishermen was Rs 183 was (Table 3.24).

**Table 3.24 ISFUs: Recurring Expenditure**

| | Kerosene | | Petrol | Kerosene and Petrol | Other Exp. | Tot Exp. |
|---|---|---|---|---|---|---|
| | Litre | Rs | Rs | Total | Rs | Rs |
| Avg./Trip | 22 | 194 | 55 | 250 | 183 | 433 |

The recurring expenditure for DSFUs showed monthly variations. Its components were cost of diesel and expenditure on ice, food (for one week), port fee (if any), and crew allowances. The average expenditure per fishing trip was about Rs 9500 ranging from Rs 8500 to Rs 12000. During the monsoon season (July-September) the expenditure lies within the lower limit of Rs 9000, and it was in the upper limit of Rs 12000 during fair weather (January-March), and pre- monsoon seasons (April–May). The factors that would make it necessary to incur expenses at the higher levels were long-duration fishing, search for new fishing ground, and deep-sea fishing. The wide range observed at the upper and lower limits in expenses for fuel indicates that the fishermen were engaged during fair weather and pre-monsoon seasons (Table 3.25).

**Table 3.25 DSFUs: Recurring Expenditure**

| | Fuel Expense | | Other Exp. | Tot Exp. |
|---|---|---|---|---|
| Month | Liter | Rs | Rs | Rs |
| July | 413 | 4853 | 4295 | 9148 |
| Aug | 414 | 4859 | 3479 | 8338 |
| Sept | 348 | 4091 | 4243 | 8334 |
| Oct | 427 | 4013 | 5021 | 9034 |
| Nov | 384 | 4516 | 3173 | 7689 |
| Dec | 346 | 4071 | 2441 | 6512 |
| Jan | 308 | 3630 | 8813 | 12443 |
| Feb | 319 | 3751 | 8551 | 12302 |
| Mar | 271 | 3186 | 7175 | 10361 |
| Apr | 255 | 3003 | 7250 | 10253 |
| May | 215 | 2536 | 8791 | 11327 |
| Avg./Trip | 336 | 3864 | 5748 | 9612 |

* Note: Other expense includes Bata for crew, cost for ice and food.

The income and expenditure statement of DSF units reveals that, on an average, for one fishing trip, there will be a gross income of Rs 35728 and an expenditure of Rs 9612. The ratio between gross income and expenditure came to 3.5:1. In the case of ISFUs gross income and expenditure was Rs 1956 and Rs 433 respectively, showing a higher income - expenditure ratio of 5:1 (Table 3.26).

**Table 3.26 DSFUs vs. ISFUs: Income and Expenditure** (Average per trip)

| **Income/ Expenditure** | **Gross income** (Rs) | **Expenditure for fishing** (Rs) | **Ratio (G. Income: Expenditure)** |
|---|---|---|---|
| Deep sea fishing | 35728 | 9612 | 3.5:1 |
| Shallow water fishing | 1956 | 433 | 5:1 |

In DSF units, the sharing pattern differs within each combination of fishing gears. In the case of long lines, the net income – income after expenses for food, fuel, and pocket money - is divided into two-and-a-half shares. One share goes to the craft, half for the long-line, and the remaining one to the crew. In combination-fishing with gill-net, long-line, and hand-line, a larger share is allocated to the crew because of the higher involvement of skilled manpower in this operation. The net income is shared in such a way that a higher share (of 1.25) goes to the crew and the remaining one share to the fishing units. Thus the net effect in the sharing pattern was that about half the share goes to the owner and the remaining half equally divided among the crew. The pattern of sharing is the same for ISFUs also.

As per the norms of sharing, a member of the crew working in the DSFU earns Rs 350 per day and his counterpart in the ISFU earns Rs 190 per day. The DSF owner gets an amount of Rs 12000 per week in long fishing trip whereas the owner of the ISFU would get only Rs 750 for a one-day fishing trip. However, investment per ISFU is lower; only Rs 1.5 lakh to 1.8 lakh. The corresponding figures for DSFU is Rs 7 lakh to 12 lakh including other expenses on repairs, maintenance, depreciation, and interest on capital.

The DSF units were able to catch 2109kg fish worth Rs 35728 in a weekly trip. The corresponding expenditure per trip was Rs 9612. On an average, one boat was able to do 35 weekly trips in a year. Thus all together, the 320 boats land a quantity of 23,000 tonnes per annum worth Rs 40 cr at beach prices.

A techno-economic analysis of deep-sea fishing revealed that DSF has unique features that sustain the fishery as well as the economy of the units. Success in fishing operations coupled with courage and skill, sustainable fishing, eco-friendly fishing practices, and inherent advantage in marketing of produce are the major factors behind the success of DSF artisanal fishery.

Long-stay fishing, flexible fishing operations during the different seasons, combination-fishing, passive fishing methods, and concerted and continuous fish-finding efforts using high skills are the features of artisanal DSF. Rigorous fishing irrespective of State boundaries at great depths ensures success in fishing operations unlike in ISF fishing. DSF fishermen have greater choice of locations, gears, fishery, and market. Passive fishing methods by selective gears, timely response to stock depletion by appropriately changing fishing practices (eg: demersal shark-fishing to pelagic fishing) enable sustainable fishing over time. The inherent advantage of a high level of demand for shark meat and other shark produce at the local and the international markets and the existing wide marketing network are factors favourable to deep-sea fishing.

## 4. Socio-Economic Profile of Deep-Sea-Going Artisanal Fishermen

The overall impression about traditional fisherfolk is that they constitute a marginalised community. There may be exceptions in some sub-segments of the community such as deep-sea-going fishermen. In this section, an attempt is made to examine whether higher income of deep-sea-going fishermen are reflected in their socio-economic status in comparison with that of ISF groups.

### Age composition

About one-half of the DSF fishermen belong to the youthful age group 25 to 34 years; in the case of ISF fishermen, the corresponding proportion was only 10 percent. The lower age group 19-24 years accounted for about 10 percent of DSF fishermen as against about one-fourth among ISF fishermen. Among DSF fishers, nearly one-third belonged to the age group of 40 years and above while only less than one-fifth was found in this age group among ISF fishermen (Table 4.1).

Table 4.1 Age compositions of fishermen

| **Category** | **Age class** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **19-24** | **25-29** | **30-34** | **35-39** | **40-44** | **45-49** | **>49** | **Total** |
| DSG F.men (%) | 10 | 28 | 22 | 8 | 10 | 10 | 12 | 100 |
| ISF F.men (%) | 24 | 22 | 18 | 18 | 8 | 6 | 4 | 100 |

### Marital status

The proportion of the married was higher among deep-sea-going fishermen (82 percent) than among ISF fishermen. Steady and higher-level incomes could have been a factor for this higher percentage observed primarily among the lower age groups. More of the DSF fishermen lived in joint families even though the difference between the two groups is not large. Migratory fishing and consequent long absences from home may be one of the reasons for the higher proportion of joint families observed in the DSF group (Table 4.2).

**Table 4.2 Marital Status and Family Setup (in percentage)**

| **Category** | **Marital Status** | | | **Family Set-up** | |
|---|---|---|---|---|---|
| | Married | Unmarried | Total | Single Family | Joint Family |
| DSGF F.Men | 82 | 18 | 100 | 56 | 44 |
| ISFF F. Men | 74 | 26 | 100 | 63 | 37 |

## Family size

The proportion of households which have less than five members is 45 percent for the two groups taken together, 36 percent for deep-sea-goers and 54 percent for ISF fishermen. In joint families, immediate family members such as grand parents also live (Table 4.3).

**Table 4.3 Family Size**

| Category | Family size in median | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **3** | **4** | **5** | **6** | **7** | **8** | **>9** | **Total** |
| DSF F.men | 4 | 16 | 16 | 12 | 18 | 10 | 24 | 100 |
| ISF F.men | 10 | 22 | 22 | 12 | 6 | 8 | 20 | 100 |
| Average (%) | 7 | 19 | 19 | 12 | 12 | 9 | 22 | 100 |

The majority of the parents of fishermen (84 percent fathers and 60 percent mothers) were illiterate. Mothers are more educated than fathers. The mothers are mostly housewives (93 percent) (Table 4.4). Most of the literates do not have education beyond the elementary level. The new generation shows high levels of education. A few college students were found among them. The presence of St. Jude College in the locality has encouraged education in this area.

