TECHNOLOGY OF FISHING ON THE HIGH SEA: AN ANTHROPOLOGICAL STUDY OF THE FISHING COMMUNITIES AT DIGHA, WEST BENGAL, INDIA

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Submitted by:

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TO WHOM IT MAY CONCERN

This is to certify that Mr. Raj Kumar Karan is a registered Ph. D. research scholar (bearing Registration No. 0243/Ph.D. (Sc) dated: 01.12.2011) did his research for Ph.D. degree under my guidance and supervision in the Department of Anthropology, Vidyasagar University, West Bengal. The title of his Ph. D. dissertation is "Technology of Fishing on High Sea: An Anthropological Study of the Fishing Communities at Digha, West Bengal, India."

Mr. Raj Kumar Karan personally carried out fieldwork in connection with his Ph. D. work and his Ph. D. thesis is based on original data-set collected by him and the contents of his thesis has not been submitted to any other University/institution for the procurement of Ph.D. Degree/any Degree/Diploma/other academic award.

This is to further certify that Mr. Raj Kumar Karan has incorporated all the recommendations/ suggestions/ modifications forwarded by the Ph. D. committee in Anthropology of Vidyasagar University for improvement of his thesis and his performance and progress of the Ph. D. work is satisfactory.

Finally, it is recommended that Mr. Raj Kumar Karan may be allowed to submit his thesis entitled above for the procurement of Ph. D. degree in Anthropology under the Faculty of Science at Vidyasagar University and I hope he will be awarded a Ph. D. Degree after completion of necessary formalities.

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DECLARATION

I do hereby declare that the present thesis entitled "Technology of Fishing on High Sea: An Anthropological Study of the Fishing Communities at Digha, West Bengal, India" is based on my original work except for Quotations and Citations, which have been duly acknowledged. I also declare that the present thesis has not been previously or concurrently submitted for procurement of Ph. D. degree/any other degree/diploma/other academic award to any other University or institution. The supplementary/other aspect of the present data-set has been partially/fully utilized productively for research papers. All the recommendations/suggestions/modifications forwarded by the Ph. D. committee in Anthropology of Vidyasagar University have been incorporated for improvement of the thesis.

Raj Kumar Karan

(RAJ KUMAR KARAN)

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(RAJ KUMAR KARAN)

ABBREVIATION

CIFT	–	Central Institute of Fisheries Technology.
BOBP	–	Bay of Bengal Programme.
GPS	–	Global Positioning System.
CMFRI	–	Central Marine Fishery Research Institute.
DFFTA	–	Digha Fishermen and Fish Traders Association.
FTA	–	Fish Traders Association.
FAO	–	Food and Agriculture Organization.
UN	–	United Nations.
MPEDA	–	Marine Products Exports Development Authority.
ARDC	–	Agricultural Refinance Development Corporation.
EEZ	–	Exclusive Economic Zone.
OBM	–	Outboard Motor.
KDFSF	–	Kanyakumari District Fishermen's Sangams Federation.
IMC	–	Indian Major Carps.
ARDC	–	Agricultural Refinance Development Corporation.
PHFP	–	Post-Harvest Fisheries Project.
IMC	–	Indian Major Carps.

GLOSSARY

Trawler	–	Mechanized vessel used for high sea fishing with trawl net.
Fishing Body	–	Mechanized vessel used for high sea fishing with gill net.
BhutBhuti or Borshi Body	–	Mechanized vessel used for high sea fishing with hook and line.
Sarkar	–	Manager of the unit.
Majhi	–	Master of the mechanized vessel of the unit.
Side Majhi/Driver	–	Engine driver of the vessel.
Radhuni	–	Cook for the unit members.
Fisherman	–	The members of a fishing unit who sail in the deep sea for fishing.
Malik	–	Owner of the mechanized vessels.
Bayna	–	Advance money.
Kanta	–	Indigenous weighing scale.
Aaratdar	–	Owners of auctioning stall.
Dadandar	–	Money lender.
Tuani	–	Lead and line.
Bali mati	–	Sandy soil.
Lodh	–	Sticky soil.
Char	–	Elevated sea bed.
Duba char	–	Depressed sea bed.
Ghola jaul	–	Muddy water.
Kalchey jaul	–	Blackish water.
Sim-pata jaul	–	Greenish water.
Int-ronga jaul	–	Brownish-red water.
Swachcha jaul	–	Transparent water.
Dim jaul	–	Beige water.
Tithi	–	Lunar position.

Suklapaksha	–	Brighter half of the month.
Krishnapaksha	–	Darker half of the month.
Amabashya	–	New moon day.
Purnima	–	Full moon day.
Bhara kota	–	Three days preceding from new moon day or full moon day.
Mora kotal	–	Three days succeeding from new moon day or full moon day.
Pubali hawa	–	East-ward wind.
Paschima hawa	–	West-ward wind.
Pub-dakhina hawa	–	South-east ward wind.
Utturey hawa	–	Northern wind.
Ahnwik	–	Forward or stem post end or forecastle end of the mechanized vessel.
Pacha	–	Aft or stern end of the Mechanized Vessel.
Kachhi	–	Nylon rope.
Water board	–	Rectangular wooden plank.
Kandhha	–	Tapering end of the trawl.
Baam	–	Indigenous term used by the fishermen of Digha to describe the measurement in terms of length, breadth, depth etc.
Gyalo khuti	–	Heavy iron poles.
Kafia	–	Pulley.
Matsyajibi	–	Fisherman.
Haal	–	Manually operated iron steering oar.
Jaal	–	Net.
Shol par	–	Float line of a gill net.
Guri par	–	Lead line of a gill net.
Kani	–	Each corner of the gill net.
Haat	–	Forearms.
Chakai	–	Sinkers are either made of concrete or terracotta.

Tua	–	First marker buoy bearing the big kerosene lamp.
borsi or *kanta*	–	Iron made barbed fish hooks.
Cod daon	–	Hooks with a form of set line.
Pichon	–	Short line or gangion.
Pataka	–	Flag.

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CHAPTER - 1

INTRODUCTION

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INTRODUCTION

1.1. Genesis of Fishing:

Fish and fishery products are a readily available source ofprotein and essential micronutrients for balanced nutrition and good health. In 2009, fish accounted for 16.6% ofthe world population's intake of animal protein and 6.5 %of all protein consumed (FAO 2012).

The genesis of fishing may be traced back at least to the Upper Paleolithic period which began about 40,000 years ago. Isotopic analysis of the skeletal remains of Tianyuan man, a 40,000-year-old modern human from eastern Asia, has shown that he regularly consumed freshwater fish. Archaeological features such as shell middens, discarded fish bones and cave paintings show that sea foods were important for survival and consumed in significant quantities. During this period, most people lived a hunter-gatherer lifestyle and were, of necessity, constantly on the move. However, where there are early examples of permanent settlements (though not necessarily permanently occupied) they are almost always associated with fishing as a major source of food.

Jerimalai cave site in East Timor of Indonesia unearthed recently by Sue O'Connor, Head of Archaeology and Natural History at the Australian National University suggest that people lived in this cave more than 42 000 years ago and use to dine aquatic fauna like turtles, tuna etc. Sue O'Connor is of opinion that cave dwellers of Jerimalai were modern humans, Homo sapiens because of the evidence for their sophisticated behavior found in the dig. Fish such as tuna could only have been captured in deeper waters offshore using hooks, and probably also water craft she said.

Spear fishing with barbed poles (harpoons) was widespread in palaeolithic times. Cosquer cave in Southern France contains cave art over 16,000 years old, including drawings of seals which appear to have been harpooned.

The Neolithic culture and technology spread worldwide between 4,000 and 8,000 years ago. With the new technologies of farming and pottery came basic forms of the main fishing methods that are still used today.

From 7500 to 3000 years ago, Native Americans of the California coast were known to engage in fishing with gorge hook and line tackle. In addition, some tribes are known to have used plant toxins to induce torpor in stream fish to enable their capture.

Copper harpoons were known to the seafaring Harappans well into antiquity. Early hunters in India include the aboriginal inhabitants of India's Andaman and Nicobar islands, who use harpoons with long cords for fishing since early times.

The ancient river Nile was full of fish; fresh and dried fish were a staple food for much of the population. The Egyptians invented various implements and methods for fishing and these are clearly illustrated in tomb scenes, drawings, and papyrus documents. Simple reed boats served for fishing. Woven nets, weir baskets made from willow branches, harpoons and hook and line (the hooks having a length of between 8 m.m. and 18 c.m.) were all being used. By the 12th dynasty, metal hooks with barbs were being used. As is fairly common today, the fish were clubbed to death after capture. Nile perch, catfish and eels were among the most important fish. Some representations hint at fishing being pursued as a pastime.

There are numerous references to fishing in ancient literature; in most cases, however, the descriptions of nets and fishing-gear do not go into detail, and the equipment is described in general terms.

Fishing scenes are rarely represented in ancient Greek culture, a reflection of the low social status of fishing. There is a wine cup, dating from c. 500 BC that shows a boy crouched on a rock with a fishing-rod in his right hand and a basket in his left. In the water below there is a rounded object of the same material with an opening on the top. This has been identified as a fish-cage used for keeping live fish, or as a fish-

trap. It is clearly not a net. This object is currently in the Museum of Fine Arts, Boston.

Oppian, also known as Oppian of Anazarbus, of Corycus, or of Cilicia, a 2nd-century Greco-Roman poet who wrote a major treatise on sea fishing entitled the Halieulica or Halieutika. Oppian describes various means of fishing including the use of nets cast from boats, scoop nets held open by a hoop, spears and tridents, and various traps "which work while their masters sleep". Oppian's description of fishing with a "motionless" net is also very interesting:

The Greek historian Polybius (ca 203 BC–120 BC), in his Histories, describes hunting for swordfish by using a harpoon with a barbed and detachable head.

Pictorial evidence of Roman fishing comes from mosaics which show fishing from boats with rod and line as well as nets. Various species such as conger, lobster, sea urchin, octopus and cuttlefish are illustrated.

In India, the Pandyas, a classical Dravidian Tamil kingdom, were known for the pearl fishery as early as the 1st century BC. Their seaport Tuticorin was known for deep sea pearl fishing. The Paravas, a Tamil caste centered in Tuticorin, developed a rich community because of their pearl trade, navigation knowledge and fisheries.

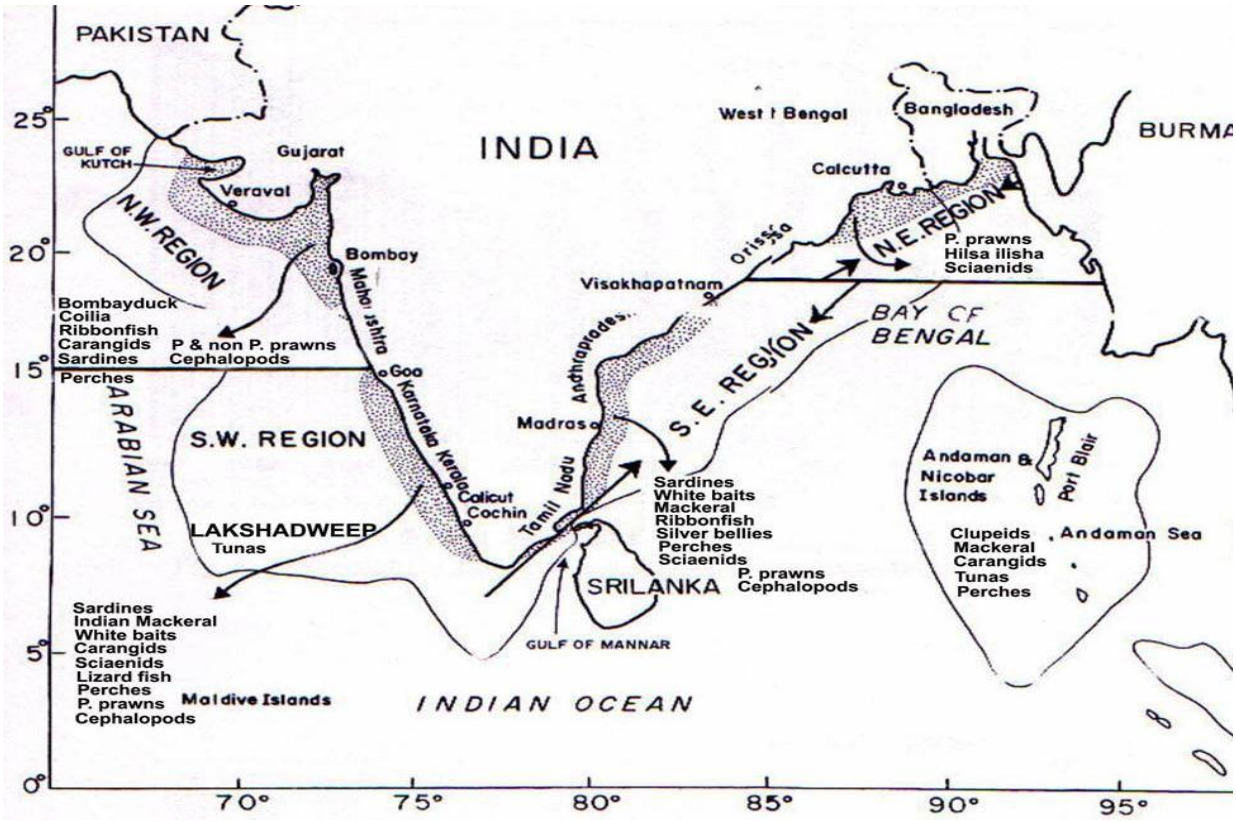
In traditional Chinese history, history begins with three semi-mystical and legendary individuals who taught the Chinese the arts of civilization around 2800–2600 B.C.Among these individuals Fu Hsiwas reputed to be the inventor of writing, hunting, trapping, and fishing.

1.2. Marine Fishery in India:

Fishing has been the main occupation of the people of the coastal belt of India from time immemorial. The fishing sector is a unique source of animal protein to the population, employment and income for the rural poor and a source of valuable foreign exchange for the country.

The marine fishery sector in India is important not only for domestic demand of protein food requirements but also from the imperatives of exports (Das et al. 2000). India, endowed with a long coastline of 8129 km, 2.02 million sq. km. of Exclusive Economic Zone (EEZ) and 0.5 million sq. km. of continental shelf and with an annual marine fishery potential of 3.93 million tonnes, occupies seventh position in the world marine capture fish production.According to the Food and Agriculture Organization (FAO) of the United Nations, fish output in India doubled between 1990 and 2010 (FAO 2011).

The different coastal regions of India along with abundance of particular varieties of fishes may be revealed from the following map:



Fisheries are an important sector in India providing employment to millions of people and contribute to food security of the country. Marine fisheries contribute to food security and provide direct employment to over 1.5million fisher people besides others indirectly depending on the sector. The total marine fisher folk population of 3.57 million is spread across the coastal states and union territories

(including islands) in 3,305 marine fishing villages of these 0.90 million are active fisher people and another 0.76 million fisher people are involved in other fisheries-related activities.

The government started its attempt of modernization of fishery sector as early as 1953 when the Indo–Norwegian Project came into being. After their unsuccessful attempts to introduce motors for artisanal craft, the project shifted its emphasis to new designs for mechanized boats to be operated from harbours.

Trawling was introduced and established in India with an active initiative of the Central Institute of Fisheries Technology (CIFT) along with other Government Organizations like erstwhile Indo-Norwegian project. Many designs of two seam trawls, four seam trawls, six seam trawls, multi seam trawls, bulged belly trawls, high opening trawls and large mesh trawls etc. were designed, experimented and developed by the institute. Bottom trawling is in practice in India for nearly 50 years (Pravin and Vijayan 2002).

A few hundred gillnet boats were introduced during early 1960s. These boats had very limited impact on production and were largely complementary to the artisanal fleet. The high market price for penaeid prawns in the world market led to the introduction of small coastal trawlers. Government's interest in promoting exports gave an impetus to trawling. Finding trawling profitable, a mad rush to own trawlers were seen in the 1970s. Many new entrants invested, to reap the profits. The government took efforts to supply trawlers to the actual working fishermen, through co-operatives. But it ended up going into the hands of middlemen and outsiders who were absentee owners who had no long term stake in fishing than only profits.

Today the fishing fleet of India consists of traditional (1,07,448), motorized (76,748) and mechanized vessels (59,743) (Anon, 2007). Marine landings of India in 2010 have been estimated as 3.07 million tonnes showing a decrease of about 1.31 lakh tonnes against the estimate of the previous year (Anon, 2011c). Out of the total quantity of marine fish landed west coast has the share of 55% whereas east coast has the share of in terms of total quantity of the fish landed over 45%. Mechanized

sector ranks first by contributing 73% of the catch and motorized and artisanal sector contributed 25% and 2% respectively.

A Working Group on Fisheries for the Eleventh Five Year Plan constituted by the Government of India and the Planning Commission suggested strategies for sustaining and augmenting marine fish production comprising change over from an open access to a regulated regime, employing a fishery management regime supported by a multi-dimensional information platform, upgrading technologies and capabilities in the artisanal and small mechanized sector for diversification reducing the excess capacity of fishing fleet, freezing the entry of new coastal mechanized fishing crafts, establishing an oceanic tuna and squid fishery, promoting mariculture for fin fishes, edible bivalves, sea plants and other important species and sustain fish production through the effective enforcement of Marine Fisheries Regulation Acts.

As a part of regulating the marine fishing different maritime states of India stipulated closing days of marine fishing with mechanized vessel. The following table shows such closing days:

Table no. 1.1: Closing Days of Marine Fishing in Different States of India.

State	Months	Days
Gujarat	June - August	45
Maharashtra	June - August	45
Goa	June - August	45
Karnataka	June - August	45
Kerala	June - August	45
Tamil Nadu	April - May	45
Andhra Pradesh	April - May	45
Orissa	April - May	45
West Bengal	April - May	45

1.3. Marine Fishery in West Bengal:

The state of West Bengal is situated between latitudes 23°N and longitudes 87° E. It is bounded on its north by Bhutan and the state of Sikkim, on its east by Bangladesh, on its northeast by the state of Assam, on its south by the Bay of Bengal, on its southwest by the state of Odisha, on its northwest by Nepal, and on its west by the state of Bihar.

Although in area, West Bengal ranks as one of the smaller states of India, it is one of the largest in population. The capital of the state is Kolkata -- India's third largest metropolitan city. The other important cities and towns of West Bengal are Howrah, Asansol, Durgapur and Siliguri, Darjeeling, Kharagpur and Haldia. The following table** shows some important facts about West Bengal.

Table No. 1.2: Important Facts about West Bengal.

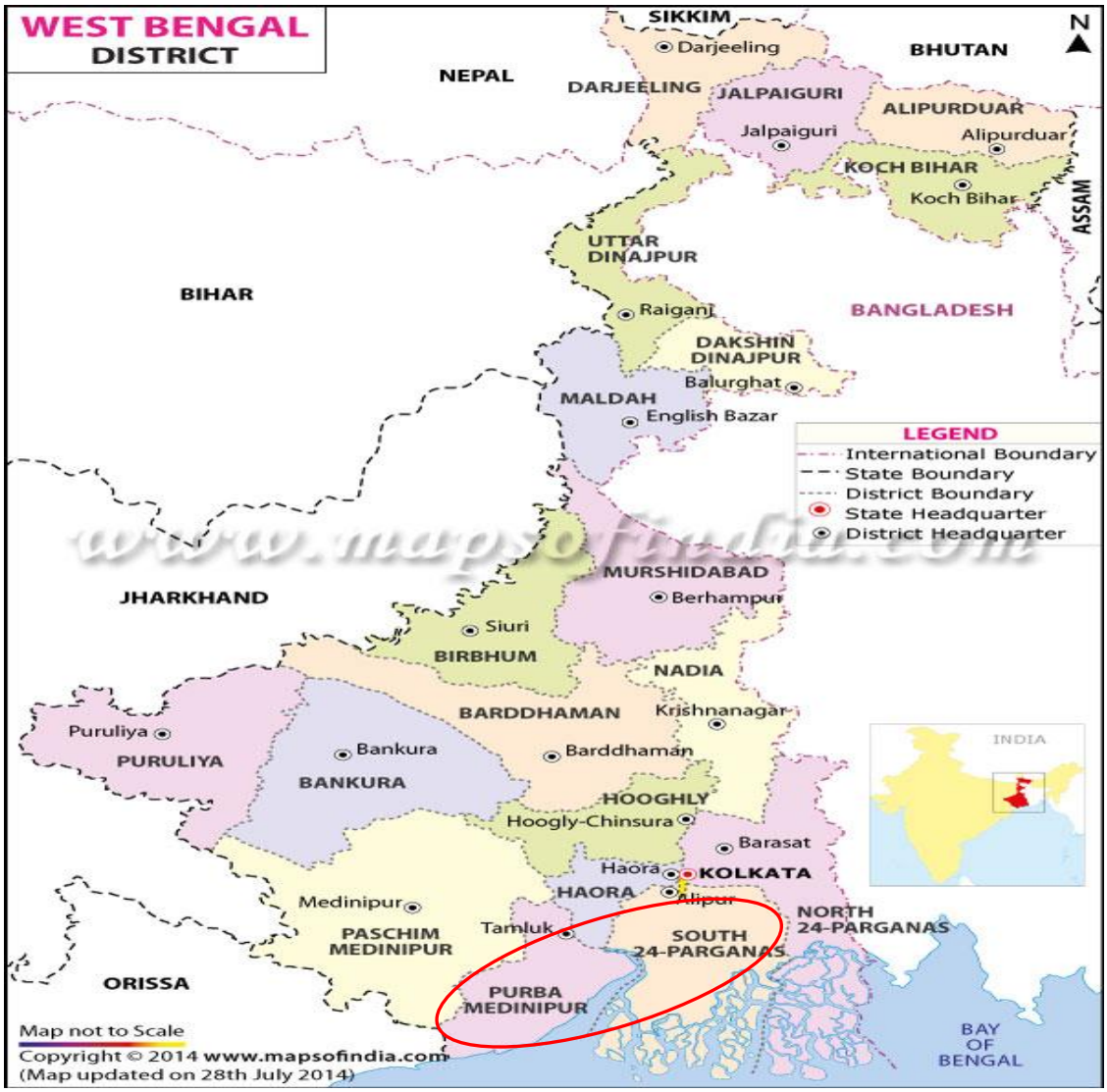
Area of West Bengal	**88,752 sq km**
Density	1,029/Km2
Population (2011)	91,276,115
Males Population (2011)	46,809,027
Females Population (2011)	44,467,088
No. of District	19
Capital	Kolkata
Rivers	Hooghly, Teesta, Jaldhaka, Rupnarayan
Languages	Bengali, Hindi, English, Nepali
Neighbours State	Assam, Sikkim, Bihar, Jharkhand, Odisha
Literacy Rate (2011)	86.43%
Females per 1000 males	947

**Source: www.westbengal.gov.in

West Bengal has a short coastline about 158 km (BOBP/INF/11). The continental shelf of West Bengal is wide (about 150 km) and shallow having a muddy bottom and its configuration is affected by the large river systems and tidal currents (Philipose et al 1987). The West Bengal coast is the part of Bay of Bengal Large Marine Ecosystem with dynamic estuarine network. The Bay of Bengal

encircles East coast of India, Bangladesh, Myanmar and Thailand. The West Bengal coast occupies two coastal districts viz, South-24 Parganas and East Midnapur. The South-24 Parganas has a magnificent mangrove (Sundarbans) on the eastern part and the East Midnapur has an open coast (Digha-Shankarpur) on the western part of West Bengal.

The marine fisheries of West Bengal have rich potential of commercially important variety of marine fisheries and shrimps due to influx of nutrient laden water in the Bay of Bengal through creeks and canals of the Sundarbans (Sawant et al 2003). The marine fishery of West Bengal mainly focused on these two districts and they have been shown in the following map.



Source: www.mapsofindia.com accessed on 12.01.2016.

Till 1950 marine fisheries in West Bengal were confined to the operation of a few bag nets, shore seines, stake nets and some seine nets (Dan, 1985). But nowadays due to the advancement of the science and technology, the fishery sector has undergone vast improvement.

However, the marine fisheries sector has developed gradually, only during the late 50's (Bay of Bengal Program, 1990). In West Bengal the number of mechanized boats is much more than the number of non-mechanized boats. And most of the mechanized boats have installed the Global Positioning System (GPS) for navigation and for searching of potential fishing zone.

It is revealed from the Marine Fisheries Census 2010 that there were 95,283 active marine fishermen in West Bengal, of whom 55,511were fulltime fishermen and 24,744 were part-time with the rest engaged in fish seed collection. Nearly 14,000 mechanized and 3,000 non-motorized crafts are in operation presently in the marine fishery sector of West Bengal during 2010 (CMFRI, 2012). A wide variety of gears is operated along the coast among which, gillnet, trawl net, bagnet and hook and line are the major ones. The total landings in the coast of West Bengal grew continuously from 2.29 lakh tonnes in 2007 to a maximum of 3.59 lakh tonnes in 2010. The total number of fishing villages and fisherman families are 188 and 76,981, respectively. The marine fishery of West Bengal is flourishing day by day due to massive demand in National and International market. As the demand increases the intensity of capture is also getting increased and that's why the number of mechanized boats is increasing in West Bengal. In 2002–2003 the total number of mechanized boats was 1189, but it increased up to 4618 in 2012–2013. The mesh size of gill net varies between 30 and 110 mm and its length is 200–500 m for all gill nets that are used for fishing at 6–100 m bathymetry, while trawl net is used to carry out fishing at 30–100 m bathymetry. Small and big bag nets are used to catch fish at 4–6 and 20–30 m bathymetry, respectively. There are five fishing harbours, viz. Sankarpur, Petuaghat, Sultanpur, Kakdwip and Freserganje and 59 major and minor fish landing centres in the state. In South 24-Parganas district of West Bengal, fish landing centres in estuary zones are eight in number and the marine sector fish landing centres are 29

in number. In East Midnapur district of West Bengal, no estuarine fish landing centres are present. All the 41 fish landing centres are from marine sector.

Some of the relevant information* about marine fisheries in West Bengal is presented in the following table:

Table no. 1.3: Information about Marine Fisheries in West Bengal.

Marine	
Length of coast line (Km)	**158**
No. of Fishing Harbour	**05**
Number of Fish Landing Centers	**59**
No. of Fishing villages	**188**
No. of fishermen families	**76,981**
Fisher-folk population	**3,80,138**

Source: Marine Fisheries Census 2010.

1.4. Objectives of the Present Study:

There are good numbers of anthropological study on the techno- economic and socio-cultural aspects of marine fishing. The authors whose name deserves special mention in this regard are: Malinowski (1918), Hocart (1937), Coker (1908), Osgood (1940), Edward (1960), Foster (1960), Lebar (1964), Firth (1946) Ward's (1958, 1960, 1965), Frazer Junior's (1962), Moses (1929), Puneker (1959), Ahmed (1966), Trivedi (1967), Raychaudhuri (1980) etc. However, all these studies were centered on the fishermen engaged in fishing by traditional methods i.e. fishing with the help of bow and arrow, harpoons, different variety of manually operated nets, trawling etc. But none of these authors carried out any research on the fisher folk who are associated with trawling by mechanized boats commonly called trawler which have the variation in terms of size and engine capacity of the respective vessel.

In recent times a number of studies have been conducted on the marine fisheries of West Bengal. These studies were primarily centered on fishing bases and landing centers, check-list of marine and estuarine fishes, identification of species and families if different fishes, uses of technology, ecology and management aspect, length weight relationship of commercially important marine fish species, tropic structure using the Eco-path model, diet composition of Hilsa Shad (Tenulosailisha) etc. The authors whose name deserve special mention in this regard are namely Dan (1985), Goswami (1985), Neogy et al. (1995), Chatterjee et al. (2000), like Islam (2003), Islam and Haque (2004), Ullah et al. (2012), Dutta et al. (2012), Mandal et al. (2013), Dutta et al. (2014). However, these authors did not undertake any research either on technological details or social-cultural milieu of the marine fishery found among the fishermen operating from different marine fishing harbors and marine fish landing centers of West Bengal.

In view of the above background present researcher undertook an anthropological study on different methods and techniques of high sea fishing adopted by the marine fisher folk operating from the marine fish landing center at Digha in Purba Medinipur district of West Bengal. Since, the attributes of technology include resources, tasks, skills, labors etc. (Hunter and White, 1977) therefore the major objectives of the present research were:

- To get an understanding about different methods and techniques of High Sea fishing with mechanized boat adopted by the fishermen operating from the marine fish landing center of Digha, Purba Medinipur district, West Bengal.
- To get an understanding about the tools and material culture associated with high sea fishing by mechanized vessel.
- To get an idea about resources, tasks, skills, labors and activities associated with high sea fishing by mechanized vessel.
- To make an understanding of the organizational aspects of high sea fishing by mechanized vessel.
- To get an understanding about the ecological perception of the fishermen engaged in high sea fishing by mechanized vessel.

CHAPTER – 2

LITERATURE REVIEW

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LITERATURE REVIEW

There are a good number of anthropological studies on the techno- economic and socio-cultural aspects of fishing. The authors whose name deserve special mention in this regard are: Coker (1908), Malinowski (1918), Hornell (1924), Moses (1929), Hocart (1937), Osgood (1940), Firth (1946), Puneker (1959), Edward (1960), Foster (1960), Frazer Junior's (1962), Lebar (1964), Ward's (1958, 1960, 1965), Ahmed (1966), Trivedi (1967), Raychaudhuri (1980) etc. Most of these studies were primarily centered on different aspects of technology and social organization of traditional way of fishing with the help of traditional equipments like bow and arrow, barbed harpoons, spears, box traps with or without valve, nets made of cotton or fiber, boats, canoes with or without outrigger etc. But most of these researchers did not discuss various aspects of fishery, either inland or marine, in terms of wider market economy.

It is evident that exploitation of marine resources from high seas with the help of steam powered vessels and industrially produced fishing tackles became a universal feature during the first quarter of the 20th century. Gradually marine fishery was recognized globally as an important source of revenue for the coastal countries and drew attention of the researchers. The researchers of respective coastal countries began to carry out researches primarily on biological aspects of marine fisheries.

However, economic aspects of fisheries emerged as an important field of research after the Second World War. During 40s and 50s following the realization that major constraints on marine fisheries development was technological, quite a few studies focusing on purely technological aspects were taken up largely in developed countries. While dealing with the technological aspects of marine fishery some of the researchers made attempt to find out the relationship between technological aspects of marine fishery with the socio-economic milieu of the respective country.

Since there are innumerable publications on different aspects of marine fishery throughout the world therefore, it is very difficult for the present researcher to traverse those literatures at this juncture. However, in the following paragraphs the present researcher has made a humble attempt to discuss about some of the publications on marine fishing in India. While doing so, the researcher considered those publications for present discussion which are relevant to his present study.

It may be stated that interest of the third world countries on fisheries gained ground in 50s and 60s of 20th century when most of such countries embarked upon ambitious schemes of economic development. At this juncture, world development agencies like United Nations (UN) through Food and Agriculture Organization (FAO) took active interest in the development of fisheries as it turned out to be potential source of food and nutrition for the rapidly growing population of the world. These gave rise to growth of prolific studies relating to fish production, marketing, technology, fishery resources, finance, price of the fish, socio-economic aspects related to fishery etc.

It is opined that for successful exploitation of the marine fishery resources, it is most important to have an absolute knowledge of the resources (George, 1973). For making high financial investments in marine fishery a thorough knowledge of the available resources is necessary. Many countries have produced fishery atlases giving full information of resources. In India Marine Products Exports Development Authority (MPEDA) has published a number of atlas and handbooks on marine fishes on the basis of several explorative surveys.