**Table 4.4 Education and Occupation of Parents (in percentage)**

| | **Class of study** | | | | | **Occupation** | |
|---|---|---|---|---|---|---|---|
| Father | Illit | 1-4 | 5-7 | 8-10 | Total | | |
| | 84 | 13 | 3 | 0 | 100 | Fishing 100 | |
| Mother | 60 | 7 | 26 | 7 | 100 | H. Wives 93 | F. Vending 7 |

## Occupation

The occupation of parents is fishing while the majority of mothers (93 percent) were housewives; fish-vending was practised by a small minority of 7 percent.

The proportion of the new generation taking to fishing is small (19 percent of the boys); only 2 percent of the girls are found to have entered fish-vending.

**Table 4.5 Status of Wives and Children**

| Wives | | | Children | | | | | |
|---|---|---|---|---|---|---|---|---|
| House wives | F. Vending | Tot | Kids | Un Emp. | Fishing | Student | F. Vending | Tot |
| 96 | 4 | 100 | 46 | 20 | 19 | 13 | 2 | 100 |

**Land**

Both the categories of fishermen live in tiny plots; more than one-half of them live in plots of less than four cents; another one-third in plots of 5 to 10 cents. Only about 5 percent have plots in the range of 11 to 17 cents (Table 4.6).

**Table 4.6 Size of Land Owned (in percentage)**

| Category | Land owned by the fishermen (cents) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2-4 | 5-7 | 8-10 | 11-14 | 15-17 | Total |
| DSF groups | 0 | 56 | 28 | 12 | 4 | 0 | 100 |
| ISF group | 16 | 50 | 22 | 6 | 2 | 4 | 100 |
| Average (%) | 8 | 53 | 25 | 9 | 3 | 2 | 100 |

A significant proportion among the ISF fishermen (16 percent) lived in extremely small plots of 1 cent. In general, the plots owned by DSF fishers were slightly larger than those of the ISF group.

**Housing**

More than four-fifths of the sample fishermen (of both the categories) owned houses. The rest lived with their relatives. The majority of the houses had cement floor (89 percent) and 80 percent mud floor. Only 2 percent of houses had sand floor, and those were owned by ISF crew. Interestingly, one percent of the houses, owned by DSF fishers had mosaic floor. About three-fourths of the houses had plastered brick walls and nearly one-sixth, thatched walls; of the houses with thatched wall, ISF group owned 12 percent, DSF group 4 percent.

Forty percent of the houses had tiled roofs and 20 percent built had reinforced concrete, asbestos sheet or thatched roof. More of DSF fishers lived in houses with concrete or tiled roofs whereas more of ISF fisher folk (+12 percent) lived in houses with roof of asbestos sheet (Table 4.7).

**Table 4.7 Condition of Housse: Roof (in percentage)**

| Category | Thatched | Asbestos | Tiles | Concrete | Total |
|---|---|---|---|---|---|
| DSF group | 22 | 12 | 44 | 22 | 100 |
| ISF group | 20 | 24 | 36 | 20 | 100 |
| Average (%) | 21 | 18 | 40 | 21 | 100 |

The vast majority of houses consisted only of a hall and a kitchen. Very few houses had latrine and bathroom facilities (Table 4.8). DSF unit owners and crew had better facilities (Table 4.8).

**Table 4.8 Rooms Available in Houses**

| | Sit-out | Hall | Dining hall | Kitchen | Latrine | Bath |
|---|---|---|---|---|---|---|
| | Figures are in percentage | | | | | |
| DSF. F.men | 16 | 47 | 18 | 49 | 23 | 8 |
| ISF F.men | 13 | 34 | 10 | 47 | 9 | 2 |
| Total | 29 | 86 | 28 | 96 | 32 | 10 |
| Without that room | 71 | 14 | 72 | 4 | 68 | 90 |

**Drinking water**

Almost all fishermen (97 percent) depended on the public tap for drinking water, but none had house connection. Community wells were used by very few (three percent) households (Table 4.9).

**Table 4.9 Source of Drinking Water (in percentage)**

| Category | Own tap | Public tap | Community well | Own well | |
|---|---|---|---|---|---|
| DSF group | 0 | 94 | 6 | 0 | 100 |
| ISF group | 0 | 100 | 0 | 0 | 100 |
| Average (%) | 0 | 97 | 3 | 0 | 100 |

**Toilets**

Seventy percent of houses had no toilets. DSF owners owned one-half of the total number of toilets; about one-fourth belonged to DSF crew; and the rest (one-fourth) were owned by owners and crew of ISF units (Table 4.10).

**Table 4.10 Toilet and Electrification (in percentage)**

| Category | Toilet | No toilet | Total | Electri fied | Non-electrified |
|---|---|---|---|---|---|
| DSF group | 44 | 56 | 0 1002 | 72 | 24 |
| ISF group | 16 | 84 | 0 1002 | 68 | 32 |
| Average (%) | 30 | 70 | 0 1002 | 72 | 28 |

More than one-fourth of the houses did not have electrification. Of the total electrified houses, about 20 percent each owned by DSF and ISF owners and nearly 15 percent each by the DSF and ISF crew.

### Information facilities

Very few had access to newspapers, radio or television. Radio was the mass media for about one-fourth of the households (24 percent) and none of the houses subscribed to newspapers. However, about one-eighth of the houses had television and two percent had telephone connections (Table 4.11).

**Table 4.11 Information Facilities in Households (in percentage)**

| | TV | Radio | Newspaper | Telephone |
|---|---|---|---|---|
| DSF. F.men | 8 | 19 | 0 | 2 |
| ISF F.men | 4 | 5 | 0 | 0 |
| Total | 12 | 24 | 0 | 2 |
| Households without that items | 88 | 76 | 100 | 98 |

### Vehicles

Of the 200 sample households, only one owned a car and eleven a cycle. The vast majority did not have any vehicles at all.

**Table 4.12 Details of Vehicles in Households (Number)**

| | Car | Cycle | Others |
|---|---|---|---|
| DSF. F.men | 0 | 8 | 0 |
| ISF F.men | 1 | 3 | 0 |
| Total | 1 | 11 | 0 |
| HHs without that vehicle | 199 | 189 | 200 |

**Fishing details**

Nearly one-half the sample fishermen had work experience for period of 10 to 20 years. A significant proportion (6 to 10 percent) still continues in fishing after the 'retirement' age of 55 years. This phenomenon is higher among the deep-sea fishing age group (Table 4.13).

**Table 4.13 Experience in Fishing (in percentage)**

| Category | Experience in years | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31-35 | >35 | Tot |
| DSF F.men | 4 | 14 | 18 | 26 | 10 | 10 | 8 | 10 | 100 |
| ISF F.men | 8 | 12 | 24 | 28 | 8 | 12 | 2 | 6 | 100 |

Though the DSF fishermen were highly experienced, irregularity in fishing has been noticed among them. Repair and maintenance of fishing implements was the main reason reported. Poor fishing season, lack of working capital, and family problems were the other reasons stated for irregular fishing. Tale 4.14 gives the details.

**Table 4.14 Reasons for Not Going for Fishing Regularly**

| Poor Season | Rough weather | Repair | Lack of working capital | Family Problem | Holiday mood |
|---|---|---|---|---|---|
| Responses in percentage | | | | | |
| 16% | 15% | 20% | 16% | 15% | 18% |

For 20 percent of household living expenses were met from fishing; another 7 percent were able to meet half the expenses from receipts from other family members and relatives. Nearly 70 percent met their total household expenses from receipts from family members such as fishermen and women workers, children and relatives in the household. The joint family system prevailing in the fishermen community enables the pooling of income from the different members of the household.

Most fishermen borrow money to meet their daily expenses. It is men who borrow more than women. Borrowing is resorted to also for meeting medical expenses and education of children. Repayment of loans is observed to be regular and prompt.