George in an article published in 1973 remarked that for successful exploitation of the marine fishery resources, it is most vital that we should have an absolute knowledge of the resources. The author states that in India all along the centuries, marine fisheries exploitation has been in the hands of a type of people who are very backward and conservative. So, modern developments in fisheries had no impact on them. It is only in recent years that a change in attitude has taken place. At present marine fish landing in India has attained the level of slightly near a million tones. It is possible to step up this production several fold. For this,

considerable planning is required. Very large numbers of mechanized fishing vessels are required, besides landing and berthing facilities for these vessels, arrangement for adequate quantities of ice, water, fuel, oils, etc. will have to be set up. All these will require high financial investments. For making such investments a thorough knowledge of the available resources is necessary. Many countries have produced fishery atlases giving full information of resources. In India also production of such an atlas is required on the basis of efficient and thorough studies of resources. The explorative survey so far done is inadequate and this will have to be planned in a much bigger way.

Nammalwar and Prakasam (1979) while studying the status and problem of fishermen in the marine fishing industry point out that over-fishing threatens the fishery resources of our country and therefore regulation of a type, leading to a reduction in the number of units is desirable to conserve valuable resource to forestall economic difficulties and to reduce the clashes among different groups is desirable.

Panikkar (1980) has studied the coastal rural indebtedness in Vizhinjam, south of Trivandrum, Kerala. This study reveals that the fishermen of the coastal villages borrow year after year and they are heavily indebted. But they are not in a position to repay the loan, either because the loans are larger or the income is not enough to pay off the debts. As such, the debt of the fishermen goes on increasing. This may be termed as coastal rural indebtedness. The fishermen of Vizhinjam borrow mainly from the moneylenders since institutional credit is not available to them.

Panikkar and his co-researcher (1981) studied the impact of the introduction of mechanized boats on the socio-economic conditions of traditional fishermen when they are supplied with mechanized boats. To study this impact, Calicut region was selected where Agricultural Refinance Development Corporation (ARDC) had supplied 50 mechanized boats of such a size so that each boat was allotted to seven fishermen families, thus involving 350 fishermen families in this venture. The study indicates an improvement in the economic condition of the fishermen families of

Puthiangadi (near Calicut) which received credit facilities from ARDC. The introduction of mechanization induced many fishermen to shift from traditional to mechanized fishing which resulted in increased landings and created more employment opportunities in net making, ice-plant and workshop operations, sorting, auctioning, transporting and fish trading. The absence of such economic activities in the neighboring Elathur village is a pointer to the significance of availability of credit facilities to invest in improved fishing techniques.

Kalawar (1981) examined the living conditions of fishermen in Maharashtra. According to him, the living conditions on the whole are deplorable. Owing to lack of economic development in this region, there is continuous exodus of labour from the coastal region. As a result, the females have to bear most of the burden of economic activity. Indebtedness in the fishermen community is widespread. Necessary infrastructure by way of communication and transport facilities, water supply and power should have to be provided on priority basis. This creates scope for setting up agro-based and fisheries-based industries.

Kurien (1981) pointed out that there are two reasons for the poverty of fishermen, namely the inequality in the asset holdings among them and secondly the exploitation of all of them by those who are involved in the process of buying what they produce. As a result for the average traditional fishermen, saving from his income for investment is a painful task. Indebtedness among the fisherfolk is high. Credit in the form of wage advances is a very common phenomenon in traditional fishing communities. Credit of other forms may be obtained by pledging ration cards, gold and fishing nets with individuals in the village who are not necessarily concerned with fishing. Rate of interests ranges from 24 to 60 percent for the mortgage of their products. Fish merchants are a source of big credit. They normally lend large amounts to fishermen who own fishing equipments.

Fernando (1981) in an article suggested the following for improving the socio-economic conditions of fishermen at all fishing centres. As per his suggestions sufficient cold storage and ice plants facilities must be provided to prevent fish from going waste. Internal market facilities must be developed with suitable transport

facilities. Every fishing village should be provided with suitable road facilities with adequate feeder roads linking every fishing center. Fishermen should be educated sufficiently to preserve fish at the catching point itself. Modern fish processing units must be established in all the important fishing centres along with State fisheries units. Fishermen in the coastal area should be provided with proper sanitation and medical facilities, drinking water, wells and electricity. All important minor ports must be given top priority for berthing facilities and processing units with freezer–cum–ice plants for the use of small fishermen. Alternate jobs during off-season should be provided to the fishermen and their womenfolk.

Paul Valiakandathil (1981) studied the socio-economic conditions of fishermen in Poonthura, Kerala. He points out that since fishing is a seasonal occupation, majority of the fishermen are actively employed for a period of six months in a year. Their equipments are not usable beyond a certain depth. Ten percent of them have access to boats and nets, the other ninety percent remain idle for a substantial part of the year. Under employment is a major problem in the area. The scanty income and the numerous demands upon it, keep the fishermen in a permanent state of bondage to the money lenders. The interest rate varies from 36 percent to 120 percent. In short, the rebuilding of the life of the fishermen group is a national challenge. Along with economic measures should go a systematic and effective educational campaign.

Durairaj (1981) in his study on Marine Fishing Industry in Thanjavur district has discussed the distribution of income, indebtedness and the annual average return per craft of both the mechanized and non-mechanized sectors. The study revealed that the distribution of income in the worker groups in both the sector was more equitable than in the owner-worker groups and also revealed that workers in the mechanized sector could get a higher income than a owner worker in the catamaran sector. The author stressed the need to improve the efficiency of catamarans by suitably modifying the traditional craft. The study identified that the annual net return per craft in catamaran sector was more than that of the

mechanized sector. The low return per craft in the mechanized sector was mainly due to the high cost of diesel and oil.

Sathiadas and her co-researcher in an article published in 1981 point out that the impact of mechanized fishing in the last two decades on the living conditions of the people of Sakthikulangara and Neendakara of Kerala has been manifold. One of the major benefits is the increased employment opportunity. There is a reduction in the number of indigenous boats in the area. At the same time there has been significant increase in the infrastructure facilities also. The process of mechanization has a great impact on the total landing of fish and prawns in that area. This has resulted in better exploitation of resources. The export of marine products has also increased. There has been an eight-fold increase in income since 1954. But the financial position of the lower income groups could not permit them either to purchase mechanized boats or to invest huge amount of money on fishery related activities. Developments of small-scale industries like coir-making and net-making which have a good scope in this area enable these people to be gainfully employed during off-season.

Srinivasan in an article published in 1981 discussed the status of marine fisheries of Tamilnadu and drew the attention to the problems faced by traditional fishermen due to the increasing competition from mechanized boatmen following the prawn boom. He cautioned that if the tempo of trawling continues unabated, the Madras coast may also experience the diminishing returns which have already set in on the west coast. The author also stressed the importance of diversified techniques in maximizing production and improving the productivity of artisanal fishermen. Further, the author has suggested that the present system of financially helping a few big boat owners may be changed in favor of helping a large number of small boat operators.

Srinivasan in his study published in 1981 worked out on the economics of various types of fishing crafts used in Tamilnadu. The return per unit investment of non-powered boats was estimated to be twice that of powered boats. It was suggested that additional income and employment be obtained by making all fishing

requisites mainly fishing nets, fish processing, transport, marketing and use of catch to raise the village poultry units.

Sathiadhas and Venkataraman (1981) studied the impact of mechanized fishing on the socio-economic condition of the fishermen of Sakthikulangar - Neendakara area of Kerala. This study found that there were improvements in housing, literacy, employment, infrastructure, production, exports and earnings of the region. It, however, recognized the rise in the level of indebtedness of the fishermen households which was attributed to the bank loans taken by the households for purchase of fishing vessels. The study further pointed out the lack of a fishing harbor as the major constraint affecting the development of the project area.

Kurien and Mathew (1982) have studied the impact of technological changes in fishing on fishermen. According to this study there are wide regional variations in the species-mix of the marine resource in the country. The nutritive value of all species of fish is almost the same but there are different type of market demand and prices for various species. There is direct impact of mechanization on fish production in quantitative as well as qualitative nature.

Sehara et al., (1983) in their article on the evaluation of fishermen economy in Maharashtra and Gujarat has dealt with the general socio-economic conditions of fishermen in these two states. The authors have analyzed the literacy, size of family, number of earning members, number of annual fishing days, households income and expenditure and saving pattern of the fishermen of these two states.

Singh and Gupta (1983) in their study on marine fish marketing, and fisheries development in India have pointed out that the transportation of fish is very inefficient in India. Due to inadequate transportation, no fresh fish is available in potential markets located away from the landing centres whereas, surplus fish at harbors is being sent to fish meal plants. The authors have also observed that the catches of certain varieties like sardines and mackerels are landed in a large quantity in fishing season which results in the glut at producing centres.

Balakrishnan and Alagaraja (1984) in a study examined the reasons for the clashes between the mechanized boat owners and the indigenous craft owners

leading to heavy damages in the year 1978 in the coast areas from Jagathapattinam in Pudukkottai District to Mallipattinam in Thanjavur district of Tamilnadu states.

Babaji (1984) has analyzed the production, marketing and consumption characteristics of marine fishery sector at Visakhapatnam in Andhra Pradesh. The author has studied the economy of fisheries sector with reference to the socio-economic profile of traditional fishermen as well as mechanized boat owners. He had also analyzed the fish consumption pattern of people in Visakhapatnam.

The Central Marine Fishery Research Institute (CMFRI) has published an article in 1985 which contains the analysis of the living conditions of the small fishermen in India. As per this publication artisanal fishermen landed 40 percent of the marine fish production in India with traditional implements. They put in an effort of 8-12 hours a day in the sea to earn an income of Rs.10/- to Rs.20/- or even less. A square meal a day is a dream for many artisanal fishermen. The standard of living of these people is generally low. The villages are remote with little transport, communication and sanitation facilities and are exposed to the fury of nature. Educational status is low and drop outs are found both among boys and girls. One of the major constraints in the development of artisanal fishing industry has been the lack of broad network of extension service with trained manpower reaching the fishermen at large and motivates them.

Kalavathy published an article in the year 1985 based on the study the organization of fish marketing in Madras Fishing Harbor in 1985. She identified different marketing channels and means of transport for different species of fishes. While studying the role of women in marketing, she has done a case study for each role, i.e. women as auctioneer, retailer and trash fish wholesaler. She concluded that the mechanization benefited some categories of fish marketing women operating at Madras Fishing Harbor by way of higher incomes or new earning opportunities. It also perhaps aggravated income disparities among fisherwomen. In a small landing centre, the marketing of fish is fairly decentralized and a high percentage of women take to fish marketing. In a large landing centre, marketing is more centralized,

offering fewer employment opportunities but higher profits for those women who have managed to stay in the business.

Panikkar and Sathiadhas (1985) studied the marketing system and price spread of some of the commercially important marine fish in Kerala state. The analysis indicated that fishermen's share of consumers rupee varied from 31 to 68 percent. The fishermen get a better share for quality fishes having high consumer preferences than for cheaper varieties.

Daniel Viswasam Samuel (1986) in his study estimated costs and returns in different fishing units. The study also included economics efficiency of fishing in the selected fish landing centres of the erstwhile Thoothukudi district of Tamilnadu.

In a desk review and resource investigation report, Bhavani (1986) points out that very little information is available on the health and nutritional status of small-scale fisherfolk of India's east coast. A few micro-level studies and base line surveys in Tamil Nadu, Andhra Pradesh and West Bengal give a basic idea. In Andhra Pradesh for instance, it is stated that the dietary habits of fishermen's families seem to be far from satisfactory. A survey undertaken for BOBP in coastal villages of Kanyakumari and Tirunelveli districts of Tamilnadu presents that a considerable number of women and children suffer from partial blindness because of vitamin "A" deficiency.

Subha Rao (1986) made a study to examine the trends in the total fish production of Andhra Pradesh and compared the same with all India fish production at different points of time. The study suggests that Andhra Pradesh was lagging behind in the long term trend of annual growth of fish production than that of India as a whole during the period 1961-81. The catching pattern with reference to percentage distribution of different species in different years showed a declining trend in most cases.

James in his article published in 1988 elaborated that pelagic resources play a key role in the overall marine fish production in India. Marine fish production from the Indian seas has shown considerable increase during the past four decades. The bulk of the resource caught is constituted by oil sardine and mackerel, but these

species showed characteristic wide fluctuations in abundance as well as distribution compared to other fishery resources.

Sudarsan et. al. (1988) conducted a study on the appraisal of marine fishery resources of the Indian Exclusive Economic Zone (EEZ). This study was based on the exploratory survey data collected by Fishery Survey of India and attempts to assess the quantum of resources from the presently unexploited grounds outside 50 metre depth upto 300 metre in the case of demersal fisheries within EEZ of India. As per the study the current yield of fishery resources of the sea around India is about 1.8 million tonnes against wide ranging estimates of a potential of 2.3 - 8.5 million tonnes, which offers great scope to increases the marine fish production. The report also described infrastructure facilities required to exploit these resources.

The Central Marine Fishery Research Institute (CMFRI) has studied in 1988 on the socio-economic conditions of fishermen in North West coast. As per this study Maharashtra and Gujarat are the important maritime States in northwest coast of India. About 180 fishing villages in 10 coastal districts of Gujarat and 375 villages in five coastal districts of Maharashtra are dominated by marine fishermen with a population of about four lakhs. The study points out that illiteracy are high in all the villages (48.75%). A significant difference in the annual income between mechanized group to non-mechanized group and also between the villages existed. The level of indebtedness is found to be high in Maharashtra. Infrastructure facilities like jetty, link roads, ice and cold storage, transport, drying, curing yards are found meager in most of the fish landing centres. The fishermen are not getting remunerative price for their catch owing to the involvement of middlemen who advance money and do marketing of catches. Fishermen are generally unemployed and are not able to meet even their household expenditure during lean season in both the States.

Selvaraj (1988) in his study has identified the fishing seasons for important species of fish groups and estimated the economics of different craft categories in the selected coastal fishing villages of Kanyakumari District of Tamilnadu. He formulated suitable strategies for the development of fisheries sector for the betterment of fisher folk in the district.

Sathiadhass and her co-researcher (1988) have studied the small scale fishermen with emphasis on costs and earnings of traditional units along Thiruvananthapuram coast of Kerala. They have analyzed the Socio-economic conditions of fishermen in relation to new technology and participation in development schemes. They have observed that Catamarans with hooks and lines are found to be suitable for the small investors.

Sathiadhas and Panikkar (1988) made a study on market structure and price behaviour of marine fish in Tamil Nadu. They concluded that fish marketing in Tamil Nadu is still under the clutches of middlemen. Of the 25 varieties of fish covered under the study, the percentage of marketing margin in consumers price for 20 varieties which constitute 90 percent of landings worked out at more than 40 percent.

Krishna Srinath published an article in 1988 on his study among the fishermen of Vypeenkara, Kerala on efficiency of the technology based on the perception of the fishermen about their present and future status in relation to their living conditions prior to motorization. Data were collected from 50 units out of 115 motorized crafts through an interview schedule. Information on personal variables, impact of motorization and the living standards and projection for future, aspirations and facility satisfaction as assessed qualitatively by fishermen themselves were collected. From the study, it was concluded that motorization can be instrumental in bringing about significant changes in the living conditions of fishermen and their outlook and inculcating the spirit of unity and co-operation among them. The fishermen in general felt that their status has improved as a result of motorization and were more optimistic about their future.

Panikkar and Sathiadhas published an article in 1989 about their study on the fish marketing system prevailing in Kerala. The study include price structure, seasonal and spatial price variations, marketing margins of commercially important varieties of fish and the share of fishermen as well as middlemen in consumer's rupee. The study revealed that due to lack of infrastructure facilities the supply of fish at the landing centre is highly inelastic which often would be resulted in

disposal of fish at throw-away prices at the time of heavy landings. The involvement of a number of middlemen in the marketing chain adversely affects the interest of both fishermen and consumer. Fishermen's share in consumer's rupee varied from an average of about 40 percent for cheaper varieties of fish to about 65 percent for high priced varieties. There has been a considerable increase in the marketing expenditure over the recent years.

Samuel published an article in 1989 points out that the study of the socio-economic conditions of fisherfolk especially fishermen have been neglected by sociologists and economists. The fishermen have a very low status in the social hierarchy, which leaves them worse off than their counterparts despite the fact, that the involvement of the fishermen in the industry is considerable. But their role stands unrecognized. In a survey conducted in Tirunelveli district by the author, it was found that the extent of literacy among fishermen ranged from 65 percent in catamaran motorized unit to 37.19 percent in mechanized unit. Being illiterate and have no other opportunity to work, the women of artisanal unit help their men folk in fish marketing and related sundry activities. More than 90 percent of fishermen in the artisanal fishermen families possess skills in net making and fish processing. It is interesting to find that there is practically no involvement of fishermen belonging to the mechanized unit in decision-making of economic activities but fishermen of artisanal units are involved in decision-making of economic activities to some degree.

Sathiadas and her co-researcher in an article published in 1989 expressed that the successful implementation of any development programmes in fisheries depends upon the socio-economic conditions of the target group. Their observation is based on a study on the socio-economic status of marine fishermen along Madras coast in 1984-85 in two fishing villages namely Thiruvottiyurkuppam where non-mechanized fishing is carried out and Pudumanikuppam where fishing is done using mechanized craft.

Senthilathiban her co-researcher in an article published in 1989 discussed the cost of production and net income of the fishing households in the selected fishing

households in the selected fishing village of the undivided Thoothukudi district. The increase from fishing was found to be highly variable while fish catch was almost static due to traditional fishing methods. Rapid motorization adequate credit and marketing were suggested for improving economic status of fisher folk.

Sathiadas her co-researcher in their article published in 1989 discussed the cost benefit relationship of three types of trawlers of sizes 8.5 meter, 9 meter and 9.5 meter operating at Thoothukudi fisheries Harbour in Tamilnadu. The initial investment, fixed cost, operating cost and returns involved with those three types of trawlers were analyzed. The authors had also calculated various key economic indicators for these types of trawlers. They concluded that the capital turnover ratio, rate of return to capital and payback period were better for smaller boats. But in terms of labour productivity, wages, quantum of catch, gross revenue and net profit, the bigger size boats were comparatively more efficient.

Sehara and Karbhari published an article in 1989 on the basis of a study aimed to measure the economic efficiency of Outboard Motor (OBM) units operating gill nets in northwest coast. Kochra Nivti in Sindhudurg district of Maharashtra and Dhamlej in Junagadh district of Gujarat were selected and the study was conducted during the year 1986-87. The data were collected from a sample of 20 units with the help of schedules. The information relating to the details of craft, gear, labour, infrastructure, credit, marketing, preservation of catch, fixed cost, operating expenditure, catch composition and price of fish were collected. Based on various economic parameters, they have concluded that the gill net fishing by dugout canoe fitted with outboard engine was found to be profitable in northwest coast during 1986-87.

Chidambaram her co-researcher published an article in 1990 on the basis of a study on the marine marketing in Tiruchendur area of Tamilnadu. They have analyzed the marine fish supplies and various marketing problems of the fishermen on the basis of an empirical study based on survey method. By adopting simple random sampling technique, the relevant data were collected from 81 fishermen. In their analysis they had found that the fishermen played only a minor role in the

actual distribution of fish. These fishermen were at the mercy of the middlemen. The co-operative marketing union had remained dormant. The authors had suggested that the fishermen should be educated about the benefits of society.

Shukla in his article published in 1990 has outlined the basic characteristics of the Indian fishery sector and stated that the contribution of the Indian fisheries to world fisheries was just three percent even though investment to employment ratio was very high. According to the author necessary provisions were to be made in regard to infrastructural, technological, financial, managerial, policy strategy and other such inputs.

Sathiadas her co-researcher published an article in 1991 on the basis of their observation on the income distribution and expenditure pattern of fishermen households representing catamaran owners and crew members of two fishing villages along Madras Coast. The authors found that diversified activities and better infrastructural facilities were necessary for better income of the fishermen households and suggestions for the overall development of the traditional fishermen were also presented.

Sehara her co-researcher in an article published in 1992 described the monsoon fisheries in the west coast of India. The authors observed that during monsoon period (June-August) fishing operation is only at a subsistence level and the number of mechanized units under operation is reduced to about 10 percent of the total units and non-mechanized units are reduced to 25 percent. The household income during monsoon is very low and consequently fishermen become permanent debtors. To overcome these difficulties, it is suggested to constitute a public agency to purchase fish at a minimum price whenever there is a glut at the landing center, and to provide adequate finance at reasonable terms and conditions through co-operatives.

Sathiadhas and Panikkar in their paper published in 1992 discussed the marketing margins, and producer's and middlemen's share in consumer's rupee for commercially important varieties of marine fish in Madras region of Tamil Nadu, India. Pudumanikuppam which is a major mechanized landing centre as primary

market, Chintatripet as wholesale market and Pattalam, Chintatripet, Saidapet and Vadapalani (all in Madras city) as consumer markets were selected for the study. Data on landing, wholesale and retail prices of selected varieties of fish were collected for 15 to 20 days in each quarter during April 1984 to March 1985 by following the marketing channel.

Sathiadhas, Panikkar and Kanakkan published a paper in 1992 on the basis of a study aimed to evaluate the changing pattern of craft - gear combinations, their catch composition and comparative economics of operations at Nagapattinam centre of Tamil Nadu coast during the year 1987-88. The authors collected primary and secondary data for their study. The primary data were collected through schedules regarding the information pertaining to initial capital investment on hull, engine, nets and other accessories, year of purchase, resale value of the unit, source of finance, sharing pattern of crew wages, annual repairing expenses, operational cost, species-wise catch and revenue. The secondary data pertaining to mechanized and non-mechanized fish landings, crafts and gears etc. were collected from Central Marine Fisheries Research Institute. Review of production trend made by the authors showed that the contribution of mechanized boats in the total marine fish landings of Tamil Nadu steadily increased from about 28 percent in 1976 to *62* percent in 1990. The trawl catch forms more than 90 percent of the mechanized landings and 50 percent of the total landings of the state. According to the authors the introduction of single and two boats high opening trawl nets were economically efficient and the pair trawling further provided a new technique to fishermen to harvest the hitherto under exploited valuable resources. The study revealed that the convenience of shifting from trawling to pair trawling or vice-versa depending on the availability of various resources within the region enhanced the overall catch rates of these units offering further scope to increase the trawl landings along Tamil Nadu coast.

Rao and Murthy in an article published in 1993 have elaborately discussed about various controversies and complexities in management of inshore fishery resources of India. They concluded that none of the management measures adopted

in the country can be considered as successful. Taking into various complexities of issues in management of fishery resources such as heavy fishing pressure in the inshore fisheries of the country, its impact on sustainability of resource and deepening conflicts among the resources users etc. they put-forth the following suggestions in policy making: (a) provide increased role to the local or regional fishing communities in the formulation of regulatory measures and their managerial responsibility; (b) ensure positive access in favor of local fishing communities; (c) formulate regulatory measures with a strong conservation policy through careful regulation of fishing effort and restrictions on gears; and (d) incorporate a system of fishing zones within the regional management scheme transmuting the conflict to co-existence or even symbiosis.

Sekar, Senthilnathan and Isabella Rani published an article in 1993 on the basis of a study aimed to analyze the coastal region-wise, craft-wise, gear-wise and month-wise fish production in Tamil Nadu during the year 1992-93. Craft-wise fish production showed that mechanized crafts are contributing around 59 percent of total catches. Among the gears used for fish production, gill net accounted for 39 percent followed by trawl net 31 percent of total fish catch. Month-wise analysis showed that July, August and September are the peak period for fishing activity. Region-wise fish production showed that Palk Bay recorded the maximum annual growth rate and the west coast has the lowest. However, production per Kilometer of coastal length was the higher in the west coast. Therefore, it was suggested that necessary steps to be taken to involve fishermen effectively by providing infrastructures needed to them for fishing, so that the west coast potential is tapped for increasing the marine fish production.

Pillai, Balakrishnan and Alagaraja published an article in 1994 based on the study on the exploited fisheries of Tamil Nadu and Pondicherry for the period from 1985 to 1989. The study dealt with the contribution of the mechanized and artisanal fisheries sectors, share of pelagic and demersal groups in the fish production, the trend of district-wise fish landings, the resources of non-conventional fisheries, the present status of marine products exports and the recent scenario of mechanization

of country craft. The authors concluded that the annual average exploited marine fishery resources of Tamil Nadu state during the period 1985-89 was estimated to be 2.6 lakh tones indicating an increase by nine percent over the preceding five year period. They also observed that there were higher returns from the mechanized sector over the non-mechanized sector during their study period. As per the authors this increase in fish production was possible by the large scale introduction of artisanal gear and motorization of country crafts. It is revealed from the article under discussion that the region 0 - 50 m depth was heavily exploited. The share of pelagic fishes during the study period was 48.8 percent which 5.8 percent higher than the preceding five year period. In the district-wise fish landings, Thanjavur and Ramanathapuram dominate which together contribute 38 percent to the total landings of Tamil Nadu. As per the article during the period 1985-89, Tamil Nadu contributed 17 percent of the total marine products exported from India. There was an increase of 15 percent and 58 percent respectively in total quantity exported and the value realized in India during 1985-89 than the previous year period 1980-84, whereas Tamil Nadu accounted an increase of 53 percent and 120 percent respectively. In respect of Pondicherry Union Territory, the fish production has increased by 13 percent during the period 1985-89 than the previous five year period 1980-84. The fish production by the mechanized and artisanal sector shows that only marginal increase by mechanized sector whereas 18 percent increase by the non-mechanized sector. The pelagic and demersal constituents of the marine fish landings during the period were 68 percent and 32 percent respectively in Tamilnadu and Pondicherry.

Pauly in an article published in 1994 has presented a brief review of the demersal and pelagic fisheries of Southeast Asia, with emphasis on biological and socio-economic factors (such as, the presence of inshore shrimp stocks and mass unemployment respectively) and which tend to promote over-exploitation of marine fish resources.

Sathiadas et al. studied the impact of mechanization on artisanal fishermen in Thanjavur coast of Tamil Nadu in 1994. The authors have observed that the intensive

mechanization programme has even deprived the traditional fishermen of their legitimate claim for fishing in the near shore areas. There are also frequent conflicts between the mechanized and non-mechanized fishermen over their fishing rights. It was found that the level of employment for hired laborers as well as those not having sufficient equipment was low and they were very much underemployed. The seasonal nature of fishery and the risk and uncertainties associated with marine fishing work of the fishermen leads to low-income trap. The poor economic conditions coupled with less availability of finance from the institutional agencies compel them to sustain with less equipped fishing equipments which in turn results in lesser returns. Lack of marketing and infrastructure facilities is another factor responsible for lesser returns to the fishermen. Therefore, as per the authors extensive and comprehensive area development programme for the entire coastal belt is required to improve the socio-economic condition of marine fishermen.

Kemparaju published an article in 1994 on the basis of a study on the drift gillnet fishery of the Goa state during the period 1985-88. It was found out from the study that the drift gillnet fishery during the period from 1985 to 1988 in major centers showed a steady improvement indicating its continued importance in the exploited fishery of Goa despite the fluctuations noticed. It was also observed that in the small-scale fisheries sector, the drift gillnet fishing was significant as it exploits the higher value fishes such as seer fishes, tunas and sharks. Thus the drift gillnet fishery has better development prospects in the state.

Siddiqui in an article published in 1995 compared the socio-economic conditions of fishermen in Tamil Nadu and Orissa. As per this article main livelihood of fishermen wholly depends on the catch of fish from fishing and marketing. Fishing season starts from August and continues upto March. Fishing is generally not undertaken for about 60 days in a year when the sea is rough or due to cyclonic weather. On the other hand mechanized fishing vessel owners are able to carry out their normal operations during the off-season also. The funds collected for the purchase of traditional craft or mechanized vessels are partly from their own sources and partly through money lenders. They are hesitant to avail bank finances

because of the conditions of repayment of loans and lots of formalities they have to undergo. About 70 percent of the persons interviewed were indebted for meeting their day to-day maintenance in time of poor catch or poor marketing, marriage expenses etc. The fish merchants or money lenders are the source for providing loans at a higher rate of interest of 36 percent. In the light of the above conditions, it is suggested by the author that the fishermen should be motivated for undergoing training so that bank loans are availed by them for the purchase of fishing crafts or gears. Efforts should be made to provide basic infrastructural facilities like pucca road, drinking water supply, sanitation facilities, medical and school facilities.

Devaraj his co-researcher in an article published in 1996 evaluated the growth of fishing industry in the east coast of India which consists of the coastal states of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Pondicherry. They came to the conclusion that during the past three decades the availability of fishing area has been increased; the number of mechanized vessels increased by about 10 times from 1,228 in 1961 to 12,223 in 1991; the marine fish production in the east coast increased by 3.4 times i.e. the average landings increased from 1,87,000 tonnes in 1960-64 to 6,34,252 tonnes in 1990-94; the annual average yield during 1990-94 was 42.3 percent of the potential yield and there is a production gap of 57.7 percent. As per the authors the inshore area (less than 50 m. depth) is intensively exploited and there is considerable scope for intensifying the effort in the offshore area (more than 50 m. depth).

Mahesh and Joshi in an article published in 1996 discussed about his study on the factors affecting the mechanization of fishing crafts and the impact of mechanization on marine fish production and income and the standard of living of fishermen's households. He also discussed about his study on the hazards effects of mechanization and foreigner's deep fishing in Indian Ocean and identified the problems of small fishermen. The main findings of his studies are: (i) There is direct relationship between fishing mechanization and employment opportunity. It was also observed that the average earning of crew members households in mechanized fishing were substantially higher than those of non-mechanized fishing.

Mechanization and higher wages are co-related to each other. (ii) Generally fishermen may borrow from the commercial banks, fish merchants, money lenders, relatives and friends. Co-operatives have failed in providing credit to the fishermen. Finance is a main obstacle in fishery development. (iii) The variable cost per trip for a trawler is higher than the Outboard Motor boat (OBM). The cost of fuel is a single prime item in the case of trawlers. The salary of crew members is high in mechanized boats. (iv) All the fishermen have strongly unanimously and aggressively opposed for deep fishing permission to the foreigners. (v) The arrangement of maintenance of mechanized boat is very difficult compared to same for non-mechanized boats. (vi) Mechanized boat owners have more income and relatively much higher standard of living as compared to non-mechanized boat owners. (vii) There are serious problems, limitations and litigations of mechanization. It badly affects the small fishermen. There are problems of fuel, finance, maintenance, repairing, higher costs, etc., due to mechanization. (viii) Contribution of the government and co-operative institutions for finance is very negligible. Fishermen prefer loans from fish merchants, friends and relatives. Banks are also one of the sources of borrowing.

Chidambaram his co-researcher (1997) have studied marine fish supplies in Tiruchendur area of Tamilnadu. They have described fishing operations, financial requirements, and profitability in fishing and production problems encountered by the fishermen. They have also given policy suggestions for the development of the fishermen.

Sathiadhas (1997) studied (i) the production trend and variation in catch composition of marine fish over the years, (ii) the economics of different craft - gear combinations in marine fishing operations, (iii) the marine fish marketing problems to determine price spread of different varieties and to assess the share of fishermen and middlemen in consumer's rupee in Tamil Nadu. The author used both primary and secondary data. Data on costs and earnings of different craft - gear combination and price of different varieties of fish including handling and transportation charges at various points of the marketing channel etc. were collected by direct observation

at selected centres of Tamilnadu. The study revealed that (i) both mechanized and non-mechanized sectors are important to increase the fish production, (ii) motorization of country craft helped the fishermen to improve their living condition, (iii) catch per unit effort of trawlers is continuously declining in Tamil Nadu (iv) lesser the number of intermediaries in the fish marketing chain, higher is the share of fishermen in the consumer's rupee.

George Mathew in an article published in 1997 discussed about his evaluation of the project jointly undertaken by the Post-Harvest Fisheries Project (PHFP) and the Kanyakumari District Fishermen's Sangams Federation (KDFSF) on commercial operation for marketing rack-dried anchovies on a pilot scale in the year 1992 in Kanyakumari District. The main aim of the project was to promote the use of drying racks for drying anchovies in order to avoid the physical and value losses sustained by Kanyakumari district fishermen through sand-drying of anchovies. The rack dried fish got good prices 10 times more than that of sand-drying fish because of its high quality, but the market potential is very limited. Only the metropolitan markets of Chennai and Hyderabad require such a superior quality product. Even though, the project's planning, problem shooting and precautionary foresight were just right, but failed in its effort to market the anchovy product on its own and replace the middlemen since the anchovy fishery collapsed in 1994. Consequently, after two years the project wound up the anchovy-drying activity. But one positive outcome is that some individual fishermen have taken up rack-drying of anchovies. The rack-drying fishes will definitely get high prices for its high quality than that of sand-drying fish.

Desai and Bhargava (1998) carried out a comprehensive work on primary and secondary production in the northern Indian Ocean including the Arabian Sea and the Bay of Bengal. The authors estimated the primary and secondary rates of production. Based on biologic data, fishery potentials have been computed to be 4.72 million tonnes in the entire EEZ of India. As per the authors present marine fish catch is about two million tons; therefore, the fish catch could be increased substantially. The authors have also described the seasonal picture of biologic

production and fishery potentials in all sectors of the EEZ. It shows the Southwest monsoon period (June to September) to have a high fishery potential. This is reflected in fish catches in the post monsoon months especially along the east coast of India.

Hameed in an article published in 1998 discussed on the exploited and potential fishery resources of the EEZ of India spread over 2.02 million sq. km. Exclusive Economic Zone of India has a fishery potential of 3.9 metric tons of which 2.21 metric tons are within the 50 m. depth zone and 1.69 metric tons beyond it. The demersal stock is about 0.65 metric tons, the coastal pelagic about 0.74 metric tons and oceanic resources about 0.30 metric tons. The depth-wise, region-wise and resource-wise potential yield of demersal, pelagic, oceanic and allied resources is presented in the article and major exploited and under-exploited resources offering scope for increased production are outlined in the article. The landing patterns of marine fish during 1980-1996 have also been analyzed in the article under discussion.

The Central Marine Fishery Research Institute (CMFRI, 1998) in a study on the Socio-Economic Conditions of Fishermen in North West coast of India points out that illiteracy was high (48-75%) in all the fishing villages along the coast. Significant difference existed in the annual income between the mechanized and non-mechanized groups and also between villages. The level of indebtedness was found to be high in Maharashtra. Infrastructural facilities like jetty, link roads, ice and cold storage, transport, drying, curing yards were found meager in most of the fish landing centers. The fishermen were not getting remunerative prices for their catch owing to the involvement of middlemen who advance money and do marketing of catches. Fishermen remained unemployed and were not able to meet even their household expenditure during lean season.

Shanmugaraj and his co-researcher in 1998 published their report of the project aimed to find out the socio-economic status of the fisherfolk communities of the Gulf of Mannar Marine Biosphere Reserve. The report revealed that there are 49 villages along the coast, of which 38 are in Ramanathapuram district and 11 are in

Thoothukudi district bordering the marine biosphere area. The fishermen from these villages depend solely on fishing for their livelihood. The fishermen are well trained in sorting fish, cleaning, drying and marketing them. They also act as agents for the boat owners at auction centers and earn a good commission. The fisherman's daily income depends upon his day's catch, which is not regular, and at a steady level. The fishermen market their catch either individually or through their association or through agents. Normally, the fishes are auctioned at the landing centres. The community of the biosphere area feels that with the support of the government agencies, better decisions can be made on planning, allocation of area within the Gulf of Mannar for certain uses, fishing gears etc. The government should provide economic and other infrastructure facilities through society or village level organisations to improve their livelihood.

Chennubhotla and his co-researcher (1999) have conducted a study about the different kinds of non-mechanized and mechanized crafts used and gear employed along the Andhra Pradesh coast. They have observed that until the middle of 1960s fishing for marine finfishes and shellfishes along the Andhra Pradesh coast used to be carried out employing indigenous non-mechanized crafts. Subsequently, trawlers and later mechanized vessels operating gillnets came into use which resulted in the creased fish production. Use of outboard engine on indigenous crafts for reaching fishing grounds is a recent feature of near the coast fishing.

Nayar and Gupta in an article published in 1999 remarked that in developing countries such as India, marine fish production is far lower than the estimated capacity. Currently, fishing activities are carried out mainly in coastal waters; fishing areas in high seas and outside of the country's EEZ are under exploited. Methods of fishery management are ineffective and advanced technologies for fish detection are practically absent. With the launching of the Indian remote sensing satellite, it is believed that India will be in a position to fully exploit its resources.

Verduijin (2000) on behalf of the Bay of Bengal Programme (BOBP) conducted a survey in Kanyakumari district to find the basic needs of 39 coastal fishing communities which inhabit the 68 km stretch of the coast. The author observed that

over the years, the intensity of fishing has increased partly on account of the increase in the active fishing population, partly due to the lack of alternative income generating opportunities and partly due to motorization and mechanization of fishing crafts. The observation further reveals that the resource has not kept up with the increase of effort, which results in a sharp reduction in catch per unit effort. Since the usage of mechanization in 1958, artisanal fishers have with dismay compared to the landings of the mechanized crafts with their own meager catches. Besides, the artisanal fishers have often seen their nets destroyed by mechanized boats. With this background, the survey points out that the major problem as given by the respondents is the non-availability of safe drinking water followed by sanitation and health care.

Varghese and Sornvanshi (2001) have presented the coastal country-wise finfish, crustacean and cephalopod species/ species-groups contributing to the fish production, as well as the similarities and variation among them in the Arabian Sea. The fish landings reported by most of the countries in the region contributed similar set of species with varying abundances. The most common species reported are groupers, threadfins, barracudas, seer fishes and mullets among fin fishes, besides a number of species of shrimps and cephalopods. Barring localized and specialized fishing methods employed for catching pelagic fish resources, trawling has been the single largest technology being practised in the region for harvesting the demersal stocks by almost all the countries. The conservation and management measures emanating from the FAO Voluntary Code of Conduct for Responsible Fishing could be a common agenda for the coastal nations in the region.

Dibakar Naik published an article in 2001 on the basis of a study on trends in marine fish landings and marine fish marketing in different maritime districts of Orissa during 1996 to 1999. The finding of the author state that marine fish production in Orissa has been increased from 38.70 thousand tonnes in 1980-81 to 133.46 thousand tonnes in 1996-97 and it declined to 121.08 thousand tonnes in 2000-01. On an average the State has recorded a growth rate of 8.86 percent for marine fish production during last one and half decades. Marine fish marketing in Orissa has

been carried out by a large number of intermediaries forming a long chain of market channels. In short five or less number of intermediaries forms the market channel for the marine fish in Orissa. In the existing marketing system the fishermen's share has been decreased to the extent of 22.20 percent to 26.76 percent with the increase in middlemen from one to five in the market channel.

Balasubramaniyan (2001) in his study compared the economic status of fishermen in two marine fishing villages of Orissa State viz., Pentakota and Belinoliasahi. The author measured the economic status and the mean scores of respondents in the two villages, which differed significantly at one percent level. The results also revealed that the fishermen had a favorable attitude towards the motorization of fishing crafts in both the villages.

Shiyani (2002) has made an analysis on district-wise and species-wise growth and instability of marine fisheries in Gujarat. It has been concluded from the study that relative share of Junagadh, Kutch and Jamnagar districts in the total marine fish production of the state increased substantially over a period of time, whereas a drastic decline in the case of Valsad and Amreli districts was noticed. The instability indices were comparatively higher during 1970-80 in all the districts except Kutch, Amreli and Jamnagar. The compound growth rates of fish production of almost all the species were positive and significant. It has been suggested by the author that awareness campaign among the fishermen on the importance of mesh size regulation would be useful for the sustainable benefit of marine fisheries in the long run. The author also suggests that the Government should take necessary steps to enforce sea law demarcating different fishing grounds for different craft gear combination which will help maintaining socio-economic balance instead of creating socio-economic conflicts among the fishermen.

Krishnan (2003) has examined the recent trends in mechanization of Malabar fishery sector in Kerala. He has studied the operating cost of trawlers fitted with in-board engines using diesel as fuel and out-board engines using kerosene for ring-seiners. He worked out that the average cost of operation per day for a ring-seiner unit using out-board engine run by kerosene was between Rs. 5000 and Rs. 6000 and

for dieselized Leyland in-board engines came down to Rs. 2000. In view of this, more and more active fishermen were attracted towards the introduction of in-board engines.

The Marine Products Exports Development Authority (MPEDA, 2003) reviewed the marine products export scenario for the year 2002-03. It has been mentioned that the export of marine products showed an increasing trend in 2002-03. The increase was 10.09 percent in quantity, 15.52 percent in rupee realization and 13.69 percent in US $ realization. The average unit value realized was US $ 3.05 per Kg. compared to US $ 2.95 per Kg. of the previous year. Frozen shrimp continued to be largest item in terms of value. Shrimp contributed 26.85 percent in volume and 66.97 percent in value of the total export of marine products from India. U.S.A. emerged as the single largest market for Indian marine productions in value terms during 2002-03 relegating Japan to the second position. Chennai continued to be the largest port through which the marine products exported.

Mini and Srinath in an article published in 2003 have made an appraisal about the trawl fishery of Tamil Nadu for the period from 1985 to 2000. In this article, the trend of fish production in Tamil Nadu and catch composition has been analyzed. It has been estimated that the annual average of marine fish production during 1985 - 2000 was 3.51 lakh tonnes representing 15.8 percent of total all India landings. The fish landings showed increasing trend during the year 1985 to 1992, and decreasing trend in 1993, recovered in 1997 and again decreasing trend in 2000. It has been found that the reason for the fluctuations was the increased number of trawlers and extension of the fishing ground for upward trend. The reason for the downward was the overexploitation. In the analysis of catch composition, it has been concluded that silverbellies was the most abundant constituent (23.2 percent) followed by cluepids (14.2 percent), penaeid prawns (10.5 percent), croakers (4.8 percent), carangids (4.3 percent), rays (3.9 percent), thread-fin-breams (3.9 percent), cephalopods (3.8 percent), other perches (3.3 percent), goat fishes (3.1 percent), crabs (2.8 percent), lizard fishes (2.6 percent), ribbon fishes (1.1 percent) and pig-face breams (1.0 percent).

Venkatachalam in his article published in 2005 examined the threat to the substantially of the fisheries in India and in particular in the Gulf of Mannar region. It is widely quoted that the depletion is due to the introduction of trawler fishing techniques, which scrape the bottom of the sea and end up catching juvenile fish. In viewing this problem of over fishing (by the trawlers) as a negative externality to the traditional fishing community, the best way to internalize the social cost inflicted by the people who over fish is the question that this study attempts to seek the answer for. One of the most commonly practiced techniques to sustain the fisheries resource is the blanket ban on fishing during specific months of the year like the one practiced in the coastal regions in India. The researcher has attempted to critically evaluate the effectiveness of this method of resource conservation.

Ganesh Kumar and his co-researcher published an article in 2008 on the basis of study conducted in all the major coastal states and some selected inland states to understand the domestic marketing of fish in India. The study reveals that the marketing efficiencies for Indian Major Carps (IMC), sardine and seer fish have been found to vary from 34 percent to 74 percent depending on the length of market channel. The marketing efficiency has been found more in the case of marine species than freshwater species, since the latter travel longer distances from the point of production to consumption centre, passing many intermediaries as compared to the former. The fisherman's share in consumer's rupee has shown variations across species, marketing channels and markets. The infrastructure facilities at most of the surveyed landing centres, fishing harbours and wholesale and retail markets have been found grossly inadequate and poorly maintained. The study has highlighted the need for formulating a uniform market policy for fishes for easy operation and regulation, so that the country's fish production is efficiently managed and delivered to the consuming population, ensuring at the same time remunerative prices to the fishers.

Gupta in an article published in 2006 has dealt with the challenges in sustaining and increasing fish production to combat hunger and poverty in Asia. The author has concluded that while there are ample opportunities for fish and

fisheries to make a major contribution to food and nutritional security and to contribution to the eradication of the poverty.

Namasivayam in his article published in 2007 observed that the marine food export of India fetches several millions of foreign exchange to our country and provides employment opportunities for people directly and indirectly. To increase the export of marine food products to various countries, the hurdles such as excise duties, over tax in the exports is to be taken into consideration with immediate effect.

Ganesh Kumar et al. published an article in 2010 based on their study conducted with the objective to understand the process of innovative marketing models in the fisheries sector and to draw lessons from the success stories to upscale and replicate in a similar socio-politico-economic scenario in other parts of India. The study aimed to provide a better understanding of fish marketing by self-help groups (SHGs), producer associations, fisheries development corporations, fisherman cooperatives and private institutions in the southern states of India, namely Tamil Nadu, Kerala, Karnataka and Andhra Pradesh with the hypothesis that the institutional arrangements in the marketing of fish and fishery products reduce the transaction cost and improve the market access and its efficiency. The study has reported the primary activities of those institutions in the efficient fish marketing, such as inbound logistics, operations, outbound logistics, marketing and sales promotion and support activities like infrastructural facilities, technological backstopping, price information and procurement. Through these advantages, the fishermen have been found to achieve economies of scale, technological innovations, capacity development, linkage among activities, degree of vertical integration, timing of market entry, product differentiation, market access, credit access, etc. The study has suggested replication of such successful innovative institutions in marketing the fish and fishery products through appropriate policies and programmes.

CHAPTER – 3

MATERIALS AND METHODS

CHAPTER - 3

MATERIALS AND METHODS

3.1. Materials of the Study:

It is already stated that the present research was carried out among the persons engaged in high sea fishing with mechanized vessel and corresponding fishing tackles operating from the fish landing centre at Digha. Therefore, the centre constitutes an important component of the material of the present study. Therefore, the present researcher considered that before proceeding to the details of the materials and methods of the present study a brief description of the fish landing centre at Digha is necessary. Thus, the following paragraphs deal with the brief description of the Digha Fish landing centre.

3.1.1. Digha Fish Landing Centre:

Digha is situated close to the Gangetic mouth on the east of India at latitude 21° 36'N and longitude 87° 30'E. It is a seaside resort town in the state of West Bengal, India and it lies in East Midnapore district and at the northern end of the Bay of Bengal. The coastline of Bay of Bengal in East Medinipur district is about 60 km. in length and it stretches from Digha under Ramnagar-I Block to Talpati Ghat under Khesuri-II Block.

Marine fish landing center at Digha is located on the shore of the confluence of a river locally called Champa and Bay of Bengal. Oral history reveals that since mid-50's a small group of fishermen associated to marine fishing with non-mechanized boats used to use a location almost adjacent to Digha tourist center for landing marine fish primarily to cater the requirement of the tourists. These fishermen and the traders associated with marine fishing formed an organization with its office in a humble cottage adjacent to the landing center. This organization was registered in the year 1978 under the name of 'Fish Traders Association' (FTA). However, during 1986 owing to a Government Program for casuarina tree plantation on the sand dunes of Digha coast

these fishermen were displaced from their landing center and move to the marine fish landing center and the office of the said association was shifted to its present place. Initially, the association purchased a non-arable land of about 20 acres with the fund made out of the contributions of the members of the association. Since the land was a cooperative property therefore, each member was allotted a plot proportionate to their respective amount of their contribution. Since the earlier name of the association did not reflect the role and contribution of the fishermen actually going to the sea for fishing therefore the association felt it necessary to give them due importance. Thus in the year 1990 the association was renamed as 'Digha Fishermen and Fish Traders Association' (hereafter DFFTA).

It is revealed that in the year 1993-1994 fishing was not much mechanized in Digha due to which fishermen there used to catch fish by using country boats or non-mechanized fishing boats. Naturally the cost of fishing at that time was not as high. Due to lack of mechanized trawlers the fishermen at that time were unable to enter deep sea as a result of which they used to sell more or less similar type of fish species in the market. Apart from this, fish marketing in Digha was not as much developed as we find in present day situation.

Present day fish landing center at Digha managed by DFFTA has the provision on the one hand and to host mechanized vessels for landing marine fish procured from the deep sea and on the other hand to extend infrastructural facilities for initiating and organizing high sea fishing expedition with mechanized vessels. From the record of the office of this association it was found that there are about 1000 mechanized vessels of different varieties — in terms of engine capacities as well as crafts and gears – operating from this landing center. It was also revealed from the record that the different types of vessels are used for marine fishing in different methods. The following table shows the distribution of the vessel types operating from Digha fishing harbor along with their association with the fishing apparatus as well as methods and area of fishing.

Table no. 3.1: Distribution of the Vessel Types and Corresponding Fishing Tackles as well as Methods and Area of High Sea Fishing.

Type of Vessels	Number	Apparatus	Method and area of operation
Trawler	550	Trawl	Trawling in High Sea
Fishing body	300	Gill net	Gillnetting in High Sea
BhutBhuti or Borshi body	150	Line and hook	Trolling comparatively nearer to the coast.
Total	**1000**		

The major infrastructural facilities available in the fish landing center at Digha is almost identical to a fishing harbor except the absence of any permanent jetty for landing and berthing facilities for the vessels. These facilities are convenient for unloading and loading respectively from and on the vessels.

In the fish landing center of Digha the unloading and loading respectively from and on the mechanized vessels is carried out with the help of small country boat since the vessels are anchored a few hundred meters away from the shore in the conducive depth of water. Whereas, unloading and loading respectively from and on the country boat is carried out with the help of manually driven trolley.

At the center in the office building of the DFFTA there are provisions for wireless, radio and television set. Apart from this there is one rest room, ten bed rooms with attached privy and bathroom, one meeting hall, one air conditioner conference room for the government officials. There is a festival arena as well as a parking space in front of the office building of the association. The association own and manage the fish market adjacent to its office building. The floor of the fish market is made of concrete and there are twenty public toilets adjacent to this market which are built and maintained by the association.

There are about one hundred seventy concrete floored shades for trading the marine fishes in the fish market. Each shade is equipped with overhead water connection for washing the fish, weight and balance, plastic crate to keep the fishes, shovel for lifting the fishes in to crate etc. Although the users of the shades are the members of the DFFTA but they are obliged to pay an amount of Rs. 30/- per day of transactions. These subscriptions are used for maintenance of the market place.

Adjacent to the fish market there are numbers of privately owned shops and establishments. Owners of these establishments have purchased their respective plot from the association. Brief descriptions of these shops and establishments have been presented in the following paragraphs.

There are altogether six fish washing center where the marine fishes selected for export are intensively and carefully washed in lieu of payment in cash. Besides, there are twenty one establishments for packaging the fishes. These establishments on payment provide ice slabs, ice-slab breaking machines, thermocol crates with lids, adhesive tapes for sealing the thermocol crates etc. There are six hardware shops where the spare parts for the mechanized vessel, iron made grapnel-anchor, floats of different varieties like plastic jerrycan and plastic ball, circular sinkers either made of terracotta or concrete, plastic barrel required either to store the sweet water or to store the fuel, nylon ropes of different diameter etc.

At least seven shops where fuel woods are sold. The fuel woods are purchased by not only by the voyagers but also by other customers seasonally inhabit in the fish landing center of Digha. Apart from the above shops and establishment there are altogether thirteen tea stall, seven confectionary shop, five hair cutting saloon for men, four cloth stores and two medicine shop with doctors chamber.

From a pilot survey it was revealed that the marine fish landing center of Digha is managed by a committee known as DFFTA formed by the owners of the mechanized vessels. There are all together 1000 mechanized vessel for marine fishing registered

under this association and more than 15000 fishermen are associated with this fish landing center. The records available from the said office suggest that different methods and techniques followed by the fishermen of Digha and they are broadly three types:

1. Trawling with mechanized vessels/trawler.
2. Gill netting with mechanized vessels.
3. Hook and line fishing with motorized boat.

In view of the above collected facts from the record of the said Association, the present researcher has also collected data from the fishermen respectively associated with above three methods of high sea fishing.

The data on the different aspects of high sea fishing technology has been collected from the fishermen associated with a particular mechanized vessel used for a particular technique of high sea fishing.

It was learnt from the pilot survey that the duration of each voyage of deep sea fishing usually varies from 10 to 15 days depending upon the size of the vessel and availability of the catch. It was further learnt that peak season of deep sea fishing was from July to November and off-season was from December to March of every year. Therefore, the present researcher has collected data from the members of the fishing unit both during peak and off-season.

Map Showing the Study Area

Source: www.mapofindia.com

3.2. Methods of Study:

The present research is primarily ethnographic in nature. Ethnography is the study of a culture or cultures that a group of people share (Van Maanen 1995:4; Leedy & Ormrod, 2005: 151). Ethnographic study and engagement in fieldwork helps to obtain rich and detailed data (Denzin 1997, Holt and Sparkes 2001, Wolcott 1999).

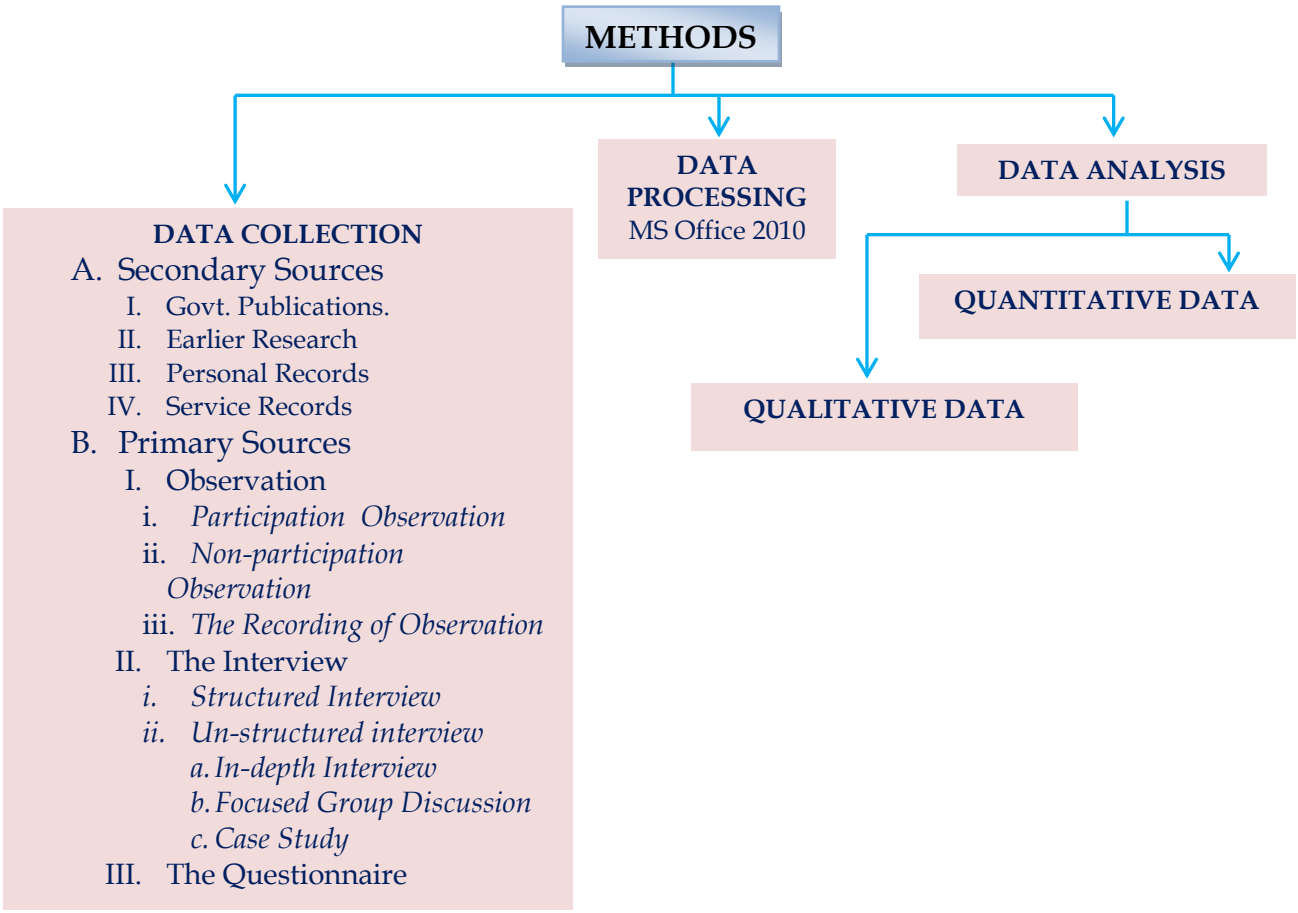
According to Creswell (2005), ethnographic research deals with an in-depth qualitative investigation of a group that share a common culture. As per Creswell ethnography is best used to explain various issues within a group of individuals that have been together for a considerable length of time and have, therefore, developed a common culture.

As a method, it is usually meant to refer to the process of participant observation by a single investigator who immerses himself or herself in the group for a long period of time (often one or more years), gradually establishing trust and experiencing the social world as do the participants (Madden 2010: 16). Ethnographic research can also be called naturalistic, because it seeks to describe and understand the natural social world as it really is, in all its richness and detail. This goal is best achieved when an ethnographer is fluent in the local language and spends enough time in the setting to know how people live, what they say about themselves and what they actually do, and what they value (Armstrong 2008: 55).

For the collection of data the present researcher has resorted both to qualitative and quantitative (mixed method) methods. However, this thesis is chiefly based on the Qualitative data. A qualitative approach was used because this research was dealing with subjective issues which are not agreeable to quantification, searching for the meanings which motivate actions (Hammersley, 1992). Besides this, some quantitative data have been taken.

3.2.1. Methods for Collection and Analysis of Data:

The present researcher has resorted to different methods for collection and analysis of data required for the present thesis. Those methods have been presented with the help of following diagrams.



3.2.1.1. Data Collection:

3.2.1.1.1. Types of Data:

There are two major approaches to gathering information about a situation, person, problem or phenomenon. Sometimes, information required is already available and need only be extracted. However, there are times when the information must be collected. Based upon these broad approaches to information gathering, data are categorized respectively as: A. Secondary data and B. Primary data.

A. Secondary Data:

Secondary data were collected from different books and journals on marine fishery, reports, articles, dictionaries, atlas, office records and many other resources those were relevant to this thesis.

B. Primary Data:

For the present research primary data were collected by the researcher personally from different persons directly or indirectly related to high sea fishing with mechanised vessels and corresponding tackles based on fish landing centre at Digha.

I. Observation:

For Tylor and Bogdan (1998), oobservation is one way to collect primary data. Observation is a purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place. There are many situations in which observation is the most appropriate method of data collection; for example, when you want to learn about the interaction in a group, study the dietary patterns of a population, ascertain the functions performed by a worker, or study the behaviour or personality traits of an individual. It is also appropriate in situations where full and/or accurate information cannot be elicited by questioning, because respondents either are not co-operative or are unaware of the answers because it is difficult for them to detach themselves from the interaction. There are two types of observation:

- Participant observation;
- Non-participant observation.

(a) Participant observation:

Participant observation is when a researcher, participate in the activities of the group being observed in the same manner as its members, with or without their knowing that they are being observed. For example, one might want to examine the

reactions of the general population towards people in wheelchairs. In that case one can study their reactions by sitting in a wheelchair. When using participant-observation as an ethnographic research method, the researcher enters the world of the people he or she wishes to study (Taylor and Bogdan 1998, Wolcott 2008).

Therefore, participant observation is most appropriate method to understand the ethnographic field of marine fishing with mechanized vessel and corresponding fishing tackles. In this field, many things are observational to know this culture of marine fishery. Therefore, different technological aspects of marine fisheries, embedded structural and organizational relationship, the role and activities of different stake holders were observed.

In qualitative research observation is a data collection procedure and the field notes are the data (Merriam, 2009). Because there were many people in multiple settings, it was not possible to observe all of the activities and interactions that occurred. Researcher focused primarily on the technological aspects of the marine fishery. He also observed those people who are associated in one way or other with the marine fishery featured by use of mechanised vessel and corresponding fishing tackles. For example, when researcher was observing preparatory and post-marine fishing activities (how they work, what components are required, what are the steps, and how much time needed), researcher also observed role of the other members of the marine fishing unit. Such observation is required because their way of acting, behaviour and attitudes give valuable data which are not always available from their interview.

While the present researcher was observing he took extensive field notes. Researcher's field notes included two types of information, descriptive and reflective. The descriptive part of the field notes recorded in objective detail the physical setting, the people involved in the interactions observed, accounts of the interactions observed, the reconstruction of any dialogue, and the behaviours of the participants in the setting as recommended by Taylor and Bogdan (1998). The reflective part consists of subjective

experience of the observation. The emphasis of the reflective part of the field notes was "on speculation, feelings, problems, ideas, hunches, impressions, and prejudices" (Bogdan and Biklen 2007).

(b) Non-participant observation:

On the other hand, is when a researcher does not get involved in the activities of the group but remains a passive observe, watching and listening to its activities and drawing conclusions from this. For example, a researcher might want to study the functions carried out by nurses in a hospital. As an observer, researcher could watch, follow, and record the activities as they are performed. After making a number of observations, conclusions could be drawn about the functions nurses carry out in the hospital. Any occupational group in any setting can be observed in the same manner.

When individuals or groups become aware that they are being observed, they may change their behavior. Depending upon the situation, this change could be positive or negative – it may increase or decrease, for example, their productivity – and may occur for a number of reasons. The use of observation in such a situation may introduce distortion: what is observed may not represent their normal behavior.

- There is always the possibility of observer bias.
- The interpretations drawn from observations may vary from observer to observer.
- There is the possibility of incomplete observation and/or recording, which varies with the method of recording. An observer may watch keenly but at the expense of detailed recording. The opposite problem may occur when the observer takes detailed notes but in doing so misses some of the interaction.

Observations can be made fewer than two conditions:

- Natural;
- Controlled.

Observing a group in its natural operation rather than intervening in its activities is classified as observation under natural conditions. Introducing a stimulus to the group for it to react to and observing the reaction is called controlled observation.

(c) The Recording of Observation:

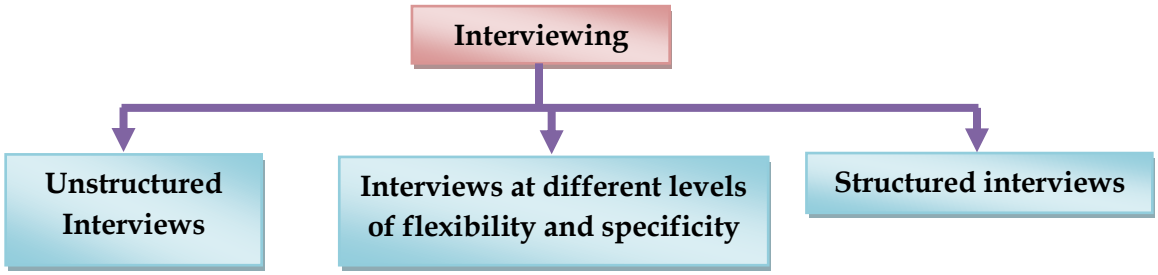
There are many ways of recording observation. The selection of a method of recording depends upon the purpose of the observation. The following are the major ways of recording:

- ***Narrative*:–** in this form of recording the researcher records a description of the interaction in his/her own words. Usually, a researcher makes brief notes while observing the interaction and soon after the observation makes detailed notes in narrative form. In addition, some researchers may interpret the interaction and draw conclusions from it. The biggest advantage of narrative recording is that it provides a deeper insight into the interaction. However, a disadvantage is that observers may be biased in their observation and, therefore, the interpretations and conclusions drawn from the observation may also be biased. Also, if the researcher's attention is on observing they might forget to record an important piece of interaction and, obviously, in the process of recording, part of the interaction may be missed. Hence, there is always the possibility of incomplete recording and/or observation. In addition, with different observers the comparability of narrative recording can be a problem.
- ***Recording on mechanical devices:–*** observation can also be recorded on videotape and then analyzed. The advantage of taping the interaction is that the observer can see it a number of times before drawing any conclusions, and can invite other professionals to view the tape in order to arrive at more objective conclusions. However, one of the disadvantages is that some people may feel uncomfortable or may behave differently before a camera. Therefore the interaction may not be a true reflection of the situation.