Nearly 45 percent of the crew in DSF units had come from other types of fishing units. Participation in deep-sea fishing has enabled about one-half the entrants to deep-sea fishing to own the production means (worth Rs 8 lakh to 12 lakh). Another one-fourth changed their status from owners of ISF units to high-earning crew in DSF units.

The majority of owners (95 percent) of 71 DSF units are seen to have made their purchases since 1991. More than 70 percent of the crafts were newly-built ones.

**Problems in Deep-Sea Fishing**

***Prolonged absence from family***

DSF fishermen have to be away from home for long periods of the year. Many problems arose in their households due to their long absence such as inadequate attention to children, financial constraints caused by problems of home remittances, and lack of supervision of children's education. The spouses left behind often lacked the capacity to manage household affairs.

Frequent contact through telegram, telephone, letter, and money orders were some of means by which they kept in touch with the family. They looked forward to local assistance from institutions such as co-operatives for financial assistance to tide over problems at home during their absence.

***Safety and security at destinations***

Migration for fishing to unfamiliar seas in far away places is attended by several problems. The environment might be totally different. Local fishermen might feel that the outsiders are depriving them of their fish resources. Marketing the produce, malpractices and *goonda* menace are some of the problems the in-migrant fishermen face. Illiteracy, unfamiliar language, hassles with coast guards, ignorance of rules and regulations of navigation are issues that make the situation more difficult for them, especially when fishing in deep waters of border seas near Pakistan and Sri Lanka. A number of cases of coast guards of these countries rounding up fishermen from India have been reported (Table 4.15).

**Table 4.15 Major Problems Encountered by Artisanal Fishermen in Deep-sea Fishing**

| Problems | No. of Responses |
|---|---|
| Interference of Coast Guard | 84 |
| Caused by Commercial ships | 46 |
| Danger to life | 32 |
| Problems caused by other fishing vessels | 14 |
| Poor condition of boats | 8 |
| Attacks by blue whale | 8 |
| Health problems due to long stay at sea | 8 |
| Lack of equipment suitable for deep-sea fishing | 8 |
| Problems caused by customs | 8 |
| Rough sea | 4 |
| Others | 14 |

Legal action taken by the customs authorities on charge of absence of proper documents, poor condition of fishing vessel, and frequent hassles with coast guards (off Bombay and Gujarat coasts) were some of the other problems reported by the respondents. By far the most serious among the problems is caused by coast guards. Quite often the authorities suspect the fishermen to be smugglers. The presence of LTTE cadres in the Palk straits is a nightmare to the DSFUs. A number of fishermen arrested by coast guards still languish in the prisons of Sri Lanka. Similar cases are also reported from Pakistan. The whereabouts of some fishermen who ventured into the seas of other States for fishing remain unknown.

In the face of such hazards, deep-sea fishermen formed an Association of Deep-Sea-Going Artisanal Fish Workers in the year 1991. The first priority was given to tackle problems with coast guards. The fishermen approached one of the NGOs namely SIFFS to assist them in dealing with their problems. In association with SIFFS, they discussed problems with the coast guard officials and established some rapport with them. The coast guards now deal with the fishermen much more amicably. At times, the coast guards even accompany the fishermen on their trips to the sea helping them to locate high-yielding fishing grounds, off Goa. Coast guards are highly impressed by the skills of the fishermen in locating positions in the open deep-sea without any navigational equipment, which is an impossible task for them.

In the absence of navigational device fishermen depend on the positions of celestial bodies and visual triangulation techniques for position-fixing. Lately, fishermen have realised the need for acquiring navigational equipment for safe fishing at deep-sea. Mariners' compass is the first device which they adopted. It has enabled them to locate fishing ground and to reach at the same location in next trip without great effort. At present, the majority of deep-sea-going boats (86 percent) have the mariners' compass.

The use of navigational chart to locate fishing ground was another step. Availability of lighthouse for position-fixing and direction-finding used to be the technique adopted to locate the fishing ground. Lighthouse installed along the coast emits distinguishable light. Recognition of the light beams by the naked eye while on board the fishing boat and finding the location from the charts constituted the initial learning process. These lights would be visible at a distance of 50 to 70 km. Use of navigational charts for position-fixing required training and therefore only a few boats (2 percent) use charts.

Use of fish-finding equipment is a later development. Echo-sounder, which was developed originally for safe navigation in deep waters, was later modified for detection of fishes in the sea. It produces and transmits ultrasonic sound waves and receives its echo. The time taken between a transmission and reception gives an indication of distance or depth. The white-line technique introduced later has enabled to separate bottom fishes from bottom echoes.

Use of the satellite navigation system by DSF fishermen indicates that have gone for the latest technology. The SATNAV system works on the basis of signals captured from a number of artificial satellites and fixing the position. The ease of operation and the comparatively low costs involved have made them attractive to increasing numbers of fishermen for deep-sea fishing (Table 4.16).

**Table 4.16 Equipment Used by DSF Fishermen**

| Equipment | Shark-lining owner | Shark-lining crew | Total |
|---|---|---|---|
| Compass | 46 | 44 | 90 |
| Echo-sounder | 36 | 42 | 78 |
| Radio Telephone | 24 | 28 | 52 |
| G.P.S | 14 | 12 | 26 |
| Foreign fishing method | 12 | 10 | 22 |
| Wireless | 10 | 10 | 20 |
| V.H.F | 6 | 10 | 16 |
| Navigation chart | 6 | 6 | 12 |
| Storage facility | 0 | 2 | 2 |

There is now increasing demand among deep-sea fishers for echo-sounders. Compasses with additional features are also in demand. Radio-telephones too have captured the attention of these fishermen. This would enable routine communication among fishermen while at sea and ensure safe fishing. Attempts are being made with the initiative of SIFFS to establish a radio-telephone network among the fishermen and related agencies.

***Problems in marketing***

Shark and shark products have good demand in both domestic and international markets. Fins, meat, liver, bone, and teeth of shark have separate uses. No body part is waste. Finished product of fin rays fetch Rs 3000 to Rs 3500 per kg depending on quality. The parameters for determining quality are size of the fin, length of the fin base, and species quality. Fins obtained from the species *Carcha hinus limbatus* and *C. melanoptreus* are considered to have the highest quality. Fresh shark meat with fins fetches Rs 40 to Rs 70 per kg. Shark liver oil is famous for its rich content of Vitamin D.

The discussion group comprising senior fishermen revealed that selling of deep-sea produce particularly shark and shark products used to be a major problem in the past, particularly selling to distant places. Currently, they conduct the business of direct marketing of deep-sea produce taking upon themselves all the risks involved.

DSF units migrate to distant ports in small groups of 10 to 15 boats. They set soil with adequate stocks of food and drinking water. Arrangements for accommodation and sales of produce are also made in advance. They raise the working capital jointly and manage all their requirements collectively. The task of management is entrusted to persons with skills and expertise. Mostly the owners, who quite often remain on land, undertake management responsibilities. Gradually some of the persons engaged in the fishing activity gain skills in marketing of the produce come to know of various opportunities on the business of deep-sea fishing and emerge as entrepreneurs in marketing.

Some of the boat-owners sold out their boats and turned middlemen establishing a symbiotic relationship with fishermen. Some of the crew who had the opportunity to intervene in marketing changed their occupation from fishing to marketing. There were cases of success and failure in the specialisation and entrepreneurial development process. Mobilisation of initial capital, establishment of contacts in the distribution channel, and extending support to the fishing units by providing working capital were the services rendered by resourceful merchants. Some of the services provided by such merchants to the DSF units are listed below:

1. Taking the fish catch from the landing centre;
2. Lending for meeting the repair work;
3. Lending for purchase of fishing implements;
4. Lending as working capital;
5. Arranging accommodation at different ports;
6. Clearing the formalities if any with port officials;
7. Information the fishing seasons at the various ports; and
8. Providing ice and other fish processing means.

The majority of the respondents expressed satisfaction over the services rendered by merchants. The boat-owners are of the opinion that merchants provide timely and on-the-spot help, which could not be offered by anybody else. “We don’t mind paying them a little more for their services because they deserve it”. As the amounts borrowed for fishing are deducted from the gross earnings, boat owners lose more if the merchants charge higher rates of interest. Confidence in the creditworthiness tested through long association could be the reasons for continuance of the system without serious hitch.