The choice of a particular method for recording observation is dependent upon the purpose of the observation, the complexity of the interaction and the type of population being observed. It is important to consider these factors before deciding upon the method for recording the observation.

II. The Interview:

Interviewing is a commonly used method of collecting information from people. In many walks of life we collect information through different forms of interaction with others. Any person-to-person interaction between two or more individuals with a specific purpose in mind is called an interview. On the one hand, interviewing can be very flexible, when the interviewer has the freedom to formulate questions as they come to mind around the issue being investigated; and on the other hand, it can be inflexible, when the investigator has to keep strictly to the questions decided beforehand. Interviews are classified according to the degree of flexibility.



(i) Structured interviews:

In a structured interview the researcher asks a predetermined set of questions, using the same wording and order of questions as specified in the interview schedule. An interview schedule is a written list of questions, open-ended or closed-ended, prepared for use by an interviewer in a person-to-person interaction (this may be face-to-face, by telephone or by other electronic media). Note that an interview schedule is a research tool/instrument for collecting data, whereas interviewing is a method of data collection.

One of the main advantages of the structured interview is that it provides uniform information, which assures the comparability of data. Structured interviewing requires fewer interviewing skills than does unstructured interviewing.

(ii) Unstructured Interview:

The strength of unstructured interviews is the almost complete freedom they provide in terms of content and structure. A researcher is free to order these in any sequence. A researcher also has complete freedom in terms of the use of wording and the way to explain questions to the respondents. A researcher may formulate questions and raise issue on the spur of the moment, depending upon what occurs to the researcher in the context of the discussion.

There are several types of unstructured interviewing like in-depth interview, focus group discussions, case study etc.

a. In-depth Interview:

In qualitative method, in-depth interview is crucial part. It helps to understand the social phenomena that individual have experienced in their everyday life (Cohen et al., 2000; Drew, Hardman & Hosp, 2008; Fontana & Frey, 2005). For gaining understanding on the day to day experience of the individual directly involved in marine fishery, the present researcher conducted semi-structured and open ended in-depth interview of the concerned persons.

In-depth interview was taken from the investor, unit manager, auctioneer, vessel master, driver, cook and other voyagers engaged in manipulating the fishing tackles relating to various matters.

A good number of persons involved in high sea fishing with mechanized vessel and corresponding tackles were interviewed from each category in their work place such as trading centre, seasonal camp office, on the deck of the vessel during fishing operation in high sea.

Each interview had taken a number of hours depending on the situation. Interview was taken up about different organizational, technological as well as economic aspects of marine fishery.

I have also interviewed a good number of vessel masters regarding their decision making power, their perception about their roles in the unit or outside.

All interview are focused a common view point but their narratives were different. All the interviews were recorded on audio tape and transcribed later.

b. Focused Group Discussion (FGD):

FGD is research technique that collects data through group interaction on a topic determined by the researcher. It is important method because - a) it locates the interaction in a group discussion as the source of data and b) it acknowledges the researcher's active role in creating the group discussion for data collection purpose. Others have argued that the value of FGD goes well beyond listening to others, since they can serve as either a basis for empowering "clients" (Magill 1993, Race et al 1994). It is more effective technique for idea generation (Fern 1982).

The present researcher has applied FGD in collecting the data about formation of fishing unit, problems of the high sea fishing and sharing of products. The researcher has purposely chosen the small group which gives each participant more time to discuss his views and experiences on the topic. Small group makes it easier for moderators to manage the active discussions that often accompany high level of involvement and emotional topic.

Ten vessel masters were interviewed who belonged to the age group ranging from 45-60 years and who were engaged in high sea fishing for at least 10 years. FGD was also conducted with six auctioneers and six unit owners were separately to gain understanding on the problems related to the financial aspects of the high sea fishing.

A voice recorder was used to record the focus group discussions.

c. Case study:

Case study is "an empirical inquiry about a contemporary phenomenon set within its real-world context—especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009a p.18). Case study research opens the door for researchers to examine small events in detail and then document complex characteristics that make a phenomenon unique (Yin 2003). Researcher has used the case study as a strategy rather than method to better understand the particular situation which gives detailed description of a situation in order to facilitate new meaning, and additional understanding on the part of readers (Merriam 1998).

Present researcher has used the case study to gain valuable information of many phenomena (cases) of the high sea fishing. The case studies on high sea fishing technology, formation of high sea fishing unit, the role and social origin of different unit members, process and steps for achievement of the status of a vessel master, the experience of the vessel master during different fishing expedition etc. were collected to gain understanding about the milieu of high sea fishing.

Some single cases like decision related to the day and time for high sea fishing expedition, purchase of mechanized vessel and corresponding tackles, purchase of ration for voyage, selection of auctioneer etc. were also taken by the present researcher.

III. The questionnaire:

A questionnaire is a written list of questions, the answers to which are recorded by respondents. In a questionnaire respondents read the questions, interpret what is expected and then write down the answers. The only difference between an interview schedule and a questionnaire is that in the former it is the interviewer who asks the questions (and if necessary, explains them) and records the respondent's replies on an interview schedule and in the latter replies are recorded by the respondents themselves. This distinction is important in accounting for the respective strengths and weaknesses of the two methods.

In the case of a questionnaire, as there is no one to explain the meaning of questions to respondents, it is important that questions are clear and easy to understand. Also, the layout of a questionnaire should be such that it is easy to read and pleasant to the eye and the sequence of questions should be easy to follow. A questionnaire should be developed in an interactive style. This means respondents should feel as if someone is talking to them. In a questionnaire, a sensitive question or a question respondents may feel hesitant about answering should be prefaced by an interactive statement explaining the relevance of the question. It is a good idea to use a different font for these statements to distinguish them from the actual questions.

3.2.1.2. Data Analysis:

3.2.1.2.1. Qualitative Data:

The present thesis is primarily based on qualitative research which is a distinct field of inquiry that encompasses observational and interactional ways of knowing (Guba and Lincoln 1998). This thesis reflects the real social worlds which are represented through the eyes of those who experience it. As per Bogdan and Biklen (2007) the data analysis is the most difficult and most crucial aspect of qualitative research. It is difficult because it is not fundamentally a mechanical or technical exercise. It is a dynamic, intuitive and creative process of inductive reasoning, reflection, and theorizing (Merriam 2009). Through analysis, the researcher attempts to gain a deeper understanding of what he or she has studied and to refine interpretations continually (Basit 2003). The researcher draws on firsthand experience with the setting, informants, and documents to interpret the data (Bogdan and Bilkin, 2007, Merriam 2009, Taylor and Bogdan 1998).

Creswell (2007) divides data analysis into five parts: 1) data managing, 2) coding and developing themes, 3) describing, 4) interpreting, and 5) representing. The researcher enters with data as text and exits with an account or narrative (Creswell 2007). So, the qualitative data analysis has several stages and every stage requires

reflexivity and carefully checking. The data analysis is carried out through following interpretative technique:

i) Data preparation is the first stage of qualitative analysis.
ii) Researcher splits the data according to theme.
iii) There are categories into coding because it is essential to organize the data into categories, finally
iv) The meaning of the data is interpreted.

3.2.1.2.2. Quantitative Data:

The quantitative data were collected to measure the size of the high sea fishing unit, types and size of mechanized vessels, engine capacity of the vessels, types and size of the nets and their respective meshes, size of the hooks and lines, types and size of the fishes, amount of advance salary paid to the different members of the respective high sea fishing unit, monthly salary of different unit members etc.

3.2.1.3. Data Processing:

Quantitative data collected on the above topics were analysed with the help of MS Office 2010 by the present researcher.

3.2.2. Ethical Concern:

Ethic has become a cornerstone for conducting effective and meaningful research. As such, the ethical behavior of individual researchers is under unprecedented scrutiny (Best and Kahn 2006, Field and Behrman 2004, Trimble and Fisher 2006). Ethically sound research should guarantee the protection of human rights. These include disclosure concerning the study, privacy, anonymity, confidentiality, fair treatment, protection from discomfort and harm, and self-determination (Kylma et al 1999).

Researchers should consider several issues before, during, and after the research has been conducted. Some of the issues involve the following:

i) Informed consent shall be taken from the respondents and it shall be considered whether the respondents have full knowledge of what is involved in the process of participation;
ii) *Risk of harm*: Researcher shall give attention on the issue that researcher not put participants in a situation where they might be at risk of harm as a result of their participation.
iii) Honesty and trust (is the researcher being truthful in presenting data?);
iv) Privacy, confidentiality, and anonymity (will the study intrude too much into group behaviours?). It is necessary to hide names, personal details and records of the participants/respondents.
v) Intervention and advocacy i.e. what should researchers do if participants display harmful or illegal behaviour (Holloway and Wheeler, 2002; Constable et al, 2005).

The researcher has to respect the participants' humanity and ensure their autonomy, and be sensitive to their expressions and gestures in a reciprocal interaction throughout the research process (Jokinen et al, 2002).

During the interviews no offending behaviour should be occurred under any circumstances and participants should at all not be forced to give statements about issues they like to avoid or provide by vague answers (Teeri et al, 2006). Concerning the questionnaire data, all the participants shall be informed about the nature of the study and what participation would entail for them (Puotiniemi and Kyngas, 2004).

As per ethical issues presented in the preceding paragraphs of this section the present researcher firstly obtained consent from each respondent respectively. In all the cases prospective respondents were informed about the nature and purpose of the study. The respondents were informed that participation in this study by them was totally voluntary. Prior consent was also obtained for photography in connection with day-to-day activities and living conditions of the respondents. Anonymity has been protected not only during the work but also during the presentation of the data. The confidentiality of the data was taken into consideration at all phases of the research.

3.2.3. Validity and Reliability:

Accounting for validity and reliability in qualitative research looks quite different from quantitative projects. The validity and reliability of the knowledge acquired through qualitative research is determined by analyzing the methodology and findings of the study. Internal validity is dependent upon how congruent the research findings are with reality. One of the assumptions underlying qualitative research is that reality is holistic, multidimensional, and ever-changing (Creswell, 2007). What is being determined in qualitative research is the participants' view of reality. Because a human being is the instrument of data collection and analysis, the participant's view of reality is accessed directly through the researcher's interviews and observations. If the goal is to determine the participant's view of reality, then internal validity is strength of qualitative research. The researcher hears the informant's viewpoints and records for herself the "truth" of various statements made by the informant. The statements are therefore congruent with the informant's reality. The internal validity of any study, quantitative or qualitative, is only as reliable as the data collection instrument. In this case, because I am the research instrument, it depends on my ability to accurately record the data.

Reliability is an examination of the stability or consistency of responses. To increase the consistency and reliability of a project, document all procedures, and if possible set up a detailed protocol (Creswell 2009, 191). Researcher was maintained reliability procedures during data collection and analysis such as-

- Always checked transcripts for obvious mistakes.
- Make sure there was no drift in definitions of codes or applications of them during the coding process. Coding is at the heart of qualitative data analysis (Bogdan & Biklen; 2006, Patton, 2002). Assigning a label or code to individual units of text characterizes or categorizes each unit. These units are then associated with each other based on those codes, and

patterns are discovered. The accuracy of the coding of the data will influence the internal validity of the subsequent data analysis.

- Repeatedly cross-checked the codes by comparing results that are independently derived.

Qualitative validity is based on determining if the findings are accurate from the standpoint of the researcher, the participant or the readers (Creswell 2009, 190). For more details, search for literature about trustworthiness, authenticity and credibility of data analysis. Procedurally, a researcher can check for the accuracy of the findings by employing a combination of multiple validity strategies: triangulation; member checking; rich, thick description; clarify researcher bias; include negative or discrepant information; spend prolonged time in the field; use peer debriefing; use an external auditor. In case of quantitative research, the questions regarding decision making checked and it is found pre-tested on the population.

3.2.4. Limitation of the Study:

Every study has a set of limitations (Leedy & Ormrod, 2005), or "potential weaknesses or problems with the study identified by the researcher" (Creswell, 2005, p. 198). A limitation is an uncontrollable threat to the internal validity of a study. The internal validity refers to the likelihood that the results of the study actually mean what the researcher indicates they mean. Explicitly stating the research limitations is vital in order to allow other researchers to replicate the study or expand on a study (Creswell, 2005). Additionally, by explicitly stating the limitations of the research, a researcher can help other researchers "judge to what extent the findings can or cannot be generalized to other people and situations" (Creswell, 2005, p. 198).

The researcher was cognizant of the limitation of this study. This research has covered only one marine fish landing centre of West Bengal. The study could have been further enriched with inclusion of other marine fishing harbours and fish landing centre of West Bengal.

This study did not focus on the marketing aspects of high sea fishing. However, the trend that emerged from this exploration served as a starting point to conduct intensive research on various aspects of high sea fishing with different types of mechanised vessel and corresponding fishing tackles.

CHAPTER – 4

ORGANIZATIONAL ASPECTS OF HIGH SEA FISHING

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ORGANISATIONAL ASPECTS OF HIGH SEA FISHING

4.1. Composition of the Fishing Unit:

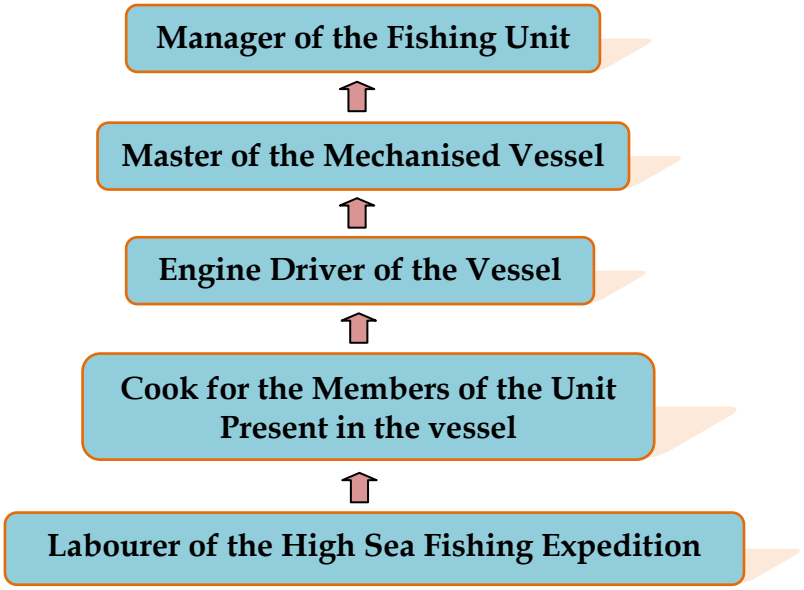
High sea fishing with mechanised vessels and corresponding tackles demands a considerable amount of cash capital as well as the man power of varied skills. Thus we see that a unit for high sea fishing operating from the fish landing centre at Digha always formed and works under the patronage of a particular financier who not only invest to purchase mechanised vessels and corresponding tackles but also bear the recurring cost required for marine sea fishery.

Moreover, recruitment of all the members in the respective fishing unit is made under the direct control and supervision of the investor who is locally called *malik*. The investor always recruits those persons as the members of a particular unit who have sufficient knowledge and skill respectively on different works associated with high sea fishing with mechanised vessels and corresponding tackles.

As per the souvenir published by the Digha Fishermen and Fish Traders Association in the year 2015 there are altogether one thousand units for high sea fishing with mechanised vessels and corresponding tackles operating from Digha. All the fishing units are composed of male members only. Each fishing unit is consisted of (i) Manager of the unit locally called *sarkar*; (ii) Master of the mechanised vessel of the unit locally called *majhi*; (iii) Engine driver of the vessel locally called *side majhi;* (iv) Cook for the unit members locally called *radhuni* except manager during the fishing season; (v) Labourer of the high sea fishing expedition.

There are different hierarchic strata found in a particular high sea fishing unit. The apex stratum is occupied by the manager of the unit who never sail in the sea. His activities are entirely limited on the shore and he acts as liaison between the unit and the investor. However, it is compulsory for the members of the remaining strata of a fishing unit to sail for high sea fishing.

The following diagram exhibits different stratum of a high sea fishing unit.



It is necessary to mention that the members of a fishing unit who sail in the high sea for fishing are commonly termed as 'fisherman', locally called *'Matsyajibi'*, irrespective of their duties and responsibilities.

4.2. Average Size of the Units:

The membership strength of different high sea fishing unit at Digha varies from 8-15 persons depending on the method of fishing as well as associated vessel and fishing tackles used by respective unit. The following table shows the relationship among the method of fishing, associated vessel, related fishing tackles and average size of the unit.

Table no. 4.1: Relationship among the Method of Fishing, Associated vessel and Corresponding Fishing Tackles and Average Size of the Unit.

Method of Fishing	Associated Mechanised Vessel	Corresponding Fishing Tackles	No. of units	Average Size of the Unit
Trawl Netting	Vessels with 200-300 bhp Engine	Trawl Net	550	12-15
Gill Netting	Vessels with 120-180 bhp Engine	Gill Net	300	10-12
Longline	Vessels with Double Cylinder Engine	Hook and Line	150	8-10

4.3. Profiles of the Investors:

It is reported that all the investors of high sea fishing with mechanised vessel and corresponding tackles are male only. It is also reported that most of the persons who have made investment on high sea fishing with trawl net and associated mechanised vessel (locally termed as 'trawler') reside in Kanthi municipal town under Purba Medinipur district which is about 30 kilometres away towards the north from the fish landing centre of Digha. The owners are found both among the Hindus and Muslims. The Hindu owners, however, belong to different middle ranking castes whose occupation is not always fishing by birth.

Similarly, most of the investors of high sea fishing with gill net and associated mechanised vessel (locally termed as 'fishing body') are the residents of Ranaghat municipal town under Nadia district of West Bengal. All such investors belong to the fisherman caste and their forefathers have reportedly migrated from different districts of present day Bangladesh. However, a very few of the investors of high sea fishing with gill net and associated mechanised vessel are the residents of Ramnagar municipal town under Purba Medinipur district which is about 8 kilometres away northwardly from Digha. It is revealed that most of the investors of marine fishing by gill net and associated vessel residing at Ramnagar, Purba Medinipur are distributed across different middle ranking Hindu castes and many of them are not fisherman by caste.

It is found that most of the investors of high sea fishing with hook and line and associated 2 c.c. engine powered vessel (locally called *'borshi body'*) are also the residents of Ramnagar. The investment on such high sea fishing is made both by the Hindus and the Muslims. However, most of the Hindu investors belong to different middle ranking castes whose occupation is not always fishing by birth.

4.4. Mode of Recruitment of the Unit Members:

It is found that regarding the recruitment of all the members of a particular fishing unit the decision of the respective investor is final. Initially an investor selects and recruits a manager of his fishing unit. An investor usually prefers to recruit

manager of his respective fishing unit from his own locality as well as religion and/or caste. Thus there are managers across the religion and caste.

An investor always prefers to appoint their respective neighbour as the manager of the unit. Moreover, he always prefers to recruit the manager from his own caste or religion. Thus we find that the managers of different fishing units of fish landing centre at Digha are distributed across different castes as well as religions. A manager, in consultation with the investor, recruits the vessel master of a fishing unit.

For the purpose of recruitment of the unit members for a particular fishing season an investor along with the manager of unit keep a close watch on the persons of their choice. An investor with the aim to give shape his fishing unit well in advance approaches the persons required to sail for high sea fishing. He tries to keep them in obligation by way of alluring them with the advance payment against their service required during the next fishing season. The investor takes this venture since he is very much aware that most of the persons experienced to sail for high sea fishing remain idle and suffer from economic scarcity during the summer i.e. from the month of March to May owing to imposition of Government Rules. Moreover, during this period most of them eke out their living very miserably since they are not capable to do any other menial work on the land owing to the lack of knowledge and experience in this regard. As a matter of fact like the unauthorized money lender an investor looks after the necessity of the persons of his choice to fulfil his own business interest. The sailors on the other hand get financial assistance from the investor at the time of their dire necessity. However, no advance is paid to the managers of the fishing units since they do not sail for high sea fishing.

It is important to mention in this context that the exclusion or the inclusion as a member in the respective fishing unit depends on various factors like: good will of the investor; sympathetic treatment and financial assistance to the expectant unit members at the time of necessity; inter-personal relation revolving around either locality, religion, caste, kin or otherwise; economic allurement and convenient terms.

After the advance money (locally called *bayna*) is paid a formal unwritten contract is made. None can break the contract thereafter without the consent of either of the parties concerned. If any other investor wants to take any person who has already made the contract, the latter investor has to take permission from the former one and the money taken as advance shall have to be refunded. But if anybody breaks the contract without the consent of the investor then the investor place the matter before the office bearers of the Digha Fishermen and Fish Traders Association and the decision of the association is final in this regard. If the either of the party disobey the decision then he is disallowed to continue his work under the banner of the association.

The following table shows the relationship among the types of mechanised vessel, category of unit members and the amount of advance required to pay.

Table no. 4.2: Relationship among the Types of Mechanised Vessel, Category of Unit member and the Amount of Advance Required to Pay.

Type of Mechanized Vessel	Category of the Unit Members	Amount of Advance paid for a fishing season
Vessels with 200-300 bhp Engine (locally called *trawler*)	Vessel Master	2,00,000/-
	Driver	70,000/-
	Cook	40,000/-
	Manipulator of fishing tackles	30,000/-
Vessels with 120-180 bhp Engine (locally called *fishing body*)	Vessel Master	1,50,000/-
	Driver	50,000/-
	Cook	30,000/-
	Manipulator of fishing tackles	20,000/-
Vessels with Double Cylinder Engine (locally called *borshi body*)	Vessel Master	70,000/-
	Driver	30,000/-
	Cook	20,000/-
	Manipulator of fishing tackles	15,000/-

A vessel master of a fishing unit is selected by the manager. However, his recruitment is finalised after the approval of the investor. A manager, in consultation with the investor, recruits the vessel master of a fishing unit. Like the manager, the vessel master is also appointed in the cases from the same locality and religion of the respective investor.

An engine driver is also recruited by the manager of a fishing unit in consultation with the vessel master. Like the manager, the vessel master is always appointed from the same locality and religion of the respective investor of the high sea fishing with a particular method. Thus we find that the engine drivers are distributed across the castes and religions.

A cook is selected and recruited by the vessel master of the respective fishing unit. A cook is also appointed from the same locality and religion of the respective owner of the vessel and associated gears. However, in case of Hindu owners the respective cook is usually appointed from the middle ranking castes.

An investor on high sea fishing assigns the respective vessel master of the fishing unit to select and appoint the Manipulator of fishing tackles required during high sea fishing. Main criteria for such selection are the knowledge, skill and experience of the respective manipulator. However, in most of the cases manipulators are also selected from the same locality of the investors. Like the previous cases, the Muslim investor select manipulators from their own religion whereas; the Hindu investors select the manipulators from the middle ranking caste whose in born occupation may not be fishing by birth.

4.5. Duties and Responsibilities of the Unit Members:

Manager is responsible for maintaining detailed accounts of the fishing enterprise of the respective owner. He is also responsible for marketing ration and other articles required on board during high sea fishing expedition. It is the duty of manager to remain present during the auction of the marine products of his unit. However, he collects the price procured out of the auction of marine products from the respective auctioneer in the afternoon. It is interesting to note in this context that it is almost a rule that the collection will only take place every day during the afternoon. Manager also supervises the repairing of nets and other fishing tackles.

A vessel master is the authority to select the engine driver, cook and labourers required for sailing for high sea fishing. Apart from this, the vessel master is responsible to steer the vessel and control its speed during high sea fishing. Vessel

master is the authority to schedule the date and time of voyage for high sea fishing. He also decides about the duration of a particular fishing expedition. Apart from these, during the fishing expedition the respective vessel master of a unit is the sole authority to select the specific location for setting and/or pulling the net or hook and line. A vessel master also decides on the use of the type of net in terms of their size of the meshes, duration of pulling the net etc. In case of hook and line method of deep sea fishing a vessel master is the sole authority to decide on the length of a line and the size of the hooks. Apart from these, a vessel master also serves as the principal priest for daily worship on the vessel during fishing expedition. Every day in the morning as well as in the evening the vessel master worship near the bollard of the vessel and prays for good catch as well as fair weather.

The engine driver of the respective vessel is primarily responsible to drive the engine and the mechanized winch of the motorized vessel during the high sea fishing. However, he is also responsible for maintenance of the engine and other machinery of the respective mechanised vessel even when the vessel is anchored on the shore of the sea. In case of exigency, the driver also takes part in sorting and storing of fish.

A cook is primarily responsible for cooking the meals for the unit members present on the vessel during high sea fishing expedition. However, in case of exigencies a cook also participates in other works like spreading and pulling of fishing tackles as well as sorting and storing of fish.

The Manipulators of fishing tackles are appointed to sail for high sea fishing are responsible to arrange and operate different type of tackles used for high sea fishing. Moreover, it is the responsibility of manipulators of fishing tackles to gather, sort and store the captured marine products on the spot during high sea fishing.

4.6. Relation between Fishing Unit and the Fish Auctioneer:

It is observed that each fishing unit is directly associated with a particular auctioneer to sell their catch made out of high sea fishing with mechanised vessel and corresponding tackles. Each auctioneer respectively maintains a stall in the fish

landing centre at Digha for the purpose of auctioning the marine products landed by different fishing unit. Most of the stall owners are the residents of Kanthi. There are both the Hindu and the Muslim stall owners. However, in case of the Hindus most of the stall owners belong to different middle ranking castes. Each owner respectively employs a few daily wage basis labours to run their business and regarding such employment locality and religion of the stall owner are always given first priority. All the stall owners and their employee in the respective stall are male only.

The stalls are locally known as *kanta* since in every such stall there is a huge indigenous weighing scale locally known as *kanta* for weighing the marine products. However, owners of such stall are locally known as *aaratdar.* The stall owner conduct the auction in lieu of five percent (5%) commission against the sum total of price earned from the sale of the entire marine products landed by a particular high sea fishing unit.

It is revealed that in many cases a stall owner also act as a money lender locally known as *dadandar*. Usually he lends money on request to a start-up entrepreneur of marine fishery at the rate of 36% to 60% interest per annum. However, good social and economic credentials of the respective borrower, as perceived by the respective money lender, are the primary criteria for such transaction.

An entrepreneur spends this money to meet the expenditure for purchasing the fixed assets like mechanised vessel and fishing gears etc. as well as for meeting the recurring expenditure like fuels, ration, advance salary to the unit members etc. required to initiate the high sea fishing expedition.

It is revealed that apart from the payment of interest against the loan, it is also mandatory for the borrower to see that all the marine products captured by the high sea fishing unit working under his ownership are landed for auction on the stall owned by the respective money lender. Thus a money lender earn in two ways i.e. interest against the money he paid as loan to the entrepreneur of marine fishery and

commission for auctioning the marine catch landed by the high sea fishing unit owned by the respective borrower cum entrepreneur.

4.7. Terms and Conditions for Recruitment of the Unit Members:

Except the manager, the recruitment of all other members of a unit for high sea fishing with mechanized vessel and corresponding tackles is valid for one fishing season i.e. for about nine months (from May to February). However, in most cases an investor prefers to continue the service of a unit manager for a number of years continuously since due to presence of direct interaction between the investor and the manager a close personal relationship develop between them.

The members of the fishing unit are recruited either on the basis of the salary or share or both depending primarily on two factors i.e. types of vessel and corresponding tackles as well as seasonal availability of the fishes. Thus we see that the members recruited in the unit constituted for high sea fishing with vessels powered by 200-300 bhp Engine (locally called *trawler*) and trawl net are paid salary per month for a nine month duration fishing season.

It is found that in case of the unit constituted for high sea fishing either with vessel powered by 120-180 bhp Engine (locally called *fishing body*) and gill net or with vessel powered by double cylinder engine (locally called *borshi body*) and hook and line the members are recruited both on the basis of salary as well as share of the total profit made out of the sale of the catch. However, salary and share do not continue simultaneously. On the contrary, during the peak season the unit members opt to work only on share basis since amount of haul are usually plentiful during this season whereas; during the off season when the sufficient amount of fishes are usually not available the unit members agree to work only on salary basis. Since this has been customary for a long time in the fish landing centre at Digha therefore, the owner of the vessel and corresponding tackles give honor to this custom.

The following table shows monthly salary of the different members of a fishing unit during a particular season of high sea fishing:

Table no. 4.3: Monthly Salary of the Different Members of a Fishing Unit During a Particular Season of High Sea Fishing.

Type of Mechanized Vessel	Category of the Unit Members	Fishing Time	Amount of Salary
Vessels with 200-300 bhp Engine (locally called *trawler*)	Vessel Master	May - February	25,000/-
	Driver		15,000/-
	Cook		9,000/-
	Manipulator of fishing tackles		8,000/-
Vessels with 120-180 bhp Engine (locally called *fishing body*)	Vessel Master	November - February	22,000/-
	Driver		11,000/-
	Cook		8,000/-
	Manipulator of fishing tackles		7,000/-
Vessels with Double Cylinder Engine (locally called *borshi body*)	Vessel Master	November - February	18,000/-
	Driver		9,000/-
	Cook		7,000/-
	Manipulator of fishing tackles		6,000/-

In case of the recruitment of the unit member on the basis of payment of share of the amount of profit made after selling all the catches the percentage of share is determine in the beginning of the season. The owner of the vessel and corresponding tackle is entitled to get 60% of the sum total of profit and the remaining 40 percent of the profit is distributed among the members of the respective fishing unit. However, in case of this distribution at first the sum total amount of the profit allotted in favour of the unit members are divided by the total number of members of the unit plus one. This additional share goes in favour of the vessel master. Thus the vessel master get double shares compared to other members of the unit. The following

table shows the relationship between the mode of payment to the unit members, associated type of vessel and periodical variation of the mode of payment:

Table no. 4.4: Relationship Between the Mode of Payment to the Unit Members, Associated Type Of Vessel and Periodical Variation of the Mode of Payment.

Mode of Payment	Associated Vessel	Periodical Variation of the Mode of Payment
Salary	Trawler	May – February
	Fishing body	November – February
	Borshi body	
Share	Fishing body	May – October
	Borshi body	

A unit member is entitled to avail leave with pay for seven days in a particular fishing season to go his residence. However, if someone avail leave more than seven days then he will not get any payment for those days.

A unit member is entitled to get medical expenditure during his illness provided he remains in the cottage built by the owner adjacent to fish landing centre. During the illness the unit member is entitled to get payment against his recruitment provided he does not leave the fish landing center. However, if he leaves the center during his illness, he will not get either the salary or the medical expenditure.

A unit member is entitled to get life insurance coverage of Rs. 1 lakh, the policy which is paid by the Digha Fishermen and Fish Traders Association.

CHAPTER – 5

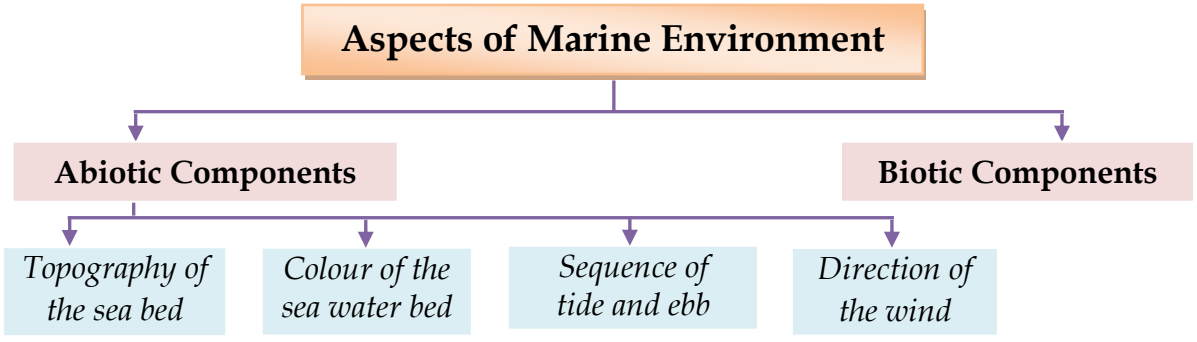
UNDERSTANDING THE ENVIRONMENT OF HIGH SEA FISHING

CHAPTER – 5

UNDERSTANDING THE ENVIRONMENT OF HIGH SEA FISHING

A great deal of knowledge and understanding about the different aspects of marine environment is required for high sea fishing. It is revealed from the fieldwork that the persons sailing for high sea fishing from the fish landing centre of Digha gain their understanding on different aspects of relevant marine environment by experience rather than textual reading. Since such understanding depend on the learning ability of an individual therefore, all the persons sailing for high sea fishing from fish landing centre of Digha are not equally knowledgeable about the relevant environment of high sea fishing. On the contrary, all the members of a particular unit sailing for high sea fishing solely depend in this regard on the vessel master who by his experience and learning ability has been able to establish himself as an indigenous expert on marine environment relevant for high sea fishing. His knowledge and expertise on marine environment has a great deal of bearing upon the success of each high sea fishing expedition. It is to be mentioned that at Digha a high sea fishing expedition is considered as successful not only in terms of haul of good quality and quantity of fishes but also in terms of absence of accident or hazard during the fishing expedition. Therefore, a vessel master has more bargaining capacity regarding his salary or share provided he has been able to prove his due expertise by way of leading a several successful high sea fishing expedition for consecutive years.

The following diagram shows the Aspects of Marine Environment.



The vessel master, on his own ways, perceives both (A) the physical or abiotic components as well as (B) the biotic components of the relevant environment of the high sea fishing. Therefore, the knowledge of the vessel master on these two aspects has been presented in the following paragraphs.

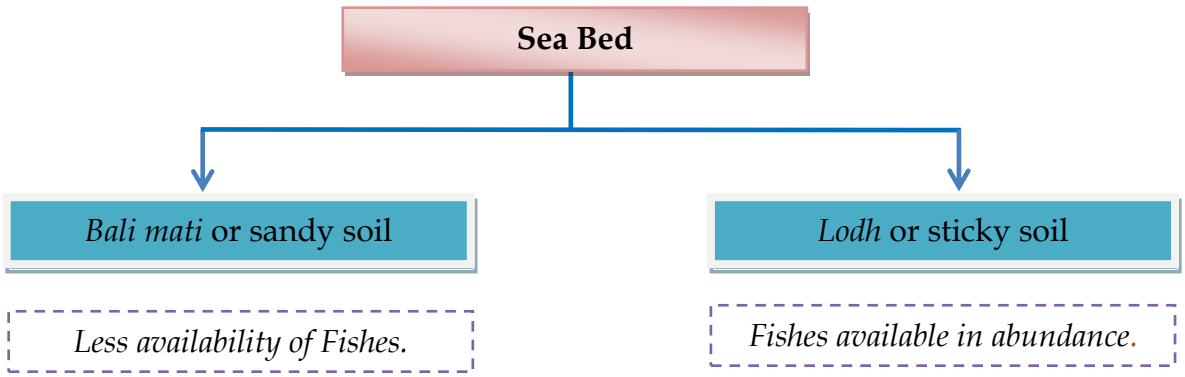
5.1. Abiotic Components:

Regarding the relevant abiotic component of the sea, a vessel master is primarily concerned with the *(I) topography of the sea bed, (II) colour of sea water, (III) sequence of tide and ebb, (IV) direction of the wind etc.*

5.1.1. Topography of the Sea Bed:

The judgement on the nature of sea bed is an important task carried out by the vessel master since as per his perception there is direct relationship between the nature of sea bed and the type of fishes. Nature of sea bed is assessed by the vessel master with the help of lead and line locally called *tuani.*

According to the vessel master there are two types of soil in the sea bed. The following diagram shows the types of sea bed:



5.1.1.1. *Bali mati* or sandy soil:

In this type of soil the proportion of sand is higher. As per the perception of the vessel master the fishes are not available in abundance in this type of sea bed. Moreover, the vessel master considers that this type of bed is not conducive either for anchoring the vessel or the lead line of the gill net or end of the main line in case of hook and line fishing. Therefore, fishing is not usually preferred in such area where the bed of the sea is characterised by sandy soil.

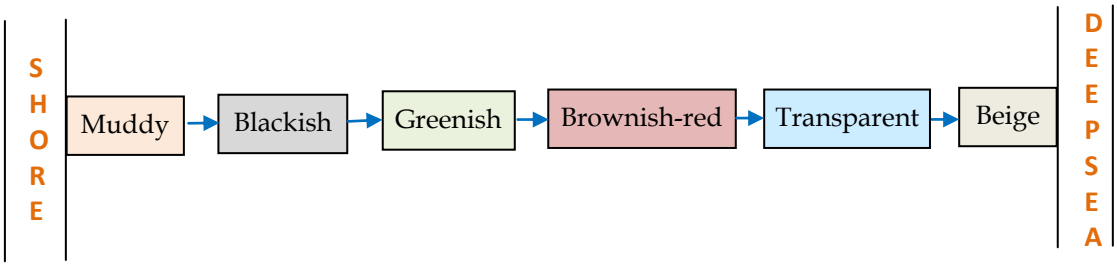
5.1.1.2. *Lodh* or sticky soil:

In this type of soil proportion of sand is very low and the soil is sticky and black in colour. The vessel master considers that the fishes are available in abundance in the water above the sea bed composed of black and sticky soil.

It is perceived by the vessel master by his experience that the depth of the sea gradually increases from the shore. Sea bed in many areas are characterised by elevation and depression. The elevated sea bed is locally called *char* whereas depressed sea bed is locally called *duba char*. A vessel master always prefers fishing in the depressed area of the sea bed since the flow of water is not disturbed for its depth by the bed surface.

5.1.2. Colour of the Water:

The vessel master identifies different types of colour of the sea water. According to him the colour of the water near the shore is usually muddy and locally called *ghola jaul.* The other colours of the sea water recognised by the vessel master are namely blackish, greenish, brownish-red, beige etc. Apart from these colours, transparent sea water is also recognised by the vessel master. However, the vessel master always uses the local parlance to describe the varying colour of the sea water. Thus, blackish water is expressed as *kalchey*; greenish water is expressed as *sim-pata jaul;* brownish-red water is expressed as *int-ronga jaul;* transparent water is expressed as *swachcha jaul* and beige water is expressed as *dim jaul*. The horizontal spread of the different colours of water from the shore to the deep sea area, as recognised by the vessel master during the navigation for high sea fishing, has been presented with the help of the following diagram:



The vessel master perceives that the colour of the sea water is suggestive about the chances for availability of the particular varieties of fishes. However, as

per his perception there is also seasonal variation of the availability of particular varieties of fishes in the particular colour of water. Therefore, as per the seasonal availability of the particular varieties of fishes the fishing is carried out in different areas of the sea characterised respectively by a particular colour of water. However, the vessel master has the least preference to carry out fishing in the muddy water near the shore since the depth of the water near the shore is not always very conducive for navigation. Moreover, in the muddy water *gogua chingri* (*Spider shrimp*) and *topsey* (*Paradise threadfin*) of small sizes are available in meagre amount which have minimum market value owing to their small sizes.

The following table represent the relationship between the colours of the sea water and type of fishes as perceived by the vessel master:

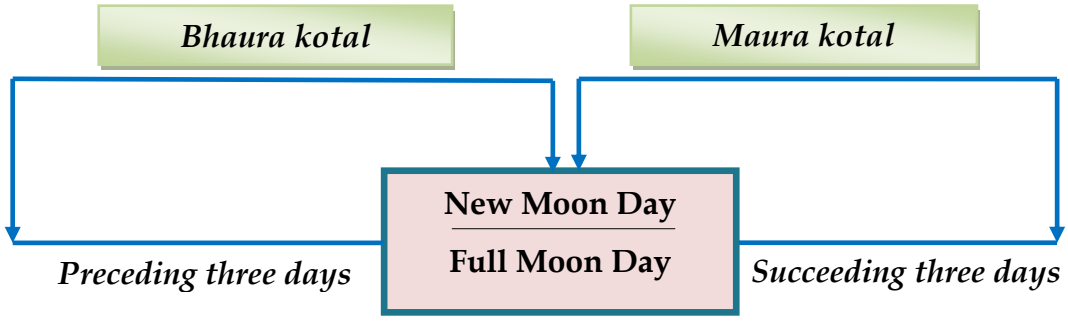
Table no. 5.1: Relationship between the Colours of the Sea Water and Available Types of Fish as Perceived by the Vessel Master.

Colour of the Sea Water	Availability of the Types of Fishes	
	Local Name	**Scientific Name**
Muddy	*Gogua Chingri*	*Spider shrimp*
	Topse	*Paradise threadfin*
Blackish	*Chela*	*Whitefin wolf-herrings*
	Kathkoi	*Mangrove red snapper*
	Baul	*Black pomfret*
	Kuni	*Indo-Pacific king mackerel*
Greenish	*Ilish*	*White sardine*
	Khoyra	*Moustached thryssa*
	Chamcham	*Striped goatfish*
	Kalo Chela	*Dorab wolf-herrings*
	Hangor	*Blacktip shark*
	Atom	*Frigate tuna*
	Para	*Talang queenfish*
	Kuni	*Indo-Pacific king mackerel*
	Kuki	*Hardnose shark*
Brownish-red	*Simul kata*	*Giant catfish*
	maguriya tangra	*Spotted codlet*
	Rur tangra	*Giant catfish*
Transparent	*Khupkupi*	*Shrimp scad*
	Bom	*Yellowfin tuna*
	Pomplet	*Silver pomfret*
Beige	*Sada bhut*	*Skipjack tuna*
	Kalo lobster	*Mud spiny lobster*
	Baam	*Indian pike conger*

5.1.3. Sequence of Tide and Ebb:

The vessel master perceives on his own that the availability of the types and quantity of fish is related with the velocity of water current. The velocity varies according to the tide and ebb which in turn are directly connected with the lunar position locally called *tithi*.

The vessel master has a very clear concept on the sequences of the tide and ebb since the sequences are very important for deep sea fishing. The vessel master uses the local parlance to describe the different episodes related to lunar position. According to him each month is broadly divided into two halves viz. *Suklapaksha* or brighter half of the month and the *krishnapaksha* or the darker half of the month. As per the perception of the vessel master on the day of *amabashya* or new moon day and on the day of *purnima* or full moon day force of the current of sea water reaches its optimum point. Therefore, he prefers to fish respectively three days preceding and three days succeeding the new moon day or full moon day. The vessel master term the period during preceding three days as *bhara kotal* and the period during succeeding days as *mora kotal* since during the preceding days current of the sea water gradually increases whereas; during the succeeding days current of the water gradually decreases. However, as per the vessel master it is desirable to avoid fishing during these two periods because good amount of fishes are not available on the one hand and on the other hand owing to the turbulent nature of the sea during these periods there are increased chances of accidents or hazards. Therefore, instead of sailing for deep sea fishing the vessel master sometime allow his unit members to visit their respective natal places of resident in case of exigencies. The following diagram shows the sequence of tide and ebb:



5.1.4. Direction of the Wind:

As per the vessel master the lunar position also influences the direction of the wind which has again as a relationship with the availability of the quantity of fishes. The following table shows the relationship between the directions of the wind and the availability of fishes as perceived by the vessel master:

Table no. 5.2: Relationship between the Directions of the Wind and the Availability of Fishes.

Direction of the Wind	Local Name of the Wind	Availability of Fishes
East-ward	*Pubali hawa*	Good quantity
West-ward	*Paschima hawa*	Lesser quantity
South-east ward	*Pub-dakhina hawa*	Good quantity
Northern	*Utturey hawa*	Fishes of big size in deep sea

From the above paragraphs it is revealed that vessel master, by his practical experience, has acquired a good deal of knowledge on various environmental aspects relevant to the high sea fishing.

A. Biotic Components:

It is also found that he has acquired very good knowledge on the biotic components of the environment relevant for the deep sea fishing. It is found that a vessel master has acquired a good deal of knowledge not only about the biodiversity of fishes but also about the shell fishes of the sea. However, since the present thesis is primarily concerned with the technology of deep sea fishing therefore, the knowledge of the vessel master on the biodiversity of marine fishes is the primary consideration of the present researcher. It is revealed that the vessel masters acquire detailed knowledge about the types of the fishes available in the areas of the sea covered under the deep sea fishing based on the fish landing centre at Digha. A vessel master possesses abundant information on the behaviour, variation of size, seasonal migratory habit, habitat and spawning period of a good number of a species of fishes. A vessel master not only classifies the fishes on the basis of their habitat but he also designates a good number of species of the fishes by local names. In the following table the knowledge of the vessel master on these subjects has been presented. However, the English equivalent and scientific name of the fishes as well as other relevant information has been presented in the table for the convenience of communication.

Table no. – 5.3: Local Name, English Equivalent and Scientific Name of the Fishes as well as Other Related Information.

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Mechanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
1	*koni*	Obtuse barracuda	*Sphyraena obtusata*	*0.5-25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
2	*surungi*	Pickhandle barracuda	*Sphyraena jello*	*0.5-25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
3	*bom*	Torpedo scad	*Megalaspis cordyla*	*20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	All Type of Tackles
4	*pencha*	Indian scad	*Decapterus russetti*	*3*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
5	*sol*	Cobia	*Rachycentron canadum*	*2-40*	Winter	Monsoon	Vessels with Double Cylinder Engine	Gill Net
6	*fita*	Savalai hairtail	*Lepturacanthus savala*	*0.25-1*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
7	*atom*	Frigate tuna	*Auxis thazard*	*20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
8	*sada atom*	Kawakawa	*Ethynmus affinis*	*20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
9	*chiruni faal*	Black marlin	*Makaira indica*	*0.5-50*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
10	*pakhi*	Indo-Pacific blue marlin	*Makaira mazara*	*30*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
11	*balkur*	Shortnose Greeneye	*Chlorophthalmus Agassizi*	*0.5-7*	Winter	Monsoon	Vessels with 200-300 bhp Engine	Trawl
12	*sada pata*	Indo-pacific Oval flounder	*Bothus Myriaster*	*0.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
13	*kalo pata*	Malaya Flounder	*Pseudorhombus Malayanus*	*0.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
14	*chainij*	Chinese Silver pomfret	*Pampus Chinensis*	*1.5-3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
15	*baul*	Black pomfret	*Parastromateus Niger*	*2-3.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
16	*para*	Talang Queenfish	*Scomberoides Commersonnianus*	*20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
17	*sada para*	Barred Queenfish	*Scomberoides Tala*	*20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
18	*patol*	Island Mackerel	*Rastrelliger Faughni*	*0.25-0.4*	Monsoon	Winter	All Types of Vessel	All Type of Tackles
19	*mekrel*	Narrow-barred Spanish mackerel	*Scomberomorus Commerson*	*3-5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
20	*sada bom*	Bigeye tuna	*Thunnus Obesus*	*15-20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
21	*kalo bom*	Longtail tuna	*Thunnus tonggol*	*15-20*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
22	*pencha*	Common Dolphinfish	*Coryphaena hippurus*	*3*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
23	*udukku*	Barbel Flyingfish	*Exocoetus monocirrhus*	*40*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
24	*pata*	Indian halibat	*Psettodes erumei*	*0.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
25	*dhela patom/ boro potol*	Indian driftfish	*Cubiceps squamiceps*	*0.4*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
26	*pomplet*	Silver pomfret	*Pampus argenteus*	*0.7-1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
27	*khupkhupi*	Shrimp scad	*Alepes djedaba*	*0.25*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
28	*digha sundori*	Malabar trevally	*Carangoides malabaricus*	*0.2-5*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
29	*fita*	Largehead hairtail	*Trichiurus lepturus*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
30	*patol*	Indian mackerel	*Rastrelliger kanagurta*	*0.25-20*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
31	*kalo bhut*	Striped bonito	*Sarada orientalis*	*0.15*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
32	*sada bhut*	Skipjack tuna	*Katsuwonus pelamis*	*0.15*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
33	*udukku*	Striped malin	*Tetrapturus audax*	*20*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
34	*kalo chanda*	Bigscale pomfret	*Taractichthys longipinnis*	*0.8-0.9*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
35	*motka*	Rainbow shrimp	*Parapenaeopsis sculptilis*	*0.025-0.075*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
36	*toni*	Kiddi shrimp	*Parapenaeopsis stylifera*	*0.01-0.03*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
37	*srimp*	Indian white shrimp	*Penaeus indicus*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
38	*bagda*	Giant tiger shrimp	*Penaeus monodon*	*0.075-0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
39	*lal chingri*	Arabian red shrimp	*Aristeus alcocki*	*0.02-0.05*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
40	*pabda*	Indian nylon shrimp	*Heterocarpus woodmasoni*	*0.25*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
41	*rani chingri*	Gladiatorstriped shrimp	*Plesionika ensis*	*0.05*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
42	*poka*	Flathead locust lobster	*Thenus orientalis*	*0.3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
43	*laal kakra*	Christian crab	*Charybdis feriatus*	*0.1-0.2*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
45	*rongin kakra/ jahajia kakra*	Blue swimming crab	*Portunus pelagicus*	*0.3-1.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
46	*braun kakra*	Three spot swimming crab	*Portunus sanguinolentus*	*0.3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
47	*misti joler kakra*	Mud crab	*Scylla serrata*	*0.15-0.2*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
48	*tuni*	Speckled shrimp	*Metapenaeus monoceros*	*0.05*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net Net
49	*sada srimp*	Spear shrimp	*Parapenaeopsis hardwickii*	*0.035*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
50	*srimp*	Sergestid shrimp	*Acetes indicus*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
51	*gogua chingri*	Spider shrimp	*Nematopalemon tenuipes*	*0.003-0.005*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
52	*golda*	Andaman lobster	*Metanephrops andamanicus*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
53	*laal golda*	Deepsea whip lobster	*Puerulus sewelli*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
54	*tusi chingri*	Jinga shrimp	*Metapenaeus affinis*	*0.05*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
55	*holud srimp*	Yellow shrimp	*Metapenaeus brevicornis*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
56	*sada srimp*	Kadal shrimp	*Metapenaeus dobsoni*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
57	*sada srimp*	Bird shrimp	*Metapenaeus lysianassa*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
58	*bolder*	Green tiger shrimp	*Penaeus semisulcatus*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
59	*rani chingri*	Coastal mud shrimp	*Solenocera crassicornis*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
60	*lokhhi chingri*	Flamingo shrimp	*Parapenaeus longipes*	*0.025*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
61	*pamra chingri*	Cocktail shrimp	*Trachypenaeus curvirostris*	*0.3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
62	*laal lobster*	Spear lobster	*Linuparus somniosus*	*0.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
63	*kalo lobster*	Mud spiny lobster	*Panulirus polyphagus*	*0.4*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
64	*green lobster*	Ornate spiny lobster	*Panulirus ornatus*	*0.3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
65	*green lobster*	Scalloped spiny lobster	*Panulirus homarus*	*0.4*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
66	*hangor*	Blacktip shark	*Carcharhinus limbatus*	*100-150*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
67	*kuki*	Hardnose shark	*Carcharhinus macloti*	*1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
68	*dudh sankar*	Blacktip reef shark	*Carcharhinus melanopterus*	*50-70*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
69	*kuki*	Spadenose shark	*Scoliodon laticaudus*	*50-70*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
70	*sada kuki*	Whitecheek shark	*Carchahinus dussumieri*	*20-40*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
71	*hangor*	Gulper shark	*Centrophorus granulosus*	*20-40*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
72	*red kuki*	Sliteye shark	*Loxodon macrorhinus*	*20-40*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
73	*faal*	Giant guitarfish	*Rhynchobatus djiddensis*	*20-30*	No Seasonal Variation of Availability		Vessels with Double Cylinder Engine	Hook and Line
74	*kalo sankar*	Shorttail stingray	*Dasyatis brevicaudala*	*20-30*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
75	*sada sankar*	Sharpnose stingray	*Himantura gerrardi*	*20-30*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
76	*kuki*	Pelagic thresher	*Alopias pelagicus*	*20-30*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
77	*tiger kuki*	Slender bambooshark	*Chiloscyllium indicum*	*1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
78	*kuki*	Arabian smoothhound	*Mustelus mosis*	*1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
79	*kuki*	Whale shark	*Rhincodon typus*	*1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
80	*rabon kuki*	Scalloped hammerhead	*Sphyrna lewini*	*1*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
81	*endu*	Zebra shark	*Stegostoma fasciatum*	*0.7*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
82	*sitpat*	Bramble shark	*Echinorhinus brucus*	*0.6-0.7*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
83	*nil hangor/ dudhia hangor*	Hooktooth shark	*Chaenogoleus macrostoma*	*25-35*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
84	*dudh sankar*	Blacktip reef shark	*Carcharhinus neianopterus*	*25-35*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
85	*kalo kuki*	Spadenose shark	*Scoliodon laticaudus*	*25-35*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
86	*chil*	Eagle ray	*Myliobatis aquila*	*30*	No Seasonal Variation of Availability		Vessels with Double Cylinder Engine	Hook and Line
87	*faal*	Pharaoh cuttlefish	*Sepia pharaonis*	*25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
88	*sarpatria*	Needle cuttlefish	*Sepia aculeata*	*25*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
89	*chhipi*	Spineless cuttlefish	*Sepiella inermis*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
90	*baro chhipi*	Needle squid	*Doryteuthis sibogae*	*1.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
91	*dum*	Indian squid	*Uroteuthis duvauceli*	*0.05-0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
92	*squid*	Purpleback flying squid	*Sthenoteuthis oualaniensis*	*2.5-3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
93	*sada octopas*	Pulpo	*Octopus membranaceous*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
94	*kalo poctopas*	Common octopus	*Octopus vulgaris*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
95	*bhuti pata*	Malabar tonguesole	*Cynoglossus macrostomus*	*0.5-1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
96	*kalo pata*	Speckled tonguesole	*Cynoglossus puncticeps*	*0.5-1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
97	*ramchanda*	Cleftbelly trevally	*Atropus atropos*	*5-7*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
98	*pukur chanda*	Largenose trevally	*Carangoides chrysophrys*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
99	*sada mekrel*	Rainbow runner	*Elagatis bipinnulata*	*4*	No Seasonal Variation of Availability		All Types of Vessel	All Types of Tackles
100	*bhut*	Blackbanded trevally	*Seriolina nigrofasciata*	*0.25*	No Seasonal Variation of Availability		All Types of Vessel	All Types of Tackles

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
101	*kuni*	Indo-Pacific king mackerel	*Scomberomorus guttatus*	*0.25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
102	*sada mekrel*	Steaked seerfish	*Scomberomorus lineolatus*	*0.25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
103	*etem/bomb*	Yellowfin tuna	*Thunnus albacares*	*0.25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
104	*kalo etom*	Albacore	*Thunnus alalunga*	*0.25*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
105	*pani*	Bigeye rocking	*Physiculus capensis*	*1*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
106	*uronto poni*	Longnose lancetfish	*Alepisaurus ferox*	*1*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
107	*podmo pata*	Oriental sole	*Euryglossa orientalis*	*0.8*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
108	*chapta chanda*	Indian driftfish	*Ariomma indica*	*1.5-3*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
109	*gol pencha*	Golden trevally	*Gnathanodon speciosus*	*1.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
110	*gonbeg*	Banded scad	*Caranx para*	*0.2-0.25*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
111	*sutting*	Yellowtail scad	*Atule mate*	*0.4*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
112	*ramchanda*	Indian pompano	*Trachinotus mookalee*	*0.4*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
113	*koni*	Wahoo	*Acanthocybium solandri*	*0.4*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
114	*mekrel*	Bullet tuna	*Auxis rochei*	*0.4*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
115	*uronto pakhi*	Indo-Pacific sailfish	*Istiophorus platypterus*	*0.4*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
116	*uronto pakhi*	Swordfish	*Xiphias gladius*	*0.4*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
117	*shol*	Live sharksucker	*echeneis naucrates*	*10*	Monsoon	Winter	All Types of Vessel	All Type of Tackles
118	*bang*	Ocean sunfish	*Mola mola*	*1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
119	*bhangor*	Flathead mullet	*Mugil cephalus*	*2.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
120	*kumkum*	Yellowscale parrotfish	*Scarus ghobban*	*0.7*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
121	*doi chaka*	Spotted sicklefish	*Drepane punctata*	*1.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
122	*kunkuni*	Largescaled terapon	*Terapon theraps*	*0.4*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
123	*tin*	Moonfish	*Mene maculata*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
124	*tangra*	Engraved catfish	*Arius caelatus*	*0.25*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
125	*rur tangra*	Thinspine sea catfish	*Arius tenuispinis*	*0.8*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
126	*simul kata*	Giant catfish	*Arius thaalossinus*	*5*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
127	*kokila*	Indian oil-sardine	*Saordinella longiceps*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
128	*chandana ilish*	White sardine	*Sardinella albella*	*2.5*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
129	*ilish*	Fringescale sardine	*Sardinella fimbriata*	*2.5*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
130	*bomla*	Bombay duck	*Harpadon nehereus*	*0.25*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
131	*fali*	John's snapper	*Lutjanus johni*	*0.1*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
132	*bhola*	Goatee croaker	*Dendrophysa russelli*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
133	*bhola*	Belanger's croaker	*Johnius befangerii*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
134	*topse*	Paradise threadfin	*Polynemus paradiseus*	*0.05-0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
135	*gurjabali*	Striped threadfin	*Polynemus plebeius*	*4*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
136	*sona tangra*	Soldier catfish	*Osteogeneiosus militaris*	*1.5*	Monsoon	Winter	All Types of Vessel	All Type of Tackles
137	*rur tangra*	Blackfin sea catfish	*Arius jella*	*0.8*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
138	*maguriya tangra*	Spotted codlet	*Bregmaceros mcclellandi*	*1.5*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
139	*fali*	Goldstripe sardine	*Sardinella gibbosa*	*0.05-0.1*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
140	*ilish*	hilsa shad	*Tenualosa ilisha*	*2*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
141	*chandana ilish*	Toli shad	*Tenualosa toli*	*2.5*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
142	*boro silver*	Moontail bullseye	*Priacanthus hamrur*	*1.5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
143	*chhoto silver*	Japanese threadfin bream	*Nemipterus japonicus*	*0.7*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
144	*chomchom*	Thumbprint monocle bream	*Scolopsis bimaculatus*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
145	*tika bhola*	Spotted croaker	*Protonibea diacanthus*	*1.5*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
146	*nore bhola*	Bronze croaker	*Otolihoides biauratus*	*12*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
147	*grin bhola*	Blotched croaker	*Nibea maculata*	*0.5*	Winter	Monsoon	Vessels with 120-180 bhp Engine	Gill Net
148	*gujrati*	Blackspot trheadfin	*Polynemus sextarius*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
149	*gurjabali*	Fourfinger threadfin	*Eleutheronema tetradactylum*	*0.15*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
150	*chele*	Sevenfinger threadfin	*Polynemus heptodactylus*	*25*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
151	*chela*	Whitefin wolf-herrings	*Chirocentrus nudus*	*5-7*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
152	*kalo chela*	Dorab wolf-herrings	*Chirocentrus dorab*	*1.5*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
153	*baam*	Indian pike conger	*Congresox talabonoides*	*5-7*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles
154	*mukundi*	Chacunda gizzard-shad	*Anodontostoma chacunda*	*0.1*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
155	*khoyra*	Moustached thryssa	*Thryssa mystax*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
156	*khoyra*	Orangemouth thryssa	*Thryssa vitrirostris*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
157	*kulkul*	Thornycheek grouper	*Epinephelus diacanthus*	*0.1*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
158	*koi*	Mangrove red snapper	*Lutjanus argentimaculatus*	*5-7*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
159	*supru*	Malabar blood snapper	*Lutjanus malabaricus*	*5-7*	No Seasonal Variation of Availability		Vessels with 120-180 bhp Engine	Gill Net
160	*chanda*	Orangefin ponyfish	*Leiognathus bindus*	*5-7*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
161	*kath chanda*	Common pony fish	*Leiognathus equulus*	*5-7*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
162	*sada chanda*	Pugnose ponyfish	*Securtor insidator*	*5-7*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
163	*chomchom kaale*	Barramundi	*Lates calcarifer*	*0.05*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
164	*sada kaale*	Sunrise goatfish	*Upeneus sulphurus*	*0.05*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
165	*grin kaale*	Goldband goatfish	*Upeneus moluccensis*	*0.05*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
166	*ruli mach*	Golden anchovy	*Coilia dussumieri*	*0.5-0.1*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
167	*kakaja*	Commerson's anchovy	*Stolephorus commersonil*	*0.025*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
168	*futfuti*	Spangled emperor	*Lethrinus nebulosus*	*0.025*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
169	*kulkuli*	Saddle grunt	*Pomadasys maculatum*	*0.025*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
170	*chomchom*	Striped goatfish	*Upeneus vittatus*	*0.025*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net

Sl. No.	Types of Fishes			Available Average Weight (in kg.)	Seasonal Variation of Availability		Types of Machanised Vessel Used	Types of Fishing Tackles Used
	Local Name	English Name	Scientific Name		Peak Season	Off-Season		
171	*chanda*	Whipfin silver-biddy	*Gerres filamentosus*	*0.025*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
172	*khurot*	Lined surgeonfish	*Acanthusrus lineatus*	*20-40*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
173	*kholla*	Indo-Pacific Tarpon	*Megalops cyprinoides*	*0.2*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
174	*kunkuni*	Jarbua terapon	*Terapon jarbua*	*0.2*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
175	*gangtora*	Viviparus halfbeak	*Hermiramphus dispar*	*0.2*	Monsoon	Winter	Vessels with 200-300 bhp Engine	Trawl Net
176	*Chhecha*	Spotfin flat-head	*Grammoplites suppositus*	*2.5*	Monsoon	Winter	Vessels with 120-180 bhp Engine	Gill Net
177	*doi chaka*	Orbicular batfish	*Platax orbicularis*	*5*	No Seasonal Variation of Availability		Vessels with 200-300 bhp Engine	Trawl Net
178	*farse*	Silverspot squirrelfish	*Sargocentron caudimaculatum*	*0.3-40*	Winter	Monsoon	Vessels with 200-300 bhp Engine	Trawl Net
179	*bele/tular dandi*	Silver sillago	*Sillago sihama*	*0.25-0.75*	No Seasonal Variation of Availability		All Types of Vessel	All Type of Tackles

CHAPTER – 6

METHODS AND TECHNIQUES OF HIGH SEA FISHING

Chapter - 6

METHODS AND TECHNIQUES OF HIGH SEA FISHING

The attributes of technology not only include the tools and material culture but also include the resources, tasks, skills, labors etc. (Hunter and Whiten, 1977). Since the present researcher has already dealt with the resources of high sea fishing in the earlier chapter therefore, in this chapter he intends to deal with other aspects of the technology of high sea fishing found among the fishermen operating from the fish landing centre at Digha.

There are at least three types technological variation of high sea fishing found among the fishermen under study. The variations are primarily based on the types of mechanized vessel and corresponding fishing tackles. The following table shows different methods of high sea fishing and their relationship with the types of mechanized vessel and the fishing tackles.

Table no. 6.1: Different Methods of High Sea Fishing and their Relationship with the Types of Mechanized Vessel and Corresponding Fishing Tackles.