The merchants who deal with the marketing of shark and shark products belong mostly to the Thoothor and the Pozhiyoor regions and are the relatives or neighbours of the fishermen. These merchants extended services such as timely marketing of the catch and providing working capital of the order of Rs 0.5 lakh to 1 lakh per boat. Each merchant purchased the catch as well as they took care of the requirements, of about 10 to 15 boats in a group. Besides, the marketing of fish, the merchants arranged food, accommodation, fuel, drinking water, and clearance certificate from the port authorities whenever necessary. They also provided information on good landing places at the different ports.

**Socio-economic indicators of the merchant class**

The housing conditions, land holding patterns, and means for marketing of produce of the merchant class are seen to be quite different from those of the fishing crew and boat owners. The qualitative investigation of 10 cases (out of about 20 merchants in this belt) revealed that a handful of them had moved from the crowded fishing village to areas close by. The general picture of fishing village is that of a coastal road passing through it with crowded fishing hamlets on the sea-ward side. Nearly half the merchant groups has moved to the land-ward side of the road. A few of them have constructed two-storied buildings with modern furnishings and facilities. They have sheds, curing tanks, vehicles, and telephones, which are some of the essential pre-requisite to run the business successfully. Formerly they were owners or crew in DSF units. They are at present exclusively involved in the marketing of shark meat and shark products like fin and liver oil.

There are merchants who still reside in the village, but playing only a limited role, of procurement of fish from the landing centres. They directly participate in the auction and procure the fish mostly on behalf of merchants who have the infrastructure and business acumen for marketing.

Collecting the catch and its preservation by salting aid marketing. The shark fins are removed and dried separately, and sold to wholesale merchants who export the finished product in the name shark fin rays. Singapore, Malaysia, and Japan are the major markets. In the case of meat, whenever a full lorry load of catch is collected, the trucks move to the interior domestic markets situated mostly in the different parts of Kottayam and Idukki districts of Kerala. The nature and length of the marketing chain, the margins to intermediaries at the different stages of the chain, expenditure on various services at each stage of transaction extending from the producer to the consumer, the nature of credit support provided by the merchant-cum-moneylender and the symbiotic or parasitic nature of the relationship between them are aspects that merit further investigation.

**Support systems**

Deep-sea-going artisanal fishermen face several problems for the solution of which they have initiated some measures on their own. Deep-sea fishing is an enterprise which has few parallels and which requires well-thought-out and comprehensive measures for solution of problems faced by it. The enactment of DSFP in 1991 and the subsequent emergence of an uneven playing ground for the participants, particularly for the artisanal group, call for a re-examination of the situation. The other two groups (deep-sea fishing shrimp trawlers owned by the Indian companies and foreign deep-sea trawlers) have made their entry into fishing availing the benefits offered by several organisations whereas DSF artisanal group ventured into deep-sea fishing on their own initiatives by way of a response to their trying socio-economic and community conditions. They have found it impossible to solve many of their problems by themselves. The present status of their involvement with organisational support systems for DSFUS is reflected in Table 4.17.

**Table 4.17 Membership of DSFUs in Organisations**

| | Organisations | | | | | | |
|---|---|---|---|---|---|---|---|
| **Category** | **Govt. cops** | **NGO cops** | **SIFFS** | **Church** | **Trade union** | **Pancha-yat** | **Total** |
| Owner (%) | 2 | 2 | 14 | 24 | 0 | 0 | 42% |
| Crew (%) | 2 | 0 | 7 | 30 | 0 | 0 | 39% |

The majority of owners and members of the crew have membership in the church and they pay the monthly subscription regularly and without default, due mainly to the strength of their faith. They attend the holy mass every Sunday. Though the church provides them the religious support, it seldom intervenes in issues of fishing and related activities.

South Indian Federation of Fishermen Societies (SIFFS) is another organisation in which most owners of DSF units have become members. Boat-owners approached SIFFS after organising themselves, under the umbrella of Deep-Sea-Going Artisanal Fish Workers Association and asked for affiliation under SIFFS. SIFFS is the apex body of a three-tier organisation of small-scale artisanal fish-workers. SIFFS gave associate membership to this organisation in the year 1991 and started working with them by intervening in several issues. A few members of the crew are also members of SIFFS.

Though the initial attempt was to intervene mostly in issues of dealing with the coast guard and technological up-gradation, later interventions became ineffective due to a number of reasons. DSF fishing has its own merits, demerits and problems and prospects, which are different from those of the existing inshore-fishing units. A different strategic approach is required to make SIFFS interventions effective to find answers to problems of technological upgradation, strengthening of the resource bases, identification and promotion of forward and backward of linkages of deep-sea-fishing and development of the marketing channels and methods.

## 5. Conclusions and Recommendations

### Conclusions

The artisanal group display many distinct features which place them in a unique category among deep-sea-fishing groups and distinguish them from other artisanal groups. Its uniqueness lies in two aspects, technological and socio-cultural.

#### *Technological*

The technological features that make them different are the following:

1. Deployment of different combinations of fishing gear targeting a variety of fish species.
2. Extensive and migratory fishing over the entire West Coast of India.
3. Low cost but highly skilled and knowledge-based technology employed without resort to costly electronic equipment meant for deep-sea fishing.
4. Use of simple and comparatively low-cost fishing crafts.
5. Continuous and sustained improvement in fishing techniques and gear in response to the fluctuations in resource base.
6. Long-stay weekly fishing extending up to seven days.
7. Use of mechanical energy for reaching the fishing ground and non-use of mechanical energy for operation of fishing gears.
8. Use of indigenous and traditional skills appropriate to the local resource base.
9. Selective fishing by using a particular size of mesh in gill-nets and hook-size in long-lines.
10. Non-destructive, sustainable, eco-friendly and selective fishing, avoiding young fishes and other flora and fauna unlike in trawler-fishing.

Artisanal fishers claim that they are the children of Mother Sea. Through continuous interaction they have learnt the hidden intricacies of the vast expanses of the sea. They have rich knowledge of the pattern of ocean currents during each season, and of plankton bloom and its correlation with fish production. By merely looking at the colour of the sea (plankton bloom) they predict the immediate fishing potential and the species that would be available, by correlating the food chain and the annual weather cycle. They are aware of the complexities of tropical fishery and the availability of a variety of species in small quantities at different seasons. Accordingly they have designed and fabricated a variety of fishing gear to catch diverse species of fish available at different seasons of the year.

Artisanal fishermen have gained mastery over the fishing gear by constant interaction with the sea under compulsions of earning a livelihood.  None is more concerned than the fishermen to ensure the sustainability of resources of the size. The design details of their fishing gear and their fishing methods incorporate features to ensure sustainability and the sharing of common property resources. The genuine community perspectives of sharing and sustainability are reflected in the mix of practices and the technology employed listed below:

1. Excluding juveniles by selecting a combination of netting with different mesh size and selecting different sizes of hook for different lines;
2. Use of different fishing gears to target different species and sizes of fish (eg. 10mm small meshed net for catching anchovies, and 250 mm large meshed nets for large shark);
3. Passive methods followed for fishing in which fish come and get entangled instead of chasing and catching them with active gear using high techniques and large equipment.

The commercial fishing gear designed by gear technologists has greater catching efficiency. But does not take care of the other subtle intricacies of fishery particularly fisheries of tropical areas. These gears are 'active' in nature – chasing the fish with intricate equipment and using large amounts of mechanical energy unlike in traditional fishing which uses shooting and hauling of the gear (e.g. in trawling and purse seining). The features the gear used, that is, whether it is passive or active have a direct implication for the sustainability and economic viability of fishing operations. The choice of technique determines the volume and quality of output and the pattern of its sharing. Striking contrasts exist in these respects between artisanal deep-sea fishing and Indian deep-sea fishing using trawlers.

***Socio-cultural***

Deep-sea artisanal fishing has evolved as a continual improvement process over centuries in the social and cultural setting of the coastal areas of Kerala and has enjoyed favourable market conditions for its output, particularly for shark and shark products. The major features of the socio-cultural features include the following:

1. Inherited knowledge system and traditional skills acquired through trans-generational processes.
2. Accumulated knowledge gained from continuous interaction with the sea
3. Initiation of the learning process from early childhood.
4. Skill development through responsible methods of learning in a community context.
5. Proactive and timely responses to changing fishing technology over time.
6. Continuous assimilation of positive features of traditional fishing practices in the system.
7. Positive and ready response to potential opportunities in the market
8. Capability to pursue risky and adventurous economic activity in competition with 'modern technology and capital-intensive corporate businesses'.

Community learning is an inherited process handed down from generation to generation and from master craftsmen to enthusiastic learners. The curriculum is very special and continually revised to respond to new changes; the process is one of learning by doing. The means of learning and the age at which learning begins are also unique. There exists an inherited body of knowledge and a set of skills and traits. The knowledge base comprises relevant information and collective memory of case histories of fishing episodes, learnt mostly from elders. Besides, the repository should include skills to translate knowledge into action and to improve them on the basis of results. The skill development and learning process starts at the early age of seven; it may begin at slightly higher age also, but never by later than 13 years. Thus the knowledge acquired through informal learning and acquisition of skills through rigorous practice from early childhood prepares them to perform the daring task of deep-sea fishing with artisanal tools and techniques, a task which is well-neigh impossible for any other category of fishermen.

A proactive approach to technology blended with traditional resource conservation practices is another important merit of artisanal deep-sea fishing. The group makes positive responses to technological advances even risking their hard-earned money. Some boats have fish-finders - a modified echo sounder with video screen display, which enable them to trace the water column for fish. However, the majority confine to the use of traditional skills to find positions at the open sea, particularly of natural reefs. Most of them possess good mental maps of the sea floor, location of natural reefs and high-yielding fishing ground, which make fish-finding equipment unnecessary for them.

The deep-sea going fishermen face higher risks than other fishermen. Higher returns accrue to them particularly from shark and shark products sold in domestic and foreign markets. Some fishermen who did not go to sea but preferred to remain on land took to the sale and marketing of the produce. They realised gradually the potential of marketing the produce, and emerged in course of time, as a merchant class, from among the fishing group.

**DSF *Vs* ISF artisanal groups**

1. The artisanal ISF group fishes in the continental shelf of the ocean floor whereas the DSF group fishes mostly on the continental slope.

   The DSF group occasionally moves to the shallow seas (mostly during monsoon) and to the abyssal plane of the ocean comprising of oceanic trenches which they call *kayam;* which means unfathomable depth) during non-monsoon months.

2. The DSF group uses long-lines to target large-size sharks, rays and skates and gill-nets to target oceanic tunas, marlins, and also sharks whereas the ISF group uses gill-nets to target seers and little tunas.

   The DSF group also uses a variety of small-lines such as surface, mid-water and bottom hand-lines, to target smaller and medium-size fishes. These are the gears used also for seasonal fishing on natural reefs.

The species composition of ISF gill-net units show that as the gear is targeted at tuna and seer, which constitute one-third of the total catch by weight. Scads and mackerel form another one-third. The remaining part is a mix of different species.

3. The DSF catch comprises 17 species of sharks, the predators occupying the top-most position in the food web.

   Sharks play an important role in the keeping of the ecological balance, by controlling the excessive growth of other fishes. Slow growth rate, low fecundity, and long period of gestation are the major factors that control shark population intact and arresting the decline of fish species at the lower levels of the food chain. Therefore, external interventions such as fishing would cause imbalance in the population base of sharks.

   One of the important indicators of the population dynamics of shark was that a decreasing trend in its average size. Fishermen who are aware of the declining stock in demersal population of shark manage the situation by targeting pelagic sharks and operating the long-line at the sea surface.

4. CPUE per trip during the study period was 69kg fish (worth Rs 1958) for ISF units and 2109kg (worth Rs 35728) for DSf units.

   The CPUE for ISF was the highest during the monsoon months (July-Sept), very low during the fair weather season (Jan-Mar) and rising during the pre-monsoon season.

   The landings by DSFUs are more or less stable around 1000 tonnes per month. The fluctuations were less during the monsoon months (July-September), and prices remained at around 40 percent below average during the post monsoon season (October-December) and at 40 percent above average during the fair weather season (January to March).

A number of parameters related to cost and earnings were analysed and compared between the DSF and ISF fishing groups. The salient features are listed below.

1. On an average an artisanal DSF unit was able to earn a gross income of Rs 35728 and it incurred an annual expenditure of Rs 9612 per fishing trip. The gross income-expenditure ratio was 3.5:1. Similarly, in the case of ISF units the gross income and expenditure were Rs 1956 and Rs 433 respectively per one-day fishing trip, showing a higher income-expenditure ratio of 5:1.

2. A crew member working in a DSF unit was able to earn Rs 350 per day as against only Rs 190 learned by a crewmember of an ISF unit.

3. A DSF unit owner gets an average amount of Rs 12000 for a week-long fishing trip and the ISF owner only Rs 750 for a one-day fishing trip. However, the ISF owner invests only Rs 1.5 lakh to 1.8 lakh as capital whereas the DSF owner makes a much

higher investment, Rs 7 lakh to 12 lakh. Out of their net incomes both types of owners had to meet all expenses related to maintenance and repairs of fishing gear and crafts and provide for fishing units such as repair, maintenance, depreciation, and interest on capital investment.

4. DSF units catch, on the average, 2109 kg of fish worth Rs 35728 in a weekly trip. On an average one boat makes 35 weekly trips in a year.

The DSF group may be sub-divided into three categories:

1. Merchants with adequate financial sources, who deal in the deep-sea produce, and who have evolved from among DSF fishing groups;
2. Owners of DSF units who have high earnings and live in comfortable conditions.
3. DSF crew which earn fairly good income, but definitely higher than of the ISF crew, living approximately in the same conditions in which ISF crew live.

Merchants and DSFU owners show great attention to the education of their children. They look forward to joining the mainstream and upward social mobility.

**Suggestions**

1. Deep-sea Fishing by artisanal fishermen is economically viable and ecologically sustainable. On the contrary, medium and large fishing fleet of India have not succeeded economically and their activities are ecologically non-sustainable.
2. Through the DSFP, the Government of India have opened up the country's lesser-exploited deep-sea resources to foreign DSF companies enabling them to re-deploy their fleets from intensive fishing areas.
3. Extensive revision of DFSP, 1991, is required to bring under its purview of policies and programmes formulated for redeployment of small-scale coastal fishers from over-exploited inshore fishing grounds to deeper waters, in view of the excellent performance of the artisanal DSF group.
4. The total stock of 1.64 million tonnes of deep-sea resources comprises 45 percent of pelagic, 40 percent demersal, and 15 percent oceanic species (Sudarsan, 1991). The major fish groups are the threadfin breams, yellow fin tuna, pelagic sharks, cephalopods, carangids, and shrimps in the order of abundance. The artisanal deep-sea fishermen catch yellow fin tuna, pelagic shark, and carangid. A system may be evolved to empower them for catching the remaining minor deep-sea fish resources.
5. Unlike the capital-intensive fishing fleets, the artisanal DSF group requires decentralised organisational support through local bodies like co-operatives and *panchyats*. These autonomous and semi-government institutions would be able to solve the problems arising from shift of fishing grounds from territorial waters to the national waters and

problems of technology, marketing, safety measures and so on. With such support, the hardships of small-scale deep sea fishing may be reduced.

6. Over-exploitation of inshore resources at or beyond MSY level calls for the attention of all parties concerned with the future of the fisheries sector. Several researchers have proposed deployment of fishing units to deeper seas. Absence of a feasible model has remained the major bottleneck. The artisanal groups have already ventured into the so-called difficult-to-harvest deep-sea resources and developed a model by themselves without any external intervention. However, the replicability of this model is limited since the model involves the availability and the use of specialised knowledge and skill not easily transferable to the average fisherman.