Method of Fishing	Types of Mechanised Vessel	Types of Fishing Tackle
Trawl Netting	Vessels with 200-300 bhp Engine	Trawl Net
Gill Netting	Vessels with 120-180 bhp Engine	Gill Net
Longline	Vessels with Double Cylinder Engine	Hook and Line

6.1. Seasons of High Sea Fishing:

Before discussing the technology of high sea fishing with different types of mechanized vessels and corresponding tackles, the present researcher considered it necessary to discuss briefly about the seasons of high sea fishing based on the fish landing centre at Digha. It is found during the field work that the seasons have bearing upon the technology of high sea fishing. Therefore, the following paragraphs

contain the information on seasons of high sea fishing provided by different concerned persons of Digha.

Different fishing units operating from fish landing centre at Digha sail for high sea fishing with different type of nets and mechanized vessels almost throughout the year. However, as per the Government regulation deep sea fishing is prohibited from the 15th April to 31st May in every year since this period is considered the breeding time for the marine fauna. Therefore, to protect the gravid fishes from killing, the fishermen are not allowed to practice deep sea fishing during this period.

Usually, the duration of a particular deep sea fishing expedition with mechanized vessel and corresponding fishing tackles varies according to the size and engine capacity of the respective vessel and the availability of fishes. The climate and weather has bearing upon the duration of the expedition since these two factors have a close relation with the availability of fish. Thus, it is revealed from the prolonged field work that the length of a fishing expedition during monsoon is shorter not because of the rough sea but owing to the fact that during this season large volumes of fishes are frequently available. As a result, even an expedition of shorter duration during monsoon is sufficient to get the desired quantity of fish in terms of volume and weight. From the post-monsoon period, the duration of the fishing expedition gradually increases and it reaches its peak during winter since schools of fishes are rarely available in the area closer to the shore during winter. Therefore, it is necessary to cover deeper area of the sea for fishing during winter and this demand more time for a particular expedition. Moreover, it is reported that during the winter the size of the school of fishes become smaller in volume, therefore, the fishermen are always in search of larger number of school of fishes to make each of their expedition economically viable. Although the fishing expedition during the summer becomes very infrequent due to the scorching sun, even then such expeditions are of longer duration compared to rainy season since there is the

possibility of lesser availability of fishes in the areas nearer to the shore during the summer.

It is revealed that contrary to the fishing with trawl and gill net, duration of hook and line fishing is comparatively long during the monsoon owing to the less availability of large sized predatory fishes during this season. Since the sole target of hook and line method of fishing is always the large predatory fishes that are more available during the winter, the duration of a fishing expedition with hook and line during this season is shorter. However, even this shorter duration of expedition becomes sufficient to the fishing unit to catch the desired quantity of fishes in terms of number, volume and weight.

It is also revealed that the duration of a hook and line fishing expedition in deep sea with mechanized vessel does not exceed a week since the vessels used for this purpose are smaller in size and lower in engine capacity compared to the vessels used for fishing with trawl and gill net. However, the climate and weather has bearing upon the duration of the expedition since these two factors have a close relation with the availability of fish on the one hand and the safe voyage on the other.

6.2. Technology of Trawl Net Fishing:

Trawling is a process for catching the fishes. The net used for catching the fishes is termed as 'trawl'. The vessels which are used to catch fish by way of pulling the trawl through the water behind them are called trawler. However, the fishermen operating from Digha call only those vessels as trawlers which are not only powered by heavy engine (as mentioned in the above table) but also of considerable size and equipped with permanently installed GPS, Sonar or fish finder, mechanized winch etc.

6.2.1. Size and engine capacity of the trawler:

The bodies of the trawlers used by the fishermen operating from Digha are usually made of wood and their length varies from 45 to 60 ft. The breadth of the

trawlers varies from 15 to 24 ft. The floor of the deck is made of wood and the surface is convex in nature so that water cannot accumulate on it.

The height of trawlers are varies from 18 to 24 ft. This height is calculated from the base of the vessel to the roof of the engine room. The engine capacity of the trawlers varies according to the size of the vessels. Thus, it is found that the engine capacity of the trawlers varies from 200 bhp to over 300 bhp.

6.2.2. Space utilization within the Trawler:

The forward or stem post end or forecastle end of the trawler is locally called '*ahnwik*' since the heavy wooden mooring bollard stands at this end is worshipped by the vessel master. Mooring bollard is used to secure ropes for towing, mooring and other purpose. It is exactly cylindrical, but typically has a larger diameter near the top to discourage mooring warps (docklines) from coming loose.

The bollard is imagined as the abode of different deities responsible for safe voyage and good quality and quantity of haul therefore, the vessel master of a trawler at Digha worships the respective bollard every morning during the entire duration of the fishing expedition.

The aft or stern end of the trawler is locally called '*pacha*' (Bengali equivalent of buttock) which may be considered as an expression of anthropomorphism. The nets are rolled and heaped on the deck at the stern end of the trawler.

The bridge of the vessel is locally called '*steering room*' since the rudder of the vessel is steered from this room. However, different electronic gadgets like in-built GPS, fish finder, wireless etc. are also installed in the bridge or steering room.

The machine room is located just below the floor of the steering room. In this room the engine of the vessel is installed. However the machine room is also used to store the standby nets, floats (plastic ball), iron chain (used as sinker) etc.

The store room is located at the stern end of the vessel, and is used not only for storing the daily haul but also for keeping the slabs of ice necessary for preservation of the fish netted during the high sea fishing expedition.

A rest room for the fishermen during the voyage is located adjacent to the steering room. However, this room is rotationally occupied by different members of the high sea fishing unit during the expedition. The room is furnished with open-wardrobe, movable mattress, video set, music system. There is a wooden altar at one corner of the rest room on which framed pictures of different Hindu Gods, Goddesses and Saints placed on a wooden altar. The vessel master worships before these images every evening during the period of high sea fishing expedition. However, in case of the fishing unit respectively owned by a Muslim person and composed of the Muslim persons, picture of the Holy mosque of Mecca is placed on the altar. Although vessel master offer daily *Namaj* before this picture but other members of unit also offer such daily *Namaj* as per their respective convenience.

A covered place by the side of the rest room is used as kitchen. It is equipped with cooking gas cylinder and oven, crockery, stone mortar and pestle, chopper, knife, plastic boxes for spices etc. Moreover, several big plastic drums, filled with sweet water up to about 3000 liters are placed within the kitchen. The stored sweet water are exclusively used for drinking and cooking only. The kitchen is also used to store the ration required during the fishing expedition. The ration includes rice, lentils and pulses, spices, mustered oil, limited quantity of vegetables (primarily pumpkin, potato, onion and garlic, lemon etc.). Apart from these, the ration also includes betel leaf and nut, first aid medicines, including digestive and anti-nausea tablets and pain killers, etc. The amount of ration varies according to preplanned duration of the expedition.

The open deck by the side of the kitchen is used for keeping plastic barrels full of diesel. Usually a barrel contains 600 liters of diesel and the number of barrels varies according to the duration of the fishing expedition.

The empty crates required for storing the fishes are usually piled on the roof of the steering room and rest room. The number of plastic crates carried to store the haul varies from 250 to 300. Each crate has the capacity to store 25 to 30 kg of haul.

6.2.3. In-built Electronics Gadgets

A trawler always bear an in-built 'Global Positioning System' (here after GPS) and a 'Fish finder'. The GPS is used to detect the location of the vessels in the sea whereas; a fish finder is used to obtain the depth of the sea, underwater physical and biological components. Fish finder is also helpful to evaluate fish biomass and their spatial distribution in a particular location within the sea water.

6.2.4. Preparation of the Net for Fishing

The trawls or nets which are used for catching fish in deep sea by way of pulling with the help of trawler are conical in shape and made of nylon thread. Although both ends of the net are usually kept open but during the use of a particular net for fishing, the fishermen close the tapering end by knotting it tightly with the help of nylon ropes. The length of the net varies from 100-150 ft, whereas the diameter of the mouth or rim of the net varies from 25-30 ft. The size of the meshes of the trawls varies according to the targeted size of the fishes. The nets used by the fishermen of Digha are in most cases machine-woven and are usually procured by the respective owner of the trawlers from the daily markets of Digha or Kanthi town of East Medinipur district of West Bengal.

A heavy iron chain used as sinker is attached with one half of the circumference of the mouth or opening of the net so that it gets submerged properly in the sea water. The other half of the circumference is fitted with floats made of heavy plastic balls at regular interval of 2-3 ft. so that the mouth of the net remain properly open during the pulling of the net under water with the help of trawler.

After the floats and sinkers are fitted with the rim of the net, a long and heavy nylon rope is used to connect the two ends of the net i.e. the mouth and tapering end of the net respectively. This connected rope is used to drag the net out of the water on to the deck of the trawler after the trawling is over.

Following the same methods mentioned in the earlier paragraphs, the fishermen on the boat keep ready 5 to 6 nets of different size of meshes

simultaneously for the purpose of catching fish of different sizes. The selection and/or operation of a particular variety of net in terms of the size of the mesh is determined by the size of fishes that are likely to be found. The nets are prepared for operation during the beginning of the fishing session while the trawlers are anchored in the harbor. Each net prepared in the fashion described so far are wound up respectively around a bobbin made of the piece of bamboo.

On the onset of using a particular net for fishing, two nylon ropes, locally called *kachhi,* of about 30 ft. long are tied respectively at either end of the diameters of the mouth of the net. These ends of the diameter are respectively the meeting point of the either end of the iron chain i.e. sinker and the either end of the floats bearing rope. The other end of the respective rope is knotted respectively with the centrally fitted iron 'D' shackles of two corresponding '*water board*'. These centrally fitted iron 'D' shackles are welded respectively with each end of two iron ropes wound up around two separate drums of the mechanized winch installed on the deck of the stern end of the trawler. Thus, the iron 'D' shackles on the water board serve as the meeting point of the nylon ropes of the net and the iron ropes of the winch respectively. However, the nylon ropes of the nets are temporarily knotted/tied with the water board only during the use of a particular net whereas, iron ropes of the winch are permanently fixed with the water board by way of welding them with the shackle of the board.

These iron ropes are used to release and wound up trawls with the help of the mechanized winch. A new net is connected and the used-net is disconnected from the centrally fitted 'D' shackles of the 'water board' during the fishing operation.

The Water board is a 5ft. × 7ft. rectangular wooden plank. An iron tape of about one inch width is used to cover all the four borders of the plank for protecting it against erosion. Two iron tapes of about 1.5 to 2 inches width run vertically and horizontally across both the upper and lower surface of each plank. At the meeting point of the two tapes on the central point of the respective plank, an iron 'D' shackle

is tightly fitted. A heavy plastic ball is attached to the 'D' shackle of each water board so that they remain submersible while the net is under operation.

When a particular net is selected for fishing it is first unwound from the bamboo made bobbin and then heaped on the floor of the deck in such a fashion so that the tapering end of the net locally called *'kandhha'* remains on the top of the mound.

6.2.5. Casting of Net beneath the water:

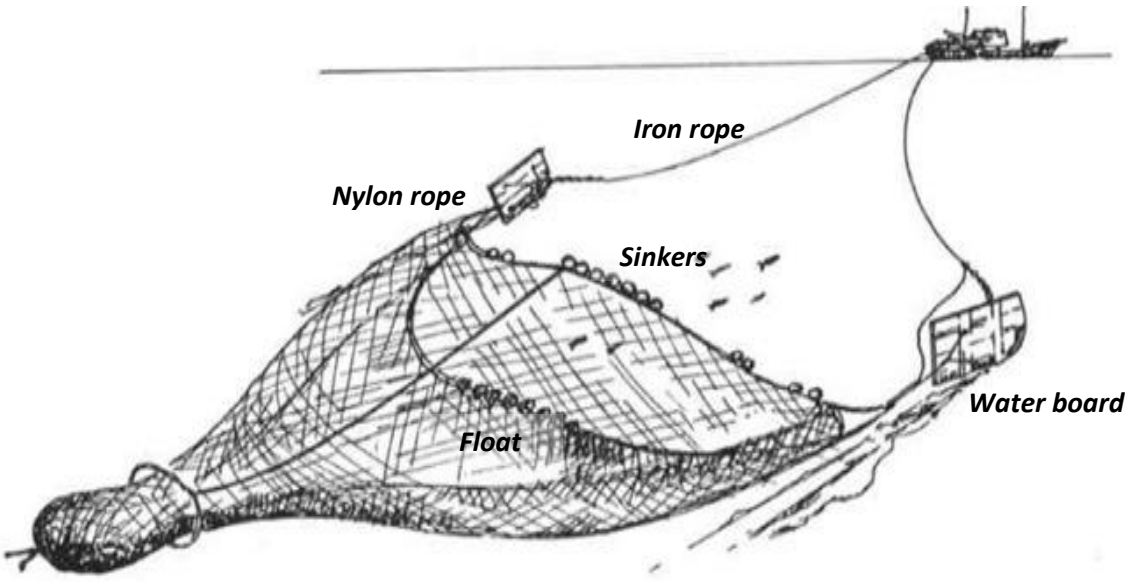
At the first stage, the trawler master selects a particular location or area of the sea where there is abundance of fish as per the perceptions of trawler master, based on his experience and skill. He usually selects the area for fishing on the basis of the color of the sea water since he perceives that the colour of the sea water has bearing upon the type and quantity of the fishes.

After selecting such location trawler master slows down the speed of the trawler and asks the members of the fishing unit, except the engine driver, to cast the net. After connecting the net with the 'water board' the members of the unit begin to throw the net from its tapered end slowly into the water. During the throwing of net, the trawler moves in a minimum speed to facilitate proper opening of the mouth of the net. When the entire net opens properly under the water then the engine driver starts to release the iron ropes from the respective drums of the winch. Since both the drums of iron rope are operated mechanically by a common winch, equal lengths of ropes are released simultaneously. After the desired lengths of both the iron ropes are released under water the drum of the rope are locked. The length of the iron ropes to be released under water from the respective drum is exclusively decided by the trawler master.

For estimating the length of ropes released in the water, the entire length of each of the iron rope wound up around each drum is punctuated with markers made of colored twine at a regular interval of about 6 ft. The gap between the two markers is locally called *baam*. It is to be mentioned in this context that the word *'baam'* is the indigenous term used by the persons engaged in high sea fishing to

describe the measurement in terms of length, breadth, depth etc. According to these persons four '*haat*' or forearms constitute one *'baam'* and one *'baam'* is equivalent to 6 feet approximately.

The casting of the trawl has been shown with the help of the following sketch:



The length to be released depends on the size of the meshes of a particular net under use as well as the strata of the sea water selected for fishing. Thus, for the purpose of demersal fishing the length of the iron ropes are released to such an extent that the sinker of the net can touch the sea bed since the demersal fishes usually live and feed on the bottom of the sea. Demersal fishes are also known as 'bottom feeders' or 'ground fish' owing to the fact that they live in the bottom of the sea. Demersal fishing is usually practiced during the winter when the sea remains comparatively calm and size of the waves is significantly small. The fishermen consider this kind of environment as conducive for immersing the net smoothly on the sea bed. The nets with small size of meshes are used for demersal fishing.

Similarly, for trawling the pelagic fishes or 'column feeders' the *majhi* releases lesser length of iron rope to immerse the net into the water since these varieties of fishes usually live and feed in the mesopelagic (depth varies from water surface to 650 ft.) and bathypelagic (depth varies from end of mesopelagic to 3300 ft.) zone of

the sea water. Examples of larger pelagic fishes are tuna, oceanic sharks, mackerel etc. The nets with comparatively larger sizes of meshes are used for catching column feeders. The fishermen of Digha consider rainy season to be the best for trawling pelagic fishes since they are found in abundance in the sea during the monsoon.

After the net is properly immersed and spread under water the trawler master accelerates the speed of the trawler and after reaching a suitable speed he fixes the accelerator as well as the steering connected with the rudder of the trawler. In this condition, the trawler pulls the trawl under the sea for about 2 to 3 hours. After such duration of trawling the master of the trawler at one stage by his skill and experience realizes that the trawler has become slow even in the state of its locked accelerator owing to the pull from its back due to weight of the captured fishes. On the basis of such observation the master unlocks the accelerator and the steering of the trawler. Thereafter, he slows down the speed of the vessel. Then he directs the *driver* to pull the net with the help of winch. When the iron ropes along with two water boards are taken out of the sea; then the boards are respectively tied with two heavy iron poles locally called *gyalo khuti.* However, the net with the captured fish still remains under the water. In this state, the trawler master drives the trawler very slowly for 2 to 3 minutes so that all the fishes trapped in different meshes of the net are deposited in its tapering end.

6.2.6. Lifting of net from the sea:

Meanwhile, other members of the expedition team lift most part of the net on the deck of the trawler. However, the tapering end of the net, locally called *kandhha,* filled with fishes is allowed to remain under the water. The tapering end filled with the catch is separated from the upper portion of the net with the help of a tight knot of nylon rope. The upper portion of the net is heaped on the deck of the trawler. Thereafter, the knot is clasped with an iron hook tied at the end of a nylon rope. The terminal end of this nylon rope runs through a pulley and knotted with one of the terminal end of a iron rope which is wound up around a drum of the winch. The pulley, locally called *kafia,* is fixed at the tip of a heavy vertical iron pole of about 20

ft. height. During the idle time, the hook along with nylon rope passing through the pulley is wound up around this pole.

After connecting the hook with the winch via pulley, the trawler master accelerates the speed of the trawler and runs for about 2 to 3 minutes and in this way the sands and mud deposited on the body of the fishes are washed. Thereafter, the speed of the trawler is lowered down and the knotted tapering end of the net packed with fishes is pulled from the water on the deck of the trawler with the help of the winch. However, this packed fishes are allowed to hang from the pulley fixed with the iron pole so that the water drops out from the packed tapering end of the net. After a while mouth of the knotted tapering end is opened and all the fishes from the net are released on the floor of the deck. Thereafter, the heap of the fishes on the deck is further washed by way of showering buckets of water lifted manually from the sea.

6.2.7. Sorting and Storing of Fishes:

Then the members of the team, except trawler master and engine driver, sit around the heap of fishes and sort out them according to the types or species. During the sorting, species of some non-edible fishes as well as some edible species suitable to consume as dry fish are respectively separated and collected in rectangular plastic crates. Other fishes sorted as per types or species are collected in different large plastic crate of rectangular shape each of which measures about 3ft in length, 1.5 ft in width and with a depth of about 1.5 ft. Each crate has the capacity to contain about 25 – 30 kg of fishes.

After the sorting of fishes is over on the deck, the team members pack them as per types or species in different crates, for the purpose of storing. The fishes are packed by making alternate layers or strata of small pieces of ice, followed by those of fishes. However, the lowest and the topmost layers or strata of a packed crate are always made of small pieces of ice. After packing in this manner, the crates are placed in the designated store room of the trawler.

Thereafter, the crates containing the non-edible fishes are placed over the roof of the bridge of the trawler whereas the species suitable to consume as dry fish are spread on the roof top of the vessel. The non-edible fishes are sold at the earliest opportunity to the itinerant traders moving around different high sea fishing team. These traders with the help of their motorized boat come closer to different trawlers engaged in high sea fishing and enquire about the availability of non-edible fishes. They collect these fishes even in rotting condition and later on supply to different poultry food manufacturers in lieu of cash. Similarly, dry fishes are carried to the shore and sold in the market. In this case also money earned out of the sale is shared only among the voyagers.

However, the trawler master does not allow the team members to carry the non-edible fishes for more than 2-3 days on the vessel owing to the requirement of the crates for packing the recurring catch on the one hand and necessary protection of the members of the team from the odor of the rotten fish on the other. If within the period mentioned above the non-edible fishes could not be sold to the itinerant traders then the trawler master directs the members of the unit on deck to throw all the non-edible fishes which have already started to decompose.

It is pertinent to mention that the money earned out of sale of non-edible fishes is equally shared among the members of the unit. However, owner of the trawler as well as his manager never claim any share out of such earning.

6.3. Technological of Gill Net Fishing:

6.3.1. Size and engine capacity of the 'Fishing Body':

The body of the vessel including its deck is usually made of wood. The length of the 'fishing body' varies from 54 to 62 feet whereas width varies from 10 to 18 feet. The height of the vessel from the floor of its hold to the roof of the engine room varies from 18 to 20 feet.

The engine capacity of the 'fishing body' varies according to the size of the vessel. Thus, it is found that the engine capacity varies from 120 hp to over 280 hp.

6.3.2. Space utilization within the Fishing Body:

The forward or stem post end or forecastle end of the fishing body is locally called *'ahnwik'* since the heavy bollard stand at this end is worshipped every morning by the vessel master during the entire period of a particular fishing expedition. The bollard is imagined as the abode of different deities responsible for safe voyage and good amount of haul. The open space adjacent to the bollard is used to heap the ready-to-use gill nets.

At the end of the heaped nets towards the aft or stern post end of the vessel the rest room for the fisherman stands. In the rest room the GPS, magnetic compass, and television set etc. are installed. In the corner of the rest room a wooden altar is placed for the similar use as it is found in case of the trawler.

The roof of the store room is used to store the empty plastic crate for keeping the captured fishes in refrigerating chamber within the vessel. Each crate has the capacity to store 25 to 30 kg of haul. The number of plastic crates carried to store the haul varies from 150 to 200 depending on the size of the refrigerating chamber.

In the ground floor of the rest room within the hold of the vessel there is a room where the engine of the vessel is installed. This room is called machine room. However, the machine room is also used to store the fuel i.e. diesel for the vessel engine, additional number of nets, floats, sinkers etc.

At the end of the machine room and the rest room the refrigerating chamber of the vessel is located. The chamber is in the shape of a cubicle that rises from the floor of the hold of the vessel with its upper rims touching the level of the deck. The entry to the refrigerating chamber is made through a rectangular opening which is covered with a movable wooden plank or lid. The length and breadth of the refrigerating chamber are respectively 8ft. and 7 ft. whereas depth of the chamber is about 10 ft. and the lid is measuring about 3.5 ft. in length and 2.5 ft. in breadth. This chamber is used to carry the ice slabs as well as to refrigerate the captured fishes during the expedition. The refrigerating chamber is insulated with varieties of materials. Thus, the outer walls of the chamber are made either of aluminum sheets

or ply wood boards, whereas the inner walls of the chamber are insulated with one layer of ply wood board and one layer of thermocol board.

The aft or stern end of the fishing body is locally called '*pacha*' which is equivalent of buttock. The toilet and privy is located at the extreme border of this end. Next to the toilet towards the fore part or forward of the vessel a manually operated iron steering oar locally called '*haal*' is installed. The total length of the steering oar including the blade and the shaft varies from 12 to 15 ft. depending on the size of the vessel. The rectangular blade of the steering oar remains submerged in the sea and its cylindrical shaft is inserted vertically through the stern post of the vessel to reach the deck. The portion of the shaft that stands on the deck has the height of about 2.5 feet. An iron tiller of about 5 ft. length is horizontally welded with the tip of the shaft of the steering oar to rotate the oar as and when necessary.

A covered place on the deck by the side of the handle of the steering oar is used as kitchen. It is equipped with Kerosene stove or clay made oven within a metal drum jericans full of kerosene oil, fuel wood, crockery, stone mortar and pestle, chopper, knife, plastic jars for spices etc. Moreover, several big plastic drums each containing about 3000 litre sweet water are also stored in the kitchen for the purpose of drinking and cooking only. The kitchen is also used to store the ration required during the fishing expedition. The ration includes rice, lentils and pulses, spices, mustered oil, limited quantity of vegetables (primarily pumpkin, potato, onion, garlic, lemon etc.). Apart from these, the ration also includes betel leafs and nuts, first aid medicines, including digestive, anti-nausea and pain killer tablets etc. The amount of ration varies according to the pre-scheduled duration of the expedition.

The open deck adjacent to the kitchen is used for keeping barrels of diesel. Usually the barrels are made of plastic and each barrel contains 600 liters of diesel. The quantity of diesel carried in a particular expedition again depends on the duration of the respective pre-scheduled trip.

6.3.3. Gill Nets and their Varieties:

All varieties of nets irrespective of their size or location for casting or setting are commonly called '*jaal*' in local dialect. However, the persons associated with high sea fishing at Digha mostly use the English word net instead of *jaal* during communication among themselves or with the out siders.

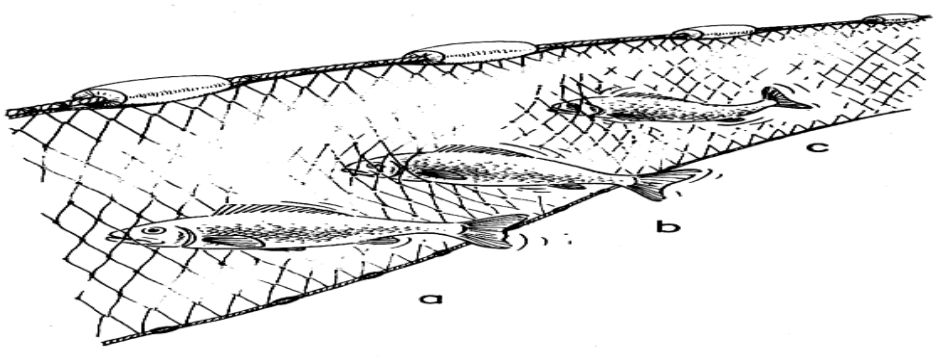
The gill net is rectangular in shape and catches fish that swim into it. The net hangs straight up-and-down in the water like a fence. It has a *float line* along the top locally called *'shol par'* and *lead line* along the bottom locally called *'guri par'*. Each corner of the net is locally called *'kani'*.

The length of a single piece of gill net varies from 165 to 180 ft. whereas breadth varies from 42 to 48 ft. Two lateral margins of single piece of gill net are bordered with nylon rope of 2 m.m. thickness. These ropes are used to sew together a number of pieces of gill net to be set or put out in a wider area of the sea.

A gillnet catches fish by their gills. It works like this: the *twine* of the netting is very thin, and either the fish does not see the net or the net is set to trap the fish. The meshes of the net hang wide open. When the fish swims up to the net it sticks its head right into one of the meshes.

If the fish is too small for the mesh it will swim right through and get away. If the fish is the right size it pushes its head and body tightly into the mesh, but it is too big to fit through.

When the fish tries to pull its head out of the mesh the thin twine cuts into its skin; its gills and fins get caught in the mesh. The fish stays in the net until it is pulled up. Fish are also caught when the net wraps around them. The way the fishes are trapped in gill net has been shown with the help of the following sketch:



Gillnet is used in many ways. They can be made to rest on the bottom, to hang between the bottom and the surface, or to float on the surface. Gillnets can be *set* in one place with anchors, or allowed to drift with the current. However, the fishermen of Digha always join together a number of pieces of gill net and set them with different types of anchors in a particular location of the sea.

Depending on the material of the thread, method of weaving and size of the mesh etc. the persons associated with marine fishing based on Digha classify the gill nets into four categories and they are namely: Kuni Jaal, Monofil jaal, Cord jaal, and Parachute jaal. The following table shows the relation among types of gill net, technology of net production, materials and mesh size of the gill nets, seasons of use for the particular types of net and the variety of fishes captured with each type of gill net.

Table no. 6.2: Relationship among Types of Gill Net, Technology of Net Production, Materials and Mesh Size of The Gill Nets, Seasons of Use for the Particular Types of Net and the Variety of Fishes Captured with Each Type of Gill Net.

Types of Gill Net	Technology of Production	Material used	Mesh size (in mm.)	Season of use	Varieties of Fish Captured
Kuni Jaal	Machine made	Blue colored thick plastic thread.	110 115	October to February	Yellow tail scad, Spade nose shark, Hammer head shark, False trevally etc.
Monofil Jaal	Machine made	White or blue colored thin plastic thread.	105 110 102 95 90	Mid-May to September	Hilsa, Silver Pomfret, Chinese silver Pomfret, Black pomfret, Scalloped hammer-head shark etc.
Cord Jaal	Hand made	Blue colored thick nylon thread.	105 110 120	Mid-May to September	Indian salmon, Horse mackerel, Indian cod fish, Grey mullet, Flat head mullet, Bigeye tuna, Talang queen fish and Long tail tuna etc.
Parachute Jaal	Hand made	Sky colored thin parachute thread.	110 120 130 140	January to February	Scalloped hammer-head shark, False trevally, Yellow tail scad, Bigeye tuna, Spadenose shark, Indian salmon, Horse mackerel, Indian cod fish, Grey mullet, Island mackerel etc.

6.3.4. Preparation of the Net for Fishing:

To prepare or make a fleet of nets (since several nets are tied together) the fisherman use netting, floats for the float line, sinkers for the lead line and plenty of twine and ropes to sew everything together. During the setting of the net the fishermen use buoys, anchors and anchor ropes.

There are many different kinds of rope used by the persons associated with marine fishing based on Digha for the float line, lead line and anchor ropes. They use the ropes which are stiff enough to help give the net its shape, but soft enough to be easy to coil and handle. The ropes are mostly made of polyethylene, polypropylene or polyamide (nylon). The ropes are either twisted or braided.

The big plastic ball and polyethylene jerrycan of 20 litres capacity are used as floats. The floats are big enough to lift the netting, but not so big that they lift the sinkers on the lead line. However, the fisher men select the floats in such a manner that same buoyancy or lifting power remains in case of plastic balls and polyethylene jerrycan. The floats have ring in case of plastic ball or handle in case of jerry can to fasten them to the float line.

The sinkers along the lead line keep the floats from lifting the net off the bottom. The sinkers are either made of concrete or terracotta. They are round in shape with a hole in the center and locally called *chakai* since they appear like wheel. Sinkers have the radius of 50 cm. and thickness of 4-5 cm. The fishermen maintain the same weight for the sinkers and they are very careful about the smoothness of the surfaces of the sinkers so that they may not catch or tangle the net. The fishermen of Digha are very careful to note that sinking-power of the sinkers remains three to five times greater than the floating power of the floats.

The anchors at the ends of the fleet of nets keep them from drifting. Grapnel-type iron anchor or six pieces of full size terracotta bricks weighing about 8 kg. are used as anchor.

The buoys attached to each anchor rope mark the place where the net is set. The buoy is indigenously manufactured by the fishermen themselves. It is a 3 ft. X 2.5 ft. square structure made of light-wood logs. For making the structure tight and strong, two pieces light-wood logs are made to criss-cross to each other to join the four corners of the wooden structure. The margins of the structure are fitted with floats made of big and heavy plastic balls. During the expedition the fishermen attach a bamboo pole of about 10 ft. height with the national flag of India to the buoys so they can be seen from far away during day time. However, to mark the spot of setting the fleet of nets during night time they attach 1 litre capacity kerosene lamp locally called *tua*. For attaching the lamp with the buoy the surface of a horizontally placed big jerrycan on the middle of the buoy is used.

The floats are knotted on the float line of the net. A nylon rope of 12 mm. thickness is tied on the upper margin of the net for the purpose of knotting the floats as well as pulling the net. The floats of plastic ball are knotted at a regular interval of 24 feet and after every 20 plastic balls a jerrycan float is knotted. Floats of plastic balls are stitched with nylon rope in such a fashion that a gap of about 1 ft. remains between the float line of the net and the respective float. However, more gaps are maintained between the float line and the jerrycan floats. Moreover, provisions are made to extend the gap by way of rolling extra length of rope around the body of respective jerrycan. The extension of such gap varies according to the depth or zone of the sea where the setting or putting out of the fleet of nets will take place.

The sinkers are knotted on the lead line of the net. A nylon rope of 6 mm. thickness is lashed all along the lead line of the net for fastening the sinkers. The sinkers are knotted at the regular interval of 24 ft. like the floats so that for each float on the float line there must be a weight in sinkers. Sinkers are stitched with nylon rope in such a fashion so that a gap of about 1 ft. remains between the lower margin of the net and the respective sinker.