7. In view of the above constraints, the issue may be approached in stages. The census data of coastal fishing fleets (1998) collected by SIFFS reveal that the main crisis in coastal fishery during the 1990s was not due to the increase in population of fishermen or fishing units *per se* but to the ever-increasing capacity of fishing units, which has direct bearing on the diminishing returns.

8. To overcome the problem of diminishing returns, fishermen in certain pockets like Vizhinjam extend their reach to deeper waters (60 to 80 fathom) by fitting two OBMs to their boats. The increasing number of man-missing cases caused by this fishing method reveals that the initiative for harvesting the fish resources available at deeper waters using the present craft-OBM combination is unsafe (See Annexure I for details).

9. The strengths of the artisanal fishermen to participate in deep-sea fishing are to be reckoned and a programme may be launched to overcome their limitations. The failure to do so would be a repetition of the situation that evolved as a sequel to the famous Indo-Norwegian project.

**Programme for promoting small-scale deep-sea fishing**

An intermediate craft fitted with diesel-propelled IBE would be the ideal option to promote small-scale deep-sea fishing by semi-skilled artisanal fishermen. The following aspects need also to be incorporated in the scheme.

1. A pilot scheme may be initiated by a suitable agency that has direct access to skilled and reliable fishermen. Research and Development support of suitable personnel for responding to need-based intervention from time to time is essential.

2. As a pilot phase, two sets of five fishing units each may be operated from two major landing centres such as Pozhiyoor and Vizhinjam, where fishermen with suitable skills are available for launching the programme.

3. An intermediate craft with OAL (45 feet to 50 feet) and wide beam (6 feet to 8 feet) with the following minimum facilities may be selected for the purpose.

   a. In-built mariners' compass,

   b. First-aid box,

c. Red colour flag with yellow cross (symbol stating that boat is under accident),

d. Temporary roof that would be used as sail if the engine gets struck while at sea,

e. Ice box with good quality insulation,

f. Carrier boat for collecting the fresh catch for purposes of value addition,

g. Facilities for long-stay fishing (for period of three-to-four days)

h. A cabin for keeping navigational implements.

4. The fishing method and the gear combination could be the same as those of the present artisanal DSF group. The unit will be able to survive without migration if skilled fishermen with knowledge of good fishing grounds work in the DSF units.

5. The second phase may be initiated on the basis of observations gained through monitoring of the progress of the endeavour for a one-year period.

6. Organisational support for addressing the problems of credit, marketing, safety, and fishing technology should be addressed by R&D institutions and fishermen's co-operatives jointly.

7. With adequate political will and the required level of empowerment of fishermen, the vested interests of multinationals should be kept at bay.

**Annexure I**

**1. Face to face with death on the high seas – Incidents among ISF units**

Accidents and deaths while fishing have a long history. The number is increasing year by year particularly after the introduction of OBMs in artisanal fishing. Indian shipping law envisages measures of safety for various classes of sea-going boats. Measures of safety for navigation and fishing are incorporated in the factory vessels fishing in deep waters. It is not the case with smaller fishing crafts falling under purview of the State governments. Cases of accidents reveal that navigational equipment is essential in small crafts with OBMs both for ISFUs and DSFUs when they widen their fishing area to greater depths. The difficulties of repair of OBMs while at sea make motorised fishing in deep waters unsafe. This report is of two such incidents from Poonthura fishing village in Thiruvananthapuram district that took place on 2 January 1997 and 29 January 1999. The details were gathered from persons who led the search, members of the families concerned, and neighbours. The original idea was to collect information about Sri. Bosco who met with an accident and died while fishing on 29 December 1999. The members of his family were not in a position to explain the causes of the incident. The whereabouts of the other three persons in his group remain unknown. To obtain a clearer picture, information was also gathered from another group, which had met with a similar accident but managed to land on the eleventh day.

**The 11-day ordeal at sea: Poonthura (1997)**

| | | |
|---|---|---|
| Date | : | 2 January 1997 |
| Owner | : | Johnson (47 years), Pallivilakam compound, Poonthura, Thiruvananthapuram |
| Craft | : | Gill-net Plywood boat of OAL 28 feet with single 9.9 Suzuki OBM. |
| Crew | : | Felsis(60 years), Susan S/o Felsis (22 years), and Xavier (25 years) of Poonthura. |
| Status | : | All the crew and the craft were rescued on the 11th day |

**Experience as reported by Mr Felsis**, member of the group

On 2 January 1997 we went for gill-net fishing with an *echa vala* (gill-net for mackerel). We reached the fishing ground by 7 pm and started fishing. The net was shot at about 60 fathom and hauled around 10 pm. While propelling towards the shore and shooting the net for the second time, the engine got struck at about 35 fathoms. The time was about at 11 pm. We could not make out the direction mainly due to the rough sea, strong winds, and cloudy weather. We tried our best to repair the OBM but were not successful. The boat was anchored and the long wait hoping assistance from other boats in the vicinity began. Two boats went by at a distance not too far away from us. They did not come to us, probably thinking we were engaged in fishing. We remained at the same spot till the fifth day when a ship passed by. Somebody from the ship threw out a packet. We were starving for the previous five days and thought that this was a food packet. The anchor rope was cut quickly to collect the packet before sinking into the deep. The rear end of the anchor rope was tied to the kerosene barrel in the boat and was thrown into the sea. We managed to pick up the packet but were disappointed to find that it was only a packet of food waste thrown out into the sea. We returned to pick up the anchor rope but were shocked to realise that the kerosene barrel with the anchor rope had sunk into the sea. We got all the more upset and tired both physically and mentally. We started cursing one another for the stupid event. The anchor-less boat was drifting deeper and deeper into the sea.

Normally, for day-long fishing, we take with us a barrel of (5 litres) water and a food packet for each of us, the three persons in the crew. The food was eaten on the first day itself and the water was over on the third day. The kerosene barrel was lost together with the anchor on the fifth day. We were dead-tired and my 22-year-old son was exhausted and was drifting into unconsciousness. The boat was getting driven by winds to deeper waters. We shot one piece of net to reduce the drifting of the boat. A tortoise got entangled in the net. We killed it, collected the blood, mixed it with seawater and drank it to quench our thirst.

On the morning of the seventh day, we saw a ship moving towards Kanyakumari. We shouted, but the ship did not respond. At a little farther on the course, the ship returned and propelled towards the boat. We thought they would come to rescue us but nothing happened. As we shot the net out, the crew of the ship would have thought that we were engaged in normal fishing. Though the ship took three turns around the boat we could not communicate our helplessness. We watched in horror the ship proceeding on its course. We had hoped that the ship would certainly come to us and save us. Later we realised that as we were totally exhausted over the seven days, we would have failed to effectively communicate our problem.

On shore, our relatives were making all out efforts to locate us. Several boats from the village participated in the search operations. The Department of Fisheries arranged a boat for the rescue operations. A helicopter was arranged with the initiative of the Department. The members of the family were losing all hope and thought of making arrangements for the holy mass for the three departed souls. But the owner of the boat insisted on waiting for a couple of days more. Though many of the relatives disagreed, they finally came round and agreed to wait for a few days more. Meanwhile the incident was communicated to all parishes for possible help.

On the 11th day, around 12 noon, a plywood boat was seen a little far away. They did not realise that we were in trouble. We signalled them holding up the oar to which a white cloth was flagged. God was with us this time. They recognised the message and came to us. They soon realised that we were the persons missing from Poonthura for the past several days.

They gave us water to drink. But my son was lying totally unconscious; I was also very weak; and so was Xavier. They offered us food but we could not eat after starving for 10 days. We drank all the water available in their boat. The boat was fishing with trolling line for small tunas. They stopped their fishing activity and turned all energy into the rescue operation. They asked us where we prefer to land. I said Vizhinjam because two of young persons were lying unconscious and I was exhausted too. Poonthura has no harbour and our relatives might be too disturbed to find us in this grave mental and physical condition. We headed for Vizhinjam. From the harbour we were taken to the Government Hospital at Vizhinjam. We were given good attention. I recovered very quickly. Xavier opened his eyes on the third day when he realised that he was with his parents. Susan's condition remained precarious. He was taken to the General Hospital in Thiruvananthapuram. The doctors there referred him to the Medical College Hospital, Thiruvananthapuram. He was not mentally normal. He recovered after three weeks of treatment. I was back to fishing in two months. It took six months for Susan to resume fishing.