In the above mentioned method a fleet of about 80 – 100 pieces of gill nets of different varieties are prepared and temporarily joined together with each other at

their lateral sides with the help of 2 mm. thick nylon rope. Thus the sum total length of a fleet of gill nets stretches about 4000 to 4500 meters on an average. After the fleet of nets is prepared they are folded in several strata and heaped on the deck at *ahnwik* or stem head end of the vessel.

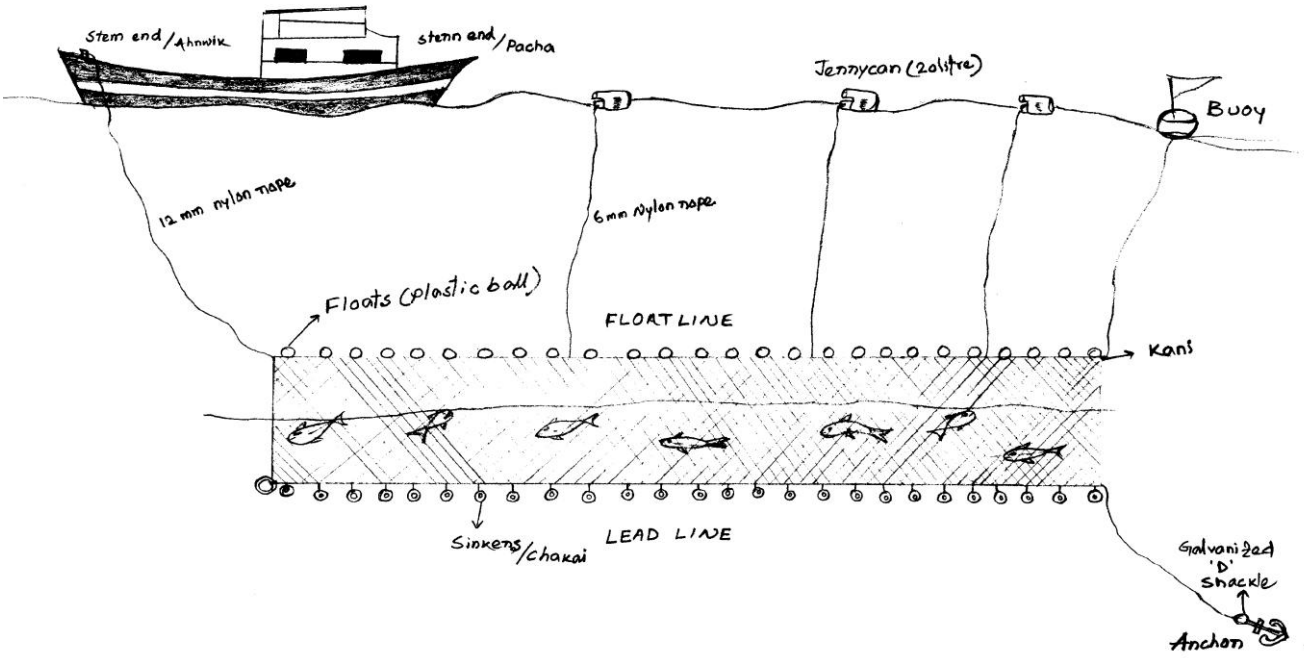
6.3.5. Setting (putting out) the Gill net:

At the first stage, the vessel master (locally called *'majhi'*) selects a particular location or area of the sea where there is abundance of fish as per his perceptions gained through his experience and skill. He usually selects an area or a particular spot for fishing on the basis of the colour of the water of sea in that location since as per his perception type and quantity of fishes has bearing upon the colour of the water. After selecting such location *majhi* asks the engine driver, locally called *'side majhi'*, to stop and anchor the vessel.

In the second step the *majhi* asks the fishermen to knot one end or corner of the float line of the net (locally called *Kani)* with the 20 mm. thick nylon rope permanently knotted with the wooden bollard stands on the fore part of the vessel. This wooden bollard is not used for mooring but only for drawing the net. The other end or corner of the float line of the net is knotted with the buoy with a piece of 60 ft. long and 20 mm. thick nylon rope.

In the third step the majhi instructs the fishermen to attach two anchors either iron made Grapnel-type or weight made of bricks on both the end of the lead line of the fleet of gill nets. A 12 mm. thick nylon rope is used attaching the corner of the lead line of the net with the galvanized 'D' shackle of the anchor. However, in case of using weight as anchor, at first a 12 mm. thick nylon rope is lashed through all along the lateral margin of the net. Then one end of this rope is knotted with the buoy and the other end is knotted with the thick nylon twine that has been used for tying the bricks used as weight. The distance between the corner of the lead line of the net and the attached anchor also varies according to the depth or zone of the sea where the net will be placed.

When the knotting of float line of the net with the buoy and the lead line with the anchor is completed the majhi at once instructs the fishermen to immerse the net slowly in to the water and asks the engine driver to start the engine and drive in back gear mode so that the fishermen can vertically spread the fleet of different varieties of gill nets slowly in the sea water. While spreading the nets the labourers always throw the lead line of the net first since this end contains the sinkers which facilitate easy spread of the net in the sea water. During these operations vessel master takes control of the steering oar or *haal* since he is the authority to decide the area and direction for spreading the net in the sea water. The method of setting of the gill net has been shown with the help of the following sketch:



The time required for spreading or setting the gill net in sea water varies from 90 minutes to 180 minutes depending upon the season. Thus it was found that during winter season the time for spreading gill net for fishing varies from 90 to 120 minutes since the sea remains calm in this season. However, during the rainy season owing to the roughness of the sea the time for spreading gill net for fishing varies from 150 to 180 minutes.

After the entire net is spread or setting in the sea water the majhi asks the fishermen to anchor the vessel and wait until he orders for pulling the net from sea. During this interval some of the fishermen carry a few of the plastic crates from the roof top of the rest room and arrange them on the deck of the stem end of the vessel, while some others help the cook to prepare food for the entire team members. It is to be mentioned in this context that while annual recruitment of the fishermen for deep sea fishing expedition is made, a member is always selected who has special skill and capacity to cook for entire team apart from his ability to participate in the fishing activities. During this interval the fishermen also enjoy leisure and recreation by way of playing cards, watching television, listening to radio and even sleeping etc.

6.3.6. Hauling (taking in) the net:

When the vessel master speculates that satisfactory amount/quantity of fishes has been enmeshed in the net then he orders the fishing team to take necessary action for lifting/pulling the net. However, he can speculate the amount of enmeshed fishes only during winter since the sea remains calm in this season which allows him to feel the tension or pull of the vessel due to the increased weight caused by the enmeshed fishes. But during the time owing to the roughness of the sea such speculation is difficult. Therefore, during rainy season vessel master allows the net to remain spread or set in the water for about 3 hours.

For the purpose of pulling the net from the water the vessel master asks the engine driver to start the engine and slowly move the vessel forward. However, the direction of the movement of the vessel is controlled by the vessel master with the help of the steering oar. The speed of the vessel is maintained in such a fashion so that most of the labourers engaged in pulling the net may get sufficient time to pull the portion of the net from the sea and heap on the deck.

6.3.7. Sorting and Storing of Fishes:

While a section of the labourers are engaged in pulling and heaping the net, the remaining section of them become busy to free the captured fishes from the meshes of the net and put them in the plastic crate. In this way entire net is pulled or

lifted from the sea. While keeping the captured fishes in plastic crate for storing/refrigeration the labourers on deck do not sort the fishes as per species or size since sufficient space is not available on the deck of the vessel for doing so. However, if the big size fishes are captured during the next courses of fishing but there are not sufficient number of crates available to store them the fishermen throw away the fishes of small size already preserved in the crate. For this reason vessel master always prefers to load more than sufficient crates and the ice slabs. After all the fishes are taken from the meshes of the net the storing of the catches are made. For the purpose of, storing the crushed ice is spread on the floor of each plastic crate. On this ice bed captured fishes are placed in a layer. This layer of fish is again covered by a layer of crushed ice which is followed by another layer of fishes. In this way captured fishes are arranged in every crate and placed in refrigerating chamber of the vessel.

6.4. Technological of Hook and Line Fishing:

6.4.1. Size and Engine Capacity of the vessel used for hook and line fishing:

The term 'Bhut Bhuti' is used by the persons associated with high sea fishing based on Digha to designate those mechanized vessels which are used to catch fish with the help of hook and line. These are also called 'Borsi body' or 'Kanta body' by the local people since the iron made barbed fish hooks are locally called '*borsi*' or *'kanta'*.

The body and deck of the vessel is always made of wood. The length of the vessel varies from 8 to 11 meter whereas width varies from 2.5 to 4 meter. The height of the vessel from the floor of its hold to the roof of the engine room varies from 3 to 4 meter. The vessel is powered by double cylinder (2 C.C.) engine. However, the vessel is devoid of any permanently installed sonar or power driven winch. But during the expedition the vessel master carry a GPS provided by the vessel owner.

6.4.2. Space Utilization within the 'Borsi Body':

The forward or stem post end or forecastle end of the vessel is locally called '*ahnwik*' since the heavy wooden mooring bollard stands at this end is worshipped every morning by the vessel master during the entire duration of the fishing expedition. The bollard is imagined as the abode of different deities responsible for safe voyage and good amount of haul. However, mooring bollard so worshipped is used to secure ropes for towing, mooring and other purpose. It is exactly cylindrical, but typically has a larger diameter near the top to discourage mooring warps or docklines from becoming loose.

After the bollard there remains an open area on the deck of the vessel which is used to keep the diesel barrels. The quantity of diesel carried in a particular expedition again depends on the duration of the respective pre-scheduled trip.

The aft or stern end of the vessel used for hook and line fishing is also locally called '*pacha*' which is Bengali equivalent of buttock. The toilet and privy of the vessel is located at the extreme margin of this end. Next to the toilet towards the fore part or forward of the vessel a manually operated iron steering oar, locally called '*haal*', is installed. The total length of the steering oar including the blade and the shaft varies from 4 to 4.5 meter depending on the size of the vessel. The rectangular blade of the steering oar remains submerged in the sea and its cylindrical shaft is inserted vertically through the stern post of the vessel to reach the deck. The portion of the shaft that stands on the deck has the height of about 0.8 meter. An iron tiller of about 1.5 meter length is horizontally welded with the tip of the shaft of the steering oar to rotate the oar as and when necessary.

By the side of the tiller of the oar there is a covered place on the deck which is used as kitchen of the fishing unit during their fishing expedition. The kitchen is equipped and used in similar fashion as found in the cases of trawler and the vessel used for gill netting. The rations stored in the kitchen are almost similar with those found in the cases of the trawling and gill netting. However, the size of the kitchen is different compared to the vessels used for trawling and gill netting.

After the iron tiller and the kitchen there is a passage on the deck of the vessel for the movements of the members of the high sea fishing unit during expedition. Next to the passage there is the rest room for the unit members. The room is about 2.5 meter in length 1.5 meter in breadth with a height of about 1.5 meter. The rest room has a door with low height entrance and two small windows on either side of the wall with the provision of sliding door. In the rest room there are the spaces allotted to keep GPS, magnetic compass, and television set etc. In the corner of the rest room a wooden altar is placed for the similar use as it is found in case of the trawler.

On the roof of the rest room a make-shift rectangular shade is erected with serried wooden railing and the top of the same is covered with a sheet of tin. The height of this shade is about 1.5 meter and the length and breadth is almost equal to the floor space of the rest room. This shade is used for storing different types of ready-to-use tackle namely floats like jerrycan and hard plastic balls, grapnel-type iron anchors used against drifting of the fishing line, buoy, kerosene lamp etc.

Just below the rest room there is another room located within the hold of the vessel. This room is called machine room since this is where the engine of the vessel is installed. However, the machine room is also used to store the fuel i.e. diesel for the engine, standby floats and sinkers etc.

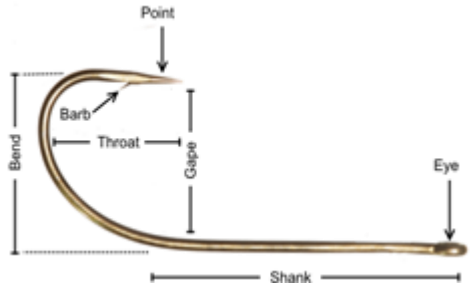
At the end of the machine room and the rest room the refrigerating chamber of the vessel is located. The chamber is in the shape of a cubicle that rises from the floor of the hold of the vessel with its upper rims touching the level of the deck. The entry to the refrigerating chamber is made through a rectangular opening which is covered with a movable wooden plank or lid. The length and breadth of the refrigerating chamber are respectively 1.5 meter and 2 meter whereas depth of the chamber is about 2.2 meter and the lid measures about 1 meter in length and 0.8 meter in breadth. This chamber is used to carry the ice slabs as well as to refrigerate the captured fishes during the expedition. The refrigerating chamber is insulated with varieties of materials. Thus, the outer walls of the chamber are made either of aluminium sheets or ply wood boards, whereas the inner walls of the chamber are

insulated with one layer of ply wood board and one layer of thermocol board respectively.

As one looks forward, toward the bow of the vessel one finds port and starboard on the left and right sides respectively. The inner margins of the port and starboard respectively of the vessel are used for hanging the hooks on their points.

6.4.3. Hooks and their Varieties:

The type of hook used by the persons associated with high sea fishing based on Digha is called barbed J-hook. This is primarily simple single hook. The hooks they use are made of aluminium coated iron. The barbed J-hook consists of different parts namely: eye, shank, bend, crook, barb and point. The following diagram exhibits a barbed J-hook and its parts.



The parts and sectors of a fish hook referred to above are as follows: it's point — the sharp end that penetrates the fish's mouth or flesh; the barb — the projection extending backwards from the point that secures the fish from unhooking; the eye — the end of the hook that is connected to the gangion; the bend and shank — the portion of the hook that connects the point and the eye; and the gap — the distance between the shank and the point.

The size of the hook used by the fishermen of Digha varies from 5/0 to 8/0. The size of the hook is determined by the length of the shank excluding the eye. It is to be mentioned in this context that in general the higher number indicates a smaller hook and vice versa. Usually No. 20 is the smallest size and hooks increase in size from No. 20 to No. 1, beyond which larger hooks are designated 1/0, 2/0 and so on, sometimes running up to 12/0.

The following table shows the correlation between different groups of the fishes, the range of weight of the group of fishes and the size of the fishing hook used for catching those fishes.

Table no. 6.3: The Correlation between Different Groups of the Fishes, the Range of Weight of the Group of Fishes and the Size of the Fishing Hook used for Catching those Fishes.

English name of the fishes	Available local name of the each variety of fish	Range of weight of the fishes (kg.)	Size of hooks
Engraved catfish	Tangra/Kanta/ Samudrik aar	2–12	5,6,7
Blacktip shark	Hangor	3-15	6,7,8
Asian Sea Bass	Bhetki	3-22	4,5,6,
Cowtail Sting Ray	Shankar maach	4-20	7,8
Bullet tuna	Mackerel	5-15	7,8
Big Eye Tuna	Tuna	4-30	7,8

6.4.4. Lines and their varieties:

It is observed that the persons associated with high sea fishing based on Digha employ an almost unlimited number of hooks (locally called *borshi kanta*) with a form of set line called the long line (locally called *cod daon*) operated in a more or less horizontal configuration. About 100 of hooks are fixed to a particular main line with a short line locally called '*pichon*' at Digha. There are various English words for short line which are namely: cast, branch line, snood, leader, dropper-line, drop-line or dropper, gangion or gangin etc. One end of each gangion is knotted with the eye of the respective hook and the other end is tied with the main line. The persons associated with high sea fishing based on Digha have reported that they have observed that some fish can bite a line in two, especially after swallowing the hook, which may have a short shank. To avoid this, in most cases they use hooks with longer shanks which are respectively fixed to the gangion. The spacing of the gangions is maintained in such a fashion that their distances from each other remain at least twice that of their length to avoid entangling. Moreover, the persons associated with high sea fishing based on Digha have noticed that the bottom long

lines with gangion set at larger spacing fish better than those with the branch lines set more closely together.

Fishing lines, either main or branch, used by the marine fishermen of Digha are of synthetic materials, especially transparent monofilaments of PA (polyamide) and twisted PE (polyethylene) which have high tensile strength as well as high specific gravity. However, material and linear density of the main line and branch line vary greatly according to the fishing conditions and target species. The marine fishermen make sure that the breaking strength of lines is high enough to cope with the weight of the fish to be caught to avoid losses by breaking. They also ensure that the lines are not excessively thick because this can decrease their efficiency in fishing. Neither should they be too fine for ease of handling. The thickness of the long line varies from 10 to 12 mm. and length of each long line used by the fishermen of Digha varies from 92 – 140 meter. Similarly, the thickness of the short line or gangion varies from 3 to 4 mm. and a fixed length of 1.2 meter is always maintained for each of the gangion. The branch lines or gangions are usually of equal length.

The marine fishermen of Digha use two types of long lines namely drift long line, bottom set long line. Drift long lines are operated close to surface or middle layers of the sea water for pelagic resources such as tunas, Indian mackerel, Spanish mackerel, pelagic sharks etc.; whereas, bottom set long lines are operated close to bottom for predatory demersal fishes such as sharks, groupers, snappers, cod, haddock, halibut.

6.4.5. Preparation of the hook and line:

During the beginning of the fishing season (i.e. 1st day of June as per Govt. Regulation) the already repaired vessel is worshiped in the morning of an auspicious day and the recruited members of the fishing unit except the vessel master/unit leader begin to stay and wait on the vessel for the forthcoming fishing expedition. During this period while vessel master remains busy in the harbour to collect ration, fuel, ice slab etc. required for the expedition, the other members of the unit remain busy on the vessel to make the lines and the hooks ready for fishing.

To make the hook and line ready for use the fishermen at the first stage knot one end of a particular gangion locally called *'pichon'*, with the eye of a particular hook. In this way altogether 2000 – 2500 hooks are prepared by the members of the unit. Now the members join hands to prepare a section or "set" of long line which measures about 140 – 150 meter in length with 90 – 100 branch lines each bearing one hook. For this they knot the bare end of each of the branch line or gangion with the mainline at an interval of 3 – 4.5 ft. depending on the size of hooks. The size of the hook is determined not only by the targeted fish but by the intervals to be allowed between two branch lines of a particular mainline. In this way, about 20 to 25 sections or 'set' of long lines are prepared for a particular fishing season.

6.4.6. Operation of the longlines:

When the ration, fuel, ice slabs etc. are loaded on the vessel and the hook and lines are made ready to use, then the vessel master announces the date of the voyage for fishing in high sea.

Before the voyage begins the vessel master worships on the spot near the bollard located at the stern end of the vessel. At first he smears the bollard with the thick mixture of vermilion and oil and then offers some sweets and basil leaf to the gods and goddesses and prays before them for safe voyage as well as good haul.

After about two hours of voyage the fishing unit enters such a zone of the sea where as per the guess and perception of the vessel master the depth of the water may be about 15.5 m. and above. After arriving in such a zone, the vessel master asks the engine operator of the vessel to stop and anchor the vessel. Then the master measures the depth of the water by plunging a lead and line. The line use for this purpose is approximately a 2 mm. thick nylon rope. The vessel master ensures so that the depth of the sea ranges from 15.5 – 48 meter since such depth is considered as conducive for hook and line fishing. However, apart from the depth of the water of the sea the vessel master also considers the colour of the water since as per his experience and perception both the depth and the colour of the water has simultaneous bearing upon the availability of desired kind and amount of fishes.

After selection of the location for fishing and considering the suitable time and calmness of the sea the vessel master asks the engine operator to slow down the speed of the vessel. Thereafter, he directs the other members of the fishing expedition to throw one end of a 'set' or section of a main line attached with a Grapnel-type iron anchor weighing about 3 kg. and the first marker buoy bearing the flag locally called *pataka* and a kerosene lamp locally called *tua.* Before throwing the lines into the sea water the hooks are kept baited with different type of fishes namely Bombay duck *(Harpadon nehereus),* Savalai hairtail *(Lepturacanthus savala),* John's snapper *(Sardinella gibbosa).*

The vessel master now directs the unit members to knot the other end of the said section of the long line with the tip of another set of long line. A float in the form of plastic jerrycan of 10 litre capacity and a Grapnel-type iron anchor are knotted in the joint of two sets of long line. In this way five to ten sets of main line joined together are thrown in the sea. Thus the sum total length of the joined sets of long lines becomes around 750 to 1500 meters. After throwing the entire connected sets of long line, its end (that is opposite to first marker buoy) is also attached with a Grapnel-type iron anchor and a float in the form of plastic jerrycan of 20 litre capacity. Thus the long lines remain in the sea water without any connection with the vessel and the team members wait on the deck of the vessel which floats near the end of the long line. After allowing a soak time of about 3 to 4 hours the joined set of main lines are hauled up by hand by the members of the fishing unit save the vessel master as well as the engine operator and fishes are removed as the branch line comes up.

6.4.7. Sorting and Storing of Fishes:

While some members of the fishing unit are engaged in hauling and removing the fish from the hooks the others members of the unit remain busy putting each variety of fish in separate area of the floor of the refrigerating chamber. Since the hook and line method is primarily employed to catch large sized fishes therefore, it is not possible to store them in plastic crates since their available size are not suitable to store large sized fishes.

CHAPTER – 7

SUMMARY AND CONCLUSION

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The present research is primarily an ethnographic account of the deep sea fishing with mechanized vessels and the corresponding fishing tackles found among the fishermen operating from the indigenous fish landing centre located at Digha under Kanthi subdivision of West Bengal, Kolkata. In this ethnographic account the present researcher has considered technological aspects of such fishing not only in terms of tools and material culture but also in terms of resources, tasks, skills, labors and activities related to the practice of high sea fishing with the mechanized vessels and corresponding tackles since as for Hunter and Whiten (1977) all these elements are considered to be attributes of technology.

The account presented in this thesis chiefly stands on exploratory research and, since this research deals with matters not agreeable to quantification, a qualitative approach has been adopted.

In this thesis an attempt has been made to present some baseline empirical information on the organizational aspects, knowledge of the environment and different technology. of high sea fishing with mechanized vessels and corresponding fishing tackles. The domain of the present study includes the technological aspects of Trawl Net Fishing, Gill Net Fishing as well as Hook and Line Fishing in high sea with the help of mechanized vessels of different engine capacity.

The account presented in the present thesis suggests that the material culture associated with the deep sea fishing with the mechanized vessels and corresponding fishing tackles is dominated primarily by the use of industrial products. These products include but not limited to the engine of the vessel; electronic items like GPS, sonar, television set, radio, wireless phone; nets made of different varieties of synthetic nylon or plastic threads; synthetic ropes and twines of different diameters mostly made of

polyethylene, polypropylene or polyamide (nylon) etc.; floats made of plastic ball and polyethylene jerrycan; storing crates and barrels made of polyethylene; thermocol and plywood sheets for insulation of refrigerating chamber on the vessel; iron made grapnel anchor, twines, ropes, chains, mechanized winch, drum, pulley etc.; gas cylinder and oven;

However, it is observed that although the material culture of high sea fishing under discussion is dominated by the items produced in the factory or industry, it is observed that there is simultaneous presence of a number of indigenously produced items in the material culture of such fishing. These items include but not limited to the terracotta wheel used as sinkers, portable earthen oven used for cooking, mortar of flat stone and cylindrical stone pestle used for grinding spices; kerosene lamp fitted on buoy.

It is found that every high sea fishing unit operating from the fish landing centre at Digha is equipped with a variety of modern electronic gadgets, as mentioned in the earlier paragraphs, to acquire information on weather condition, sequence of tide and ebb, depth of the sea, volume of the school of fishes etc. However, despite being equipped with such electronic gadgets every high fishing unit is primarily hinged on the skill and experience of a particular person locally called *majhi*. It is found that a *majhi* by virtue of his skill in different spheres of high sea fishing not only acts as vessel master but also the ultimate or sole authority during every high sea fishing expedition with mechanized vessel and corresponding fishing tackles. The role or function of the majhi or vessel master is manifold which are described in the following paragraphs.

An owner of the high sea fishing unit assigns the vessel master to select the members of the unit for sailing in the sea for fishing expedition. A vessel master is exclusively responsible for scheduling the date and time of the journey as well as duration of each fishing expedition. Moreover, during each fishing expedition he is the sole authority to steer the vessel, direct the engine driver about the necessary control of

speed of the vessel, select the fishing spot and tackles, schedule the time for setting (putting out) and hauling (taking in) the nets, hooks etc.

A vessel master possesses abundant information on the variation of sizes and behaviour of a good number of species of fishes. He has also acquired very good knowledge on the seasonal migratory habit, spawning period and habitat of a good number of a species of fishes. Therefore, he uses the types of net and corresponding mesh size of the net in accordance with the habits and habitats of the different type of fishes. His techniques of setting and hauling of a particular type of net vary in accordance with the type, habit and habitats of the fishes. Same variation of technique is also observed in case of hook and line fishing. A vessel master not only classifies the fishes on the basis of their habitat but he also designates a good number of species of the fishes by local names.

A vessel master has acquired through his experience knowledge of cosmology and climatic condition which guides him greatly during high sea fishing expedition. It has been demonstrated earlier that vessel master of a given high sea fishing unit employ the technique of fishing according to the occurrence of wind, current, waves, tides and phases of the moon. It is found that vessel master classifies the winds into different kinds and possesses detailed knowledge about them for on a particular day, month and season. A vessel master correlates the availability of a particular species of fish with a particular wind. A vessel master also classifies the colour of the sea water and correlates the colour with the availability of particular varieties of fishes.

It is observed that the profession of high sea fishing with mechanized vessel and corresponding tackles is not limited to various fishing castes that have hereditary and prolonged association with the occupation of fishing across the inland and marine water. On the contrary, a good number of persons across different castes and religion without any hereditary and prolonged association with fishing activities have resorted

to the profession of high sea fishing with mechanized vessel and corresponding fishing tackles to eke out their living.

It is found that although no caste barrier prevails in the case of the formation of the high sea fishing unit, preference of religion exists behind the formation of such unit. It has also transpired from the present research that the owner of a high sea fishing unit always prefers to recruit the ground manager of the unit from among his own close relatives. The owner also prefers to recruit the members from among his neighbors who have already gained some skill and experience.

It is found that norms of cooperation exist both within and between the fishing units during fishing expedition. It is observed that the members of the fishing unit develop into a moral community within a congenial cultural atmosphere during the expedition away from the shore. With observation of daily rituals and some other entertainments like watching television, listening to songs on radio and mobile phone, playing card etc. life in the fishing vessel during high sea fishing expedition become meaningful to the unit members while they are away from the shore as well as residence.

It is observed that shared units operate free of pressure whereas salaried unit operates strictly under the authoritative supervision of the investor for maximizing profit. However, members of both the shared and salaried units are not able to free themselves from exploitation on account of their dependence upon their unit owners for loans and advances during off seasons and life crises. Moreover, they are least willing to terminate their existing economic relationship with their respective unit owner since working atmosphere under new owner is always a matter of uncertainty.

It appears from the account provided in the foregoing chapters that a fishing unit during deep sea fishing expedition with trawl and mechanized vessel develops a symbiotic relationship with other groups who, with their engine-driven indigenous

boat, move from one trawler to another for collecting the non-edible fishes even in decomposed condition in lieu of cash. This relationship on the one hand enables the persons engaged in high sea fishing with trawler to make additional earning apart from their salary and help on the other hand the buyer of the non-edible fishes to eke out their living by way of selling the same to different manufactures of poultry food in lieu of cash.

With regard to the technology of gill net fishing it is revealed that any type of shrimps or fishes and other aquatic animals of small size are not enmeshed in the gill net. On the contrary, comparatively larger variety of fishes and other aquatic animals are captured with the help of gill net. Therefore, it may be said that the use of gill net for deep sea fishing entails loss of marine biodiversity. However, it was found that during the fishing expedition with gill net sometimes the captured fishes and aquatic animals of comparatively smaller sizes were thrown back into the sea water to accommodate subsequently captured larger varieties owing to the shortage of storing crate.

The account of the technology of hook and line fishing has revealed that the passive method of fishing with hook and line is considered by the local people as the less expensive since much less amount of capital is required for the simple but effective gear and a vessel used for this method of fishing, compared to trawling and gillnetting with mechanized vessel. Moreover, the method of fishing with hook and line is fuel efficient since no continuous voyage is required during the immersion of the hooks and lines. The account of hook and line fishing further suggests that there is lesser loss of marine biodiversity due to hook and line fishing since this method is useful to catch the fishes of large size only and thus the small size fishes and other aquatic animals of countless varieties as well as shrimps, crabs and molluscs etc. are spared.

It is revealed from the study on technology associated with different types of high sea fishing that marine fishery based on the fish landing centre at Digha is

responsible for environmental pollution in general and marine pollution in particular. The factors responsible for such kind of pollutions are enumerated below:

i. Random killing of gravid fishes as well as small sizes of fishes by way of violating the restrictions imposed by the concern department of the Government on the size of meshes of different varieties of nets causes the loss of biodiversity.

ii. Mushrooming of stake holders in high sea fishing creating the demand for different marine fauna which in turn is also affecting marine biodiversity.

iii. A good amount of fishes of small sizes are thrown in the sea water owing to the shortage of storing crates.

iv. A good amount of captured non-edible fishes decomposed owing to non-availability of itinerant customer are thrown in the sea water.

v. The spillage of fuel and emission of smoke from the fishing vessels.

vi. A good amount of human excreta is going down to the sea water owing to the participation of a good number of persons for high sea fishing expedition.

Finally, it is observed that although there is a Fishermen's Co-operative Society functioning at the fish landing centre of Digha but this society is almost playing no role in combating exploitation of the unit members by their respective owners. It is also observed that the said society is almost silent with regard to the pollution caused by the high sea fishing with mechanized vessels and corresponding tackles. Therefore, the present author is tempted to state that there is necessity of more active intervention in these spheres by the concerned departments of the State as well as the Central Government.

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APPENDICES

Collection of Fuel for the Vessel.

Ice Crashed on the Deck of the Vessel to Carry for Refrigeration during High Sea Fishing.

Preparation of nets for use during High Sea Fishing.

A Gill Net attached with Wheel-shaped Terracotta Sinkers.

A Vessel used for Hook and Line Fishing.

Kerosene Lamps (tuya) used on the Buoy during High Sea Fishing.

Engine Driver ready for Voyage.

A Trawler on the move for High Sea Fishing.

Waiting for the Selection of Fishing Site.

Fishermen final Preparation of the Trawl Net for Setting in the High Sea.

Fishermen in Relaxed Mood after Setting the Net with the Help of Winch.

The Haul Lifted on the Deck of the Vessel.

Sorting of the Fishes as per Species.

Fishes Placed in the Plastic Crate for Storing in the Vessel.

Fishermen Carrying the Crate of Fishes under the Layer of Pieces of Ices into the Preservation Chamber.

Fishermen Arranging the Crates of Fishes within the Preservation Chamber of the Vessel.

A Portion of Haul Suitable to Consume as Dry Fish is Spread Under the Sun on the Roof of the Engine of Trawler.

Heap of Non-edible Fishes Collected by an Itinerant Trader from Different Vessels Engaged in High Sea Fishing Expedition.

The Laborer using Different Mode of Transport to Carry the Haul from Vessel to the Auction Centre on the Shore.

Use of Indigenous Balance in an Fish Auction shop at Fish Landing Centre of Digha.

Huge number of Baby Shark Heaped in a Fish Auction Shop at Digha: An Example of Random Killing of Marine Fauna.

Huge number of Baby String Ray Heaped in a Fish Auction Shop at Digha: Another Example of Random Killing of Marine Fauna.

Rest Room in a Fishing Trawler Operating from Digha.

Kitchen of a Fishing Vessel Operating from Digha.

Morning Tea during the Fishing Expedition in High Sea.

A Fisherman Taking His Lunch during High Sea Fishing Expedition.