The interview continued with questions and answers as stated below:

Q: What was the major reason for the incident?

A: The engine was new. There was no standby. Owing to a minor problem with the electric connection, the OBM got struck. We were not much familiar with repair and could not identify the exact problem on the spot. It was later that we came to know that it was a minor repair related to the position of a wire in the electric connection. Cutting the anchor rope and loss of anchor was a stupid act that made the situation worse.

Q: Why were you not able to attract the attention of the ship that came by?

A: We were under stress due to thirst, hunger, and fear, a condition that affected our normal behaviour. It could be due to our ineffective communication that we missed that early chance. If we had made use of that chance, the situation would not have worsened. If we knew of communication methods, while in distress that would have helped us to overcome such a predicament.

Q: You did not take any safety precautions. Is it true that the incident was mainly due to your own irresponsible action?

A: We never anticipated such an incident. It was the first time that I encountered such a chilling experience. Normally for one-day fishing we take the same quantity of food and water that we had taken for this trip. We do not normally use the sail for one-day fishing. However, we keep some reserve fuel.

Q: Is it not better to have mariners' compass on the boat?

A: It is a welcome suggestion. But I do not know how to use it. If somebody gives us training to use the electronic equipment we are ready to use it.

Q: What precautions have you taken after the incident?

A: Nothing, we have not taken any precautions. When God calls us we have to go.

**2. Death while fishing on 29 December 1999**

| | | |
|---|---|---|
| Date | : | 29 December 1999 |
| Owner | : | Alex, Pallivilakam Compound, Poonthura, Thiruvananthapuram |
| Craft | : | Gill-net Plywood boat with OAL 28 feet, 9.9 Suzuki OBM |
| Gear | : | Edakkettuvala for Flying fish |
| Crew | : | Bosco (27), Dasan (19), Varghese (24) and Raju (17) of Poonthura |
| Status | : | Dead body of Bosco has recovered on the seventh day<br>No information about the others |

**Background**

Bosco's father disappeared while fishing in July 1997 during the monsoon. His mother had died on the very first day of fish-vending, a few days after the disappearance of his father. Of the six children four were married and living separately. Bosco and his younger sister were living with their married elder brother and Bosco was the bread-earner of the household. They had no land of their own but were living in a rented house. On the day of Bosco's father's death, only two boats had gone from the locality for fishing. The other boat returned after two days. The fishermen in that boat revealed that the wind was very strong on the day and fishing was difficult. The search party could not collect any other useful information from these fishermen, which could have facilitated the search. Francis and two others who went along with Bosco's father had not returned even after two-and-a-half years and no information is available about them. The search was done mainly under the control of the Deputy Director of Fisheries, Thiruvananthapuram. At the time, Fisheries Department had no boat for sea rescue operations. The Deputy Director agreed to arrange a boat from Kochi and people waited for the boat for another two days. Later when they directly approached the Director of Fisheries they came to know that a helicopter of Air Force wing had already carried out a search operation. Not satisfied with the explanation, they approached the Fisheries Minister and submitted a petition for effective search. The Department arranged more local boats; the helicopter came back for more trips and the search continued for a week. The boats were not able to search too far out due to rough weather. The search operations of the helicopter were also not very effective due to cloudy weather.

The message was communicated to all the parishes through the church network. Search operations were extended to Kanyakumari under the initiative of the Village Counsellor, a representative of the Fisheries Department and some of the relatives of the fishermen. A local party went to Kanyakumari by jeep, which broke down in a few places. However, the team reached Kanyakumari, stayed there for two days, and requested the workers in mechanised boat at Kanyakumari for help. The fishermen at Kanyakumari responded positively but were afraid that if they ventured out into the deeper waters, their life too would be in peril since the sea was rough and furious. Thus the efforts made by the fishermen of Kanayakumari also failed to yield any positive result.

Alex, Dasan, and Varghese are brothers. Their father was suffering from cancer and had discontinued fishing a year ago. Alex owned the boat that met with accident. He had used his dowry and loans raised from a few friends to invest in a boat and gear. Raju's father is a fisherman and mother does fish vending. His brother had died of cardiac arrest.

**The incident**

The incident took place on 29 December 1999. The body of Bosco was recovered off Anjengo at about 35 fathom depth on 5 January 2000. They had gone for fishing in the early hours (at 3 am). They would have reached the fishing ground off the Kovalam lighthouse at around 40-fathom depth. One of the fishermen from a group operating gill-nets located the dead body. Later Bosco's brother identified the body from the colour of the underwear. The body was decomposed beyond recognition.

**What went wrong?**

It is nearly impossible to reconstruct the happenings of that fateful expedition; however, elders and experienced fishermen in the locality attribute the following probable reasons for the incident.

<u>The boat was too small (of OAL 28 feet) for fishing in deep waters:</u>

The boat was propelled with a six-month-old Suzuki 9.9 OBM loaded with four members in the crew and fishing nets onboard.

<u>Adverse wind conditions and rough weather</u>

In December strong seaward winds, from land during early mornings, are common. Wind flow from the land with lower temperature to comparatively higher temperature areas above the sea surface, is a common feature of every Christmas season. At noon when the land gets warmer than the sea the wind direction is reversed; it blows from the sea to the land. Fishermen make use of this phenomenon by departing along with the wind towards the deep sea in early morning. They would reach the fishing ground along with the wind and return to land in the afternoon while the wind changes its course landward.

This fishing group violated the routine navigation procedure (they were seen propelling towards deeper waters after 2 pm). It is possible that the boat had to propel against the wind and cut the waves across that surged towards the land. The small boat with a heavy load (4 crew and net) might have been exposed to heavy rolling and pitching which could be a probable reason for the incident.

<u>The crew were young with inadequate experience:</u>

Bosco was 27, Varghese 24, Dasan 19, and Raju a mere 17 years of age.

<u>They had a good catch of the value of Rs 7000 on the previous day</u>

The previous day's good catch of p*aravu chala* (flying fish) might have urged them on for fishing in even deeper waters, a practice alien to the norms of fishing.

**Events in the search operations**

Date of incident:
Wednesday, 29 December 1999

Thursday (day 1). Conveyed message of the missing fishermen to fishing villages, through the church network

Friday and Saturday (days 2, 3)

> Search operations began with eight plywood boats from the second day; a white flag was hoisted on the search boats and another kept as reserve in each boat. The second flag was intended for hoisting when the missing boat was noticed. Search operation was carried with eight boats, three moving to south to Kanyakumari, two sailing westward, and the remaining three going towards the north to Kollam. Each boat moved at considerable distance from the others, but the flags were visible from one to others. The boats departed at around 9 am and returned in the evening. The effective search time was between 11 am and 3 pm.
>
> The operations continued for three consecutive days and Rs 17000 per day was incurred as expenditure on fuel alone. Two OBMs were fitted in each of the eight boats. Financial constraints made it difficult to continue with the search.

Sunday (Day 4)

> Search by helicopter was conducted on Sunday. The MLA, Deputy Director of Fisheries, and the Ward Council of the Corporation initiated efforts for the search. They selected Sunday for the purpose, being a holiday for Christian fishermen. Hardly any fishing boat is likely to be in the sea on this day. Unfortunately the aerial search did not yield any result. On the same day *Kaveri*, a mechanised boat meant for sea rescue operations of Fisheries Department and a few plywood boats, also conducted the search operation. The fishermen were not satisfied with the search process conducted by the Department due to various reasons.

Wednesday (Day 7) located the dead body.

The body of Bosco was located by a gill-netter and was brought to shore. The body was decomposed beyond recognition. The relatives, MLA, DD, Councillor, other officials, and the search team decided not to do post-mortem on the body but to proceed straightway with the funeral.

From Day 8 Search at Anjengo and Kanyakumari side:

The rescue boat of the Department of Fisheries, *Kaveri*, with other five plywood boats fitted with two OBMs carried out search operations off Anjengo for the other members of the crew. This was under the assumption that they would be found from the same location. But this turned out to be not the case. With the help of Fisheries Department and the Church the search activity was extended to Kanyakumari, organising other boats from the area. Rs 20,000 was spent. The church advanced the money but the Department reimbursed the expenditure.

The search process was discontinued primarily because of the high expenditure involved of Rs 10,000 to Rs 15,000 per day and disappointment about the unsuccessful efforts.

**Relief to the affected**

Fishermen’s Welfare Fund Board and *Matsyafed* are the agencies that provide relief to affected families. The Board and *Matsyafed* provide Rs one lakh to the families of fishermen who die of accidents while fishing. In the case of ‘man missing’ cases, the financial assistance is given only after one year after the incident on the basis of certificates obtained from the competent authority to the effect that the person has not yet returned.

In this case all the four persons were eligible for financial assistance. But only the body of Mr Bosco was recovered. Therefore the assistance was given to the eligible member of his family immediately on completion of formalities. In the other cases the Board and *Matsyafed* have assured the assistance as early as possible. As an immediate relief, Rs 5000 was given to the family of Bosco and Rs 1000 each to the families of the other three missing fishermen. No financial assistance was given to Alex, the owner of the craft who had spent a lot of money for the search and borne the addition to loss of his craft and gear.

**Constraints of search operations**

1. The fishermen are not satisfied with the search operation of Fisheries Department mainly because the personnel in ‘Kaveri’ were not willing to conduct search operations at distant and deep waters due probably to their reluctance or incompetence or both.

2. Search operations have become difficult and expensive particularly after the introduction of OBMs. The fishermen fish in deep waters even beyond the continental shelf in

boats fitted with simple OBM, without adequate navigational aids. For conducting an effective search with local plywood boats fitted with two OBMs, the expenditure would be about Rs 15000 per day per boat, an amount far beyond the capacity of average craft owners like Alex. In this case Alex lost everything, his brother, his fishing boat and gear, and the borrowed funds he spent for conducting search operations.

3. Other issues
   (a) Timing is the crucial factor in search operations. In this case, the search teams used to depart around 9 am and reach the search area by 11am. Only a very small number of hours were available for the search as such. By noon the wind turns landward and the sea gets rougher. The boats have to return by 3 pm.

   (b) The search teams could not have conducted their search at the probable locations like deep waters mainly due to poor planning and shortage of time available for search operations. The search process cannot be scheduled in the manner of office work, say from 10 to 5. It has to follow the fishing time pattern - early departure (3 am) early safe return (4 pm) and intensive search for the maximum number of hours possible in between.

   (c) High fuel costs, difficulty for arranging for the supply of large quantities in time for use in boats fitted with two OBMs, and shortage of boats suitable for fitting two OBMs were some of the other major constraints that led to the delay in organising the search operations.

**Remedial measures**

Insurance of new fishing units covering the cost for search operation could be made compulsory for granting registration certificate for the fishing craft. It may be renewed every five years together with verification of fitness of OBM done to issue kerosene permit card.

At the time of registration the following accessories may be made compulsory for safe navigation and fishing:

1. In-built mariners' compass;
2. First-aid box;
3. Red colour flag with yellow cross (symbol to show that boat is in danger);
4. Cloth for sail; and
5. A cabin for keeping navigational implements.

A communication package comprising awareness-building and training on safe navigation and fishing should be initiated with the support of NGOs assigning the programme top priority.

## References


Achari T. R. T. Fish Aggregating Devices and Artificial Reefs; A case study in Trivandrum District of Kerala (mimeo). 1987.

Anderson .R.C., Ahaned Hudha. "The Shark Fisheries of the Maldives: A review", Ministry of Fisheries and Agriculture, Republic of Maldives and Food Agriculture Organisation of the United Nations. 1993.

Anon. Deep-Sea Fishing In Indian Eez-Guideline for Entrepreneurs, Published by Marine Product Export Development Authority of India, March 1991.

----- Motorisation of Fishing Units Benefits and Burdens - Programme for Community Organisation, South Indian Federation of Fishermen Societies, Trivandrum. 1991.

----- *Policies and Opportunities for Investment in Fisheries in India*, Kochi: The Marine Products Export Development Authority. 1991.

----- Report of the Technical Committee on The Deep-Sea Fishing Industry in India Murari, Chairman, Technical Committee. 1993.

----- The State of World Fisheries and Aquaculture FAO Fisheries Department, Food and Agriculture Organisation of the United Nations, Rome 1995.

----- Twenty-fourth Report on Marine Products Department-related Parliamentary Standing Committee on Commerce (199-96), Presented On The 12th March 1996), Rajya Sabha No.41/96 Book No.24, pp7. 1996.

Brandt .A. "Fish Catching Methods of the World; third edition, fishing News Books Limited Farnham Survey, England. 1984.

D'Cruz. Artificial Fish Habitats –Impact on Artisanal Fisheries Published by South Indian Federation of fishermen Societies, Trivandrum. 1995.

Das S. K. in his report on "Recent Policy Initiatives on promotion of Deep Sea Fishing Industry" Ministry of Food Processing Industries, New Delhi. 1995.

Fernanddex J. Artificial Fish Habitats-A Community Programme for Bio-Diversity Conservation, Fisheries Research Cell, PCO, Trivandrum. 1994.

Fisher and Bianchi. "FAO species identification sheets for fishery purposes, Western Indian Ocean Fishing Area. 51, Vol 1-5. 1984.

Fujita M R, et al. Innovative Approach For Fostering Conservation In Marine Fisheries, Environment Defense Fund, 5655 College Avenue, Oakland California 94618 USA . Published in Ecosystem Management for Sustainable Marine Pages SI39-SI 50, Ecological Applications Volume 8 No 1, Supplement, February 1998.

Guidecelli. M. in his report on the "Study on Deep-Sea Fisheries of India" Food and Agriculture Organization of the United Nation, Rome. 1992.
Korten .C. D. *Getting to the 21st century. Voluntary action and the Global Agenda: People-Centered Development Forum,* Oxford & Ibh Publishers Co.Pvt.Ltd. 1992.

Kurien. J. "Impact of Joint Ventures on Fish Economy." *Economic and Political Weekly*, 11 February 1995.

Kurien. J. "Towards a New Agenda for Sustainable Small-Scale Fisheries development "South Indian Federation of Fisherman Societies. 1996.

Kurien J. Property Rights, Resources Management and Governance: Crafting an Institutional Frame work for Global Marine Fisheries, Centre for Development Studies and South Indian Federation of Fishermen Societies. 1998.

Kurien J. Traditional Ecological Knowledge and Ecosystem Sustainability: New Meaning to Asian Coastal Proverbns, Centre for Development Studies, Trivandrum India Published in Ecosystem Management for Sustainable marine Fisheries Pages S2-S5, Ecological Applications Volume 8 No. 1, Supplement, February 1998.

Rajan, Satyajeet. *Deep Sea Fishing Role of Fisheries Co-operatives*, Trivandrum: Matsyafed. 1993.

SIFFS. *A Census of the Artisanal Marine Fishing Fleet of Kerala*, Thiruvananthapuram: South Indian Federation of Fishermen Societies. 1998.

SIFFS. *A Census of the Artisanal Marine Fishing Fleet of Kerala*, Thiruvananthapuram: South Indian Federation of Fishermen Societies. 1991.

Steele H.J. "Regime Shift In Marine Ecosystems, Woods Hole Oceanic Institution, woods Hole, Massachusetts 02542 USA", *Ecosystem Management for Sustainable marine Fisheries*, Ecological Applications Volume 8 No. 1, Supplement, February 1998.

Sudarsan D, et al. Charted Fishing Vessels Operations in Indian EEZ and Annual Reports of FSI. 1991.

Sudarsan D. "Report on The Committee on Operations of Deep Sea Fishing Vessels" submitted to the Government of India, Ministry of Food Processing Industries, New Delhi. 1994.

Vijayan A. J. Against The Deep-Sea Fishing Policy of Government of India to The Subcommittee of The Parliament on Commerce on Marine Products and Rubber For and on behalf of National Fish Workers Forum PP4. 1995.