A Trawler Master Sending Message by Wireless to the Master of other Trawler during High Sea Fishing.

Myself with Some of the Voyagers during a High Sea Fishing Expedition.

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Technological Aspects of Deep Sea Fishing with Mechanised Trawler : A Study among the Digha Based Marine Fisher Folk

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Abstract: A good number of anthropological studies have been carried out on the techno - economic as well as socio-cultural aspects of both the marine and inland fishing. However, most of these studies were centered on indigenous methods and techniques of fishing with the traditional equipments some time unique to different ethnic groups. Therefore, the present paper aims to highlight on the methods and techniques of deep sea fishing with the help of motorized vessel and the trawl found among the fishermen operating from Digha fishing harbor of West Bengal, India. While dealing with the methods and techniques associated with the deep sea fishing with mechanized trawler, the authors have not only considered tools and material culture related to it but also resources, tasks, skills, labors and activities associated with such fishing since all these elements are considered as attributes of technology.

Key words : Techno-economic , Fishing, Indigenous method, Mechanized Trawler, Trawl, Digha, Labour.

INTRODUCTION

Fishing with nets can be traced back to Mesolithic period. There are good numbers of anthropological study on the techno- economic and socio-cultural aspects of fishing. The authors whose name deserve special mention in this regard are: Coker (1908), Malinowski (1918), Hornell (1924), Moses(1929), Hocart (1937), Osgood (1940), Firth (1946), Puneker (1959), Edward (1960), Foster (1960), Frazer Junior's (1962), Lebar (1964), Ward's (1958, 1960, 1965), Ahmed (1966), Trivedi (1967) Raychaudhuri (1980) etc. Most of these studies were primarily centered on different aspects of technology and social organization of traditional way of fishing with the help of traditional equipments like bow and arrow, barbed harpoons, spears, box traps with or without valve, nets made of cotton or fiber, boats, canoes with or without outrigger etc. But these researches did not reflect anything about deep sea fishing with mechanized boat or trawler. However, in recent past a number of scholars have conducted research on different aspects of deep sea fishing with mechanized trawler. The authors whose name deserve special mention in this regard are: Bridger (1970), Kurien (1978), Menon (1980), Sathiadas (1981, 1982), Ardizzone and Pelusi (1983), Balakrishnan and Alagaraja (1984), Estrella (1989), Auster (1998), Ammini (1999), Barnette (1999), Chennubhotla (1999), Fonteyne (2000) etc.

In the above background the present paper aims to highlight the methods and techniques of deep sea fishing with mechanized trawler found among the fishermen operating from the fishing harbor of Digha under Purba Medinipur district of West Bengal, India. While dealing with the methods and techniques of deep sea fishing with mechanized trawler, the authors have not only considered tools and material culture related with it but also has dealt with the resources, tasks, skills, labors and activities associated with such deep sea fishing since all these elements are considered as attributes of technology (Hunter and White, 1977).

MATERIALS AND METHODS

For the purpose of the present study a traditional marine fishing harbor was selected which is located at Digha, West Bengal on the shore of the confluence of a river locally called Champa and Bay of Bengal. This harbor is managed by a committee known as 'Digha Fishermen and Fish Traders Association' formed by the owners of the mechanized vessels. From the record of the office of this association it was found that there are about 1000 mechanized vessels of different varieties — in terms of engine capacities as well as crafts and gears – operating from this harbor. It was also revealed from the record that the different types of vessels are used for marine fishing in different methods. The following table shows the distribution of the vessel types operating from Digha fishing harbor along with their association with the fishing apparatus as well as methods and area of fishing.

Type of Vessels	Number	Apparatus	Method and area of operation
Trawler	550	Trawl	Trawling in Deep Sea
Fishing body	300	Gill net	Gillnetting in Deep Sea
Bhut Bhuti	150	Line and hook	Trolling comparatively nearer to the coast.
Total	1000		

Trawling is a process for catching the fishes. The net used for catching the fishes is termed as 'trawl' and the boats which are used for trawling operation are called trawlers. However, in the present paper the term trawler has only been used for those vessels which are not only mechanized but also of considerable size and equipped with store room, living room, mechanized winch etc.

Since deep sea fishing with different types of mechanized vessels has some distinctiveness of their own in terms of the characteristics of the vessels, association of the particular types of fishing apparatus with the vessel type, method and area of fishing etc. However, due to various limitations the present paper will be confined to the discussions on different aspects of deep sea trawling with mechanized trawler.

The data on technological aspects of marine fishing with mechanized trawlers were collected from the fishermen associated with the particular vessel.

It is already mentioned that the data related to numbers and types of vessels were collected from the archival record. However, data on method of operating of nets and area covered for marine fishing by the fisherfolk with the help of mechanized trawler was collected by following various anthropological methods and techniques. These include participation observation, focus group discussion, interview technique etc. For the purpose of participation observation the first author of the present article went in a number of more than week long marine fishing expeditions carried out by a particular mechanized trawler. Before joining in such expeditions the first author of this article made a life insurance as pre-condition laid down by the local office of the Fishery Department of the Govt. West Bengal.

RESULT

Technological aspects of Deep Sea fishing with mechanized trawler

Seasons of Marine Fishing with Mechanized Trawler

Usually duration of a particular deep sea fishing expedition varies according to the size and engine capacity of the trawler and the availability of fishes. The duration of expedition also varies according to the climate and weather since these two factors have a close relation with the availability of fish. Thus, we find that the length of fishing expedition during monsoon is shorter not because of the rough sea but owing to the fact that during this season large volumes of fishes are frequently available. As a result even an expedition of shorter duration during monsoon may be sufficient to get the desired amount of fish in terms of volume and weight. From the post-monsoon period the duration of the fishing expedition gradually increases and it reaches its pick during winter since during the winter it becomes necessary to cover more distant area of the sea because the schools of fishes are rarely available in the area closer to the shore. Moreover, during the winter the size of the school of fishes become smaller in volume, therefore the fishermen are always in search of more number of school of fishes to make their expedition economically viable. However, the fishing expedition during the summer becomes very infrequent due to the scorching sun and even then such expedition takes longer days compared to rainy season due to lesser availability of fishes in the areas near to the shore.

Size and engine capacity of the trawler

The vessels which are used to catch fish by way of pulling the net or trawl through the water behind them is locally called trawler. The body of the trawler is usually made of wood and its length varies from 45 to 60 ft. The breadth of the trawler varies from 15 to 24 ft and the height of trawler varies from 18 to 24 ft. This height is considered from the base of the vessel to the roof of the engine room. The engine capacity of the trawlers varies according to the size of vessels.

Thus it is found that engine capacity varies from 20 hp to over 10,000 hp engines.

Space utilization within the Trawler

The front portion of the trawler is locally called *'ahnwik'* since a spot on this end is used as the venue for daily worship of different deities with the prayer for the good catch during the expedition. The back end of the vessel is locally called *'pacha'* (Bengali equivalent of human buttock) which may be considered as an expression of anthropomorphism. The nets are rolled and heaped on the backyard portion of the deck of the vessels.

The bridge of the vessel is locally called steering room since the rudder of the vessel is steered from this room. However, different electronic gadgets like in-built GPS, fish finder, wireless etc. are also installed in the bridge or steering room.

The machine room is located just below the floor of the steering room. In this room the engine of the vessel is installed. However the machine room is also used to store the standby nets, floats (plastic ball), iron chain (used as sinker) etc.

The store room is located on the backside of the vessel and this room is used not only for storing the daily haul but also for keeping the slabs of ice necessary for preservation of the fish.

A room for the rotational rest of the fishermen is located adjacent to the steering room. This room is furnished with open-wardrobe, mattress, video set, music system and a place of worship.

A covered place by the side of the rest room is used as kitchen. The kitchen is equipped with cooking gas cylinder and oven, crockery, stone mortar and pestle, chopper, knife, plastic boxes for spices etc. Moreover, several big plastic drums filled with sum total of about 3000 liters sweet water used only for drinking and cooking are also stored in the kitchen. The kitchen is also used to store the ration required during the fishing expedition. The amount of ration varies according to preplanned duration of the expedition. The ration includes rice, lentils and pulses, spices, mustered oil, limited quantity of vegetables (primarily pumpkin, potato, onion and garlic, lemon etc.). Apart from these the ration also includes betel leaf and nut, first aid medicines including digestive and anti-nausea tablets and pain killers etc.

The open deck by the side of the kitchen is used for keeping plastic barrels full of diesel. The floor of the deck is made of wood and the surface is convex in nature so that water cannot accumulate on it. Usually a barrel contains 600 liters of diesel and the number of barrels varies according to the duration of the fishing expedition.

The number of plastic crates carried to store the haul varies from 250 to 300. Each crate has the capacity to store 25 to 30 kg of haul. The empty crates are usually preserved on the roof of the steering room and rest room.

Inbuilt Electronics Gadgets

A trawler always bear an in-built 'Global Positioning System' (here after GPS) and a 'Fish finder'. The GPS is used to detect the location of the vessels in the sea whereas; a fish finder is used to obtain the depth of the sea, underwater physical and biological components. Fish finder is also helpful to evaluate fish biomass and their spatial distribution in a particular location within the sea water.

Preparation of the Net for Fishing

The trawl or net which are used for catching fish in deep sea by way of pulling with the help of trawler are made of nylon thread and conical in shape. Although both ends of the net are open but during the use of a particular net for fishing the fishermen close the tapering end by knotting it tightly with the help of nylon ropes. The length of the net varies from 100-150 ft whereas; diameter of the mouth or rim of the net varies from 25-30 ft. The size of the meshes of the trawls varies according to the size of the fish targeted to be hauled. The nets used by the fishermen of Digha are in most cases machine woven and usually procured by the respective owner of the trawler from the daily markets of Digha or Kanthi town of East Medinipur district of West Bengal.

A heavy iron chain attached to one half of the circumference of the mouth or opening of the net makes this part of the net to sink properly so that it touches the floor of the sea. Remaining half of the circumference of the mouth of the net is allowed to remain afloat on the water level with the help of heavy plastic balls fitted at regular interval of 2-3 ft. The sinkers and the float help to facilitate the proper opening of the mouth of the net during trawling.

After the floats and sinkers are fitted with the rim of the net, a long and heavy nylon rope is used to connect two ends of the net which is used to drag the net out of the water on to the deck of the trawler after the trawling is over.

In the same methods discussed above the fishermen on the boat keep ready 5 to 6 nets of different size of meshes simultaneously for the purpose of catching fish of different sizes. The selection and/or operation of a particular variety of net in terms of the size of the mesh is determined by the size of fish likely to be found. The nets are prepared for operation during the beginning of the fishing session while the trawlers are anchored in the harbor. Each net prepared in the fashion described above are wound up around a piece of bamboo respectively.

On the onset of using a particular net for fishing two nylon ropes of about 30 ft. long are tied separately to the meeting point of the iron chain/sinker and the series of interconnected floats of heavy plastic ball, on either end of the radius of the rim. The ropes are locally called *kachhi.*

The other ends of these ropes are knotted with two corresponding 'water board' which are permanently connected with the ends of two iron ropes wound up around in two separate drums of the winch. These iron ropes are released

mechanically with the help of the winch that is installed on the backside of the deck of the trawler. In fact, the new net is connected and the used net is disconnected from the same iron triangle of the 'water board' during fishing operation.

The Water board is a 5 ft. × 7ft. rectangular wooden plank. An iron tape of about one inch wide is used to cover all the four borders of the plank for protecting it against erosion. Two iron tapes of about 1.5 to 2 inch width run vertically and horizontally across both the upper and lower surface of each plank. At the central meeting point of the two tapes of the respective plank a heavy triangle made of iron rod is tightly fitted with an iron hook. A heavy plastic ball is attached to the triangle fitted to each water board so that they remain submersible while the net is under operation. The triangles of the water boards are used to knot the ends of the nylon rope tied to either side of the mouth of the net. The triangles are also used for welding the ends of the iron ropes wound around respective drums of the winch. As a matter of fact the triangle on the water board serves as the meeting point of the nylon ropes of the net and the iron ropes of the winch respectively. However, the nylon ropes of the nets are temporarily knotted/tied with the water board only during the use of a particular net whereas, iron ropes of the winch are permanently fixed with the water board by way of welding them with the iron triangle of the board. During the time of welding the iron ropes are passed through two corresponding pulleys to facilitate smooth release of the iron ropes. It to be mentioned that whenever the replacement of a net is necessary it is only detached from the water board but the iron ropes of the winch are not detached anytime during such replacement since they are permanently fixed with the iron triangle of the respective water board by way of welding. A net is released in the sea water with the help of these iron ropes.

When a particular net is selected for fishing it is first unwound from the bamboo and then heaped on the floor of the deck in such a fashion so that the tapering end of the net locally called *'kandhha'* remains on the top of the mound.

Casting of Net beneath the water

At the first stage the trawler master (locally called *majhi*) selects a particular location or area of the sea where there is abundance of fish as per the perceptions of *majhi* based on his experience and skill. He usually selects the area for fishing on the basis of the color of the water of sea. It is perceived by him that type and quantity of fishes has bearing upon the color of the water. After selecting such location *majhi* slows down the speed of the trawler and asks the other fishermen including the engine driver (locally called *driver*) to cast the net. The fishermen after connecting the net with the 'water board' begin to throw the net from its tapered end slowly into the water. During the throwing of net the trawler moves in a minimum speed to facilitate proper opening of the mouth of the net. When the entire net opens properly under the

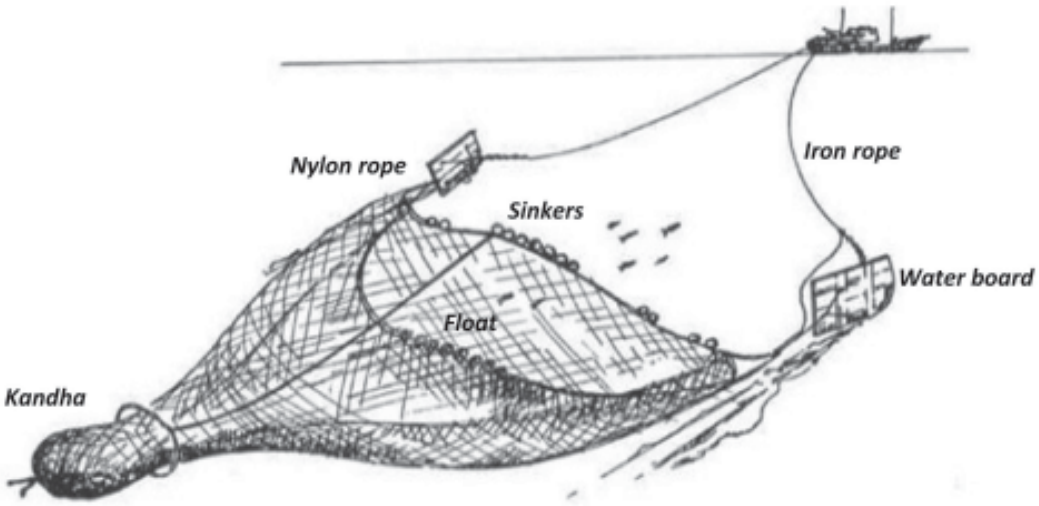
water then the *driver* starts to release the iron ropes wound up around two drums of the winch with their respective ends welded with each of the two iron triangle fixed on the water boards. Since both the drums of iron rope are operated mechanically by a common winch, equal lengths of ropes are released simultaneously. After the desired lengths of both the iron ropes are released under water the drum of the rope are locked. The length of the iron ropes to be released under water from the respective drum is exclusively decided by the *majhi*.

For estimating the length of ropes released in the water, the entire length of each of the iron rope wound up around each drum is punctuated with markers (made of colored twine) placed at regular interval of about 6 ft. The gap between the two markers is locally called *baam* by the fishermen. The *majhi* estimates the length of the released iron rope in terms of number of *baam* of the rope gone under water.

The length to be released depends on the size of the meshes of a particular net under use as well as the strata of the sea water selected for fishing. Thus, for the purpose of demersal fishing the length of the iron ropes are released to such an extent that the sinker of the net can touch the sea bed, since the demersal fishes usually live and feed on the bottom of the sea and for this reason they are also known as 'bottom feeders' or 'ground fish'. Demersal fishing is usually practiced during the winter when the sea remains comparatively calm and size of the waves is significantly small. The fishermen consider this kind of environment as conducive for immersing the net smoothly on the sea bed. The nets with small size of meshes are used for demersal fishing.

Similarly, for trawling the pelagic fishes or 'column feeders' the *majhi* releases lesser length of iron rope to immerse the net into the water since these varieties of fishes usually live and feed in the mesopelagic (depth varies from water surface to 650 ft.) and bathypelagic (depth varies from end of mesopelagic to 3300 ft.) zone of the sea water. Examples of larger pelagic fishes are tuna, oceanic sharks, mackerel etc. The nets with comparatively larger sizes of meshes are used for catching column feeders. The fishermen of Digha consider rainy season to be the best for trawling pelagic fishes since they are found in abundance in the sea during monsoon.

After the net is properly immersed and spread under water the *majhi* accelerates the speed of the trawler and after reaching a suitable speed he fixes the accelerator as well as the steering connected with the rudder of the trawler. In this condition the trawler pulls the trawl spread under the sea for about 2 to 3 hours and at one stage the *majhi*, by his skill and experience, realizes that the trawler has become slow even in the state of its locked accelerator owing to the pull from its back caused by the weight of the captured fishes. On the basis of such observation the *majhi* unlocks the accelerator as well as steering of the trawler and slows down its speed. Thereafter, he directs the *driver* to pull the net with the help of winch. When the iron ropes along



with two water boards are taken out of the sea then the boards are respectively tied with two heavy iron poles called *gyalo khuti.* However, the net with the captured fish yet remains under the water. In this state the *majhi* drives the trawler very slowly for 2 to 3 minutes so that all the fishes trapped in different meshes of the net are deposited in its tapering end.

Lifting of net from the sea

Then the other fishermen of the expedition team lift most part of the net on the deck of the trawler. However, the tapering end of the net or *kandhha* filled with fishes is allowed to remain under water and this portion is separated by a tight knot of nylon rope from the upper portion of the net that has already been heaped on the deck of the trawler. Thereafter, the knot is clasped with an iron hook tied at the end of a nylon rope. The terminal end of this nylon rope runs through a pulley and knotted with the end of one of the iron rope wound up around a drum of the mechanically operated winch. The pulley (locally called *kafia*) is fixed at the tip of a heavy vertical iron pole of about 20 ft. height. During the idle time the hook along with nylon rope passing through the pulley is wound up around the iron pole.

After connecting the hook with the winch via pulley the *majhi* accelerates the speed of the trawler and runs for about 2 to 3 minutes and in this way the sands and mud deposited on the body of the fishes are washed. Thereafter, the speed of the trawler is lowered down and the knotted tapering end of the net packed with fishes is pulled from the water on the deck of the trawler with the help winch and remains hanging from the pulley. In this hanging state the mouth of the tapering end, which was closed by a tight knot before its use, is opened and all the fishes from the net are released on the floor of the deck and form a heap. Thereafter, fishes are further washed by way of showering buckets of water lifted manually from the sea.

Sorting and Storing of Fishes

Then the fishermen sit around the heap of fishes and sort out the fishes according to the species/types. During the sorting species of some fishes are rejected and then separated and collected in rectangular plastic crates since those fishes are not considered as edible variety. Other fishes sorted as per species/types are collected in different large plastic crate of rectangular shape which measure about 3ft in length, 1.5 ft in width and with a depth of about 1.5ft. Each crate has the capacity to contain about 25 – 30 kg of fishes.

After the sorting is over on the deck, the fishermen pack them variety wise in different crates for the purpose of storing. The fishes are packed by making alternate layers/strata of small pieces of ice followed by those of fishes. However, the lowest and the topmost layers/strata of a packed crate are always made of small pieces of ice. After packing in this manner the crates are placed in the designated store room of the trawler. Thereafter, the crates containing the discarded fishes are placed over the roof of the bridge of the trawler. These fishes are sold at the earliest opportunity to the itinerant traders of the sea who visit the trawler in the sea in their motorized large boat. They collect the rejected fishes even in rotting condition for supplying in lieu of cash to different poultry food manufacturers. However, the trawler master does not allow the rejected fishes to be carried for more than two days because of the requirement of the crates for packing the recurring catch on the one hand and to protect the members of the expedition from the ill-smell of the rotten fish on the other. It is pertinent to mention that the money earned out of selling rejected fishes during expedition is equally shared among the members of the unit and the owner of the trawler who is also the investor of the expedition never claims any share out of such earning.

Division of Labour

'Matsyajibi' (or fisherman) is the common term used for all the members of fishing unit who go for marine fishing in either mechanized or non-mechanized vessels. The fishermen engaged in deep sea fishing with mechanized trawler are all employed by the owner of the vessel. The employment is offered on one year contract. The division of labour found among the unit members is as follows: A person is appointed as the trawler master of the expedition team locally called *majhi* and he receives highest payment among all the unit members. He not only steers the vessel and controls its speed but also is the authority to take decision on such matters as duration of a fishing expedition, selection of the particular locations for casting and pulling the net, use of the type of net in terms of their size of the meshes, duration of pulling the net etc. Apart from these, *majhi* also serves as the principal priest for daily worship on the vessel during fishing expedition.

Similarly, a person among the team, locally called *driver,* is assigned to drive the engine and the mechanized winch of the motorized trawler. He is also responsible for maintenance of the engine and other machinery of the

trawler. However, in case of exigency the *driver* also takes part in sorting and storing of fish during expedition.

Another person of the unit/ team is assigned the duty of cooking the food for the members of the unit during fishing expedition. However, apart from cooking he has also the obligation to participate in other works related to catching, sorting and storing of the fish.

The other members of unit are exclusively responsible for casting and lifting net, sorting and storing of fish during the deep sea fishing expedition.

CONCLUSION

The account presented in the foregoing paragraphs is based on exploratory research. In this research an attempt has been made to collect some baseline empirical information on different aspects of technology associated with deep sea fishing with mechanized trawler found among the fisherman operating from the fishing harbor of Digha, West Bengal. Above account suggests that the material culture on the trawler fishing is centered on predominantly industrial products and although the fisher men have access to a variety of modern electronic gadgets to find out the depth of the sea or the volume of the school of fishes, yet they depend more upon the indigenous knowledge and skill of a particular person called *majhi.* For such knowledge and skill *majhi* is considered as the final authority with regard to the selection of the area of the sea for trawling, selection of a particular type of net in terms of its size of meshes, duration of trawling in a particular attempt at fishing as well as the duration of a particular voyage /expedition for fishing.

It appears from the account described in earlier paragraphs that a fishing unit during deep sea fishing expedition with mechanized trawler develops a symbiotic relationship with other groups who with their engine driven indigenous boat move from one trawler to another for collecting rejected and some time rotten fishes against payment of cash. This relationship on the one hand provides scope to the fishermen of the trawler for their extra-earning whereas, on the other hand, the collectors of the rejected fishes eke out their living by way of supplying the same in lieu of cash to the different manufactures of poultry food.

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Hook and Line Fishing with Motorised Boat: A study among the Digha harbour based fishermen

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Abstract:

Use of hook and line fishing tackles may be traced back to the Upper Palaeolithic culture of prehistoric period. This traditional method of fishing, with the addition and alteration of different types of associated gears, is continuing till today and considered as one of the economically viable fishing techniques to exploit large pelagic, column, and demersal predator fishes like Tuna, Shark, String Ray, Mackerel, Cat fishes, Rock cods etc. The present paper aims to highlight the existing form of deep sea fishing with hook and line found among the fishermen operating from the indigenous fishing harbour of Digha coast of Bay of Bengal in Purba Medinipur district of West Bengal. While dealing with the existing form of hook and line fishing, the authors have primarily concentrated on the division of labour associated with this kind of deep sea fishing, method of manipulation of hook and line, salient features of different fishing gears such as hook, line, float, anchor, buoy, boat etc. associated with hook and line fishing practiced by the marine fisherfolk of Digha.

Key words: Digha Fishing Harbour, Deep sea fishing, Predator fishes, Hook and line, Division of labour.

Introduction:

Use of hook and line fishing tackles may be traced back to Prehistoric period and evidences suggest that both the human races of Upper Palaeolithic and Mesolithic period used fish hooks made of different material like bone and shell (Clark, 1948 and Corbyn, 2011). Archaeologists in the Jerimalai cave in East Timor, Indonesia discovered in 2011 the world's oldest fish hook, a shell hook between 16,000 and 23,000 years old (Corbyn, 2011).

From the prehistoric period to the present day, fish hooks have been crafted from all sorts of materials including wood, animal and human bone, horn, shells, stone, bronze, iron. In many cases, hooks were created from multiple materials to leverage the strength and positive characteristics of each material (ibid, 2011). This traditional method of fishing with the addition and alteration of different types of associated gears, is continuing till today and considered as one of the economically viable fishing techniques to exploit large pelagic, column, and demersal predator fishes like Tuna, Shark, String Ray, Mackerel, Cat fishes, Rock cods etc. Today, hook and line fishing with mechanised vessel is considered as highly fuel efficient, eco-friendly and size and species specific (Hameed and Boopendranath, 2000).

Hook and line gear can be further classified on the basis of their usage. There are four common methods for using hook and line gear: trolling, long lining, jigging, as well as pole and line fishing.

Trolling lines are lines with baited hooks that are dragged behind mechanized vessel, as well as other types of vessels.

Longlines can be classified by how they are used for fishing and thus there are (a) Set longlines which are stationary lines anchored to the vessel, the seafloor or to an anchored buoy; (b) Drift longlines which are attached to floats that drift freely with the ocean currents. All longlines consist of a main line, which may be even more than one kilometer in length, with short lengths of hooked lines (called gangions) spaced evenly along the main line.

Jigger lines are a specialized type of vertical line, fitted with specialized ripped hooks, used primarily in the southern hemisphere Squid fisheries and some northern Cod fisheries.

Pole and line gear consists of a hook and line attached to a pole. If the line is much longer than the rod it is wound around a reel or moulinet. Poles are commonly made out of wood or fiberglass and can be operated either mechanically or by hand.

In India, total amount of marine fish catch by hook and line method constitutes about two percent of the total amount of marine fish captured by different methods like Trawling, Gill netting etc (Marine Fishery Survey, 2014). The studies on different types of the hook and line fishing such as set longline and drift longline, hand line, pole and line etc. of coastal Indian waters by mechanised and non mechanised vessels were attempted by several writers like Luther (1982), Gopakumar (1986), Lal Mohan & Nandakumar (1988), Menon (1989), Sukumaran (1989), Grace Mathew & Venugopalan (1990), Jayasankar (1990), Rao (2010), Akhilesh (2009), Gabriel (2005), Hameed and Boopendranath (2000), Mathai (2009), Sainsbury (1971) and others. However, these studies were more concerned about the fishing gears and productivity associated with hook and line fishing in deep sea either with non-mechanized or mechanized vessels. And traversing these studies one may also be tempted to state that they did not sufficiently deal with the composition of the fishing units, features of the vessels, method of manipulation, storing system during fishing expedition, division of labor, indigenously innovated gears etc. associated with hook and line fishing in deep sea. Moreover, a very few of the studies mentioned above are based on a particular locality or fishing harbor from where the fishermen proceed for hook and line fishing in high sea.

The scenario presented in the preceding paragraphs tempted the present authors to highlight the methods and techniques of longlining category of hook and line fishing in deep sea with the help of mechanized vessel practiced by the fishermen operating from the fishing harbour of Digha on the coast of the Bay of Bengal in Purba Medinipur district of West Bengal, India. However, methods and techniques not only include the material culture of hook and line fishing but also include the resources, tasks, skills, labours and activities associated with such deep sea fishing since all these elements are considered as attributes of technology (Hunter and White, 1977). Stationary

Materials and Methods of Study

For the purpose of the present study, an indigenously established and developed fishing harbor has been selected. This harbour is located near the confluence of Champa River and Bay of Bengal near Digha coastal town in the Purba Medinipur district of West Bengal. The harbor is managed by a committee known as 'Digha Fishermen and Fish Traders Association' formed by the owners of the mechanized vessels. From the record of the office of this association it is found that there are about 1100 mechanized vessels of different varieties — in terms of engine capacities as well as crafts and gears – operating from this harbour (Souvenir of Annual Gangotsab, 2016). It is also evident from the record that the different types of vessels are used for different methods of marine fishing. The following table shows the distribution of the vessel types operating from Digha fishing harbor and their correlation with fishing apparatus, methods of fishing and areas of fishing within the sea.

Type of Vessels	Number	Apparatus	Method and area of operation
Trawler	960	Trawl	Trawling in Deep Sea
Gill Netter locally called 'Fishing body'	150	Gill net	Gillnetting in Deep Sea
Vessel with two-cylinder engine locally called 'Bhut bhuti' or 'borsi body'	10	Line and hook	Trolling comparatively nearer to the coast.

The data on different aspects of longlining category of hook and line fishing in deep sea with the help of vessel powered by two-cylinder engine locally called 'borsi body' were collected from the fishermen associated with a particular 'borsi body'.

The data on the technological aspects of deep sea fishing with hook and line as well as mechanised vessel has been collected by following various anthropological methods and techniques. These include participation observation, focus group discussion, interview technique etc. For the

purpose of participation observation, the first author of the present paper joined for a number of times in the weeklong expeditions in deep sea for fishing by hook and line method with the help of mechanized vessel conducted by a particular unit or team of fishermen.

Before joining in such expeditions, the first author of this article took a life insurance policy, as per the pre-condition laid down by the local office of the Fishery Department of the Govt. West Bengal.

Technological Aspects of Deep Sea Fishing with Hook and Line:

Seasons and Duration of Fishing Expedition with Hook and Line:

Deep sea fishing from Digha fishing harbour is practiced with different types of tackles and mechanized vessels almost throughout the year except from April 15th to May 31st. As per the Government rule, fishing with mechanised vessels in the deeper region of the sea is prohibited during this period since this period is considered the breeding time for the marine fishes. Therefore, to protect the gravid fishes the fishermen are not allowed to practise deep sea fishing with mechanised vessel during this period.

Usually, the duration of a hook and line fishing expedition in deep sea with mechanized vessel does not exceed a week since the vessels used for this purpose are smaller in size and lower in engine capacity compared to the vessels used for fishing with trawl and gill net. However, the climate and weather has bearing upon the duration of the expedition since these two factors have a close relation with the availability of fish on the one hand and the safe voyage on the other.

It is revealed from the prolonged field work that contrary to the fishing with trawl and gill net, duration of hook and line fishing is comparatively long during the monsoon owing to the less availability of large sized predatory fishes during this season. Since the sole target of hook and line method of fishing is always the large predatory fishes that are more available during the winter, the duration of a fishing expedition with hook and line during this season is shorter. However, even this shorter duration of expedition becomes sufficient to the fishing unit to catch the desired quantity of fishes in terms of number, volume and weight.

Size and Engine Capacity of the 'Bhut bhuti'/'Borsi Body':

The term 'Bhut Bhuti' is used by the marine fisherfolk of Digha to designate those mechanized vessels which are used to catch fish with the help of hook and line. These are also called 'Borsi body' or 'Kanta body' by the local people since the iron made barbed fish hooks are locally called '*borsi'* or *'kanta'*.

The body and deck of the vessel is always made of wood. The length of the vessel varies from 8 to 11 meter whereas width varies from 2.5 to 4 meter. The height of the vessel from the floor of its hold to the roof of the engine room varies from 3 to 4 meter. The vessel is powered by double cylinder (2 C.C.) engine. However, 'borsi body' is devoid of any permanently installed sonar or power driven winch. But during the expedition the vessel master/unit leader of the fishing expedition (locally called *majhi)* carry a GPS provided by the vessel owner.

Space Utilization within the 'Borsi Body':

The forward or stem post end or forecastle end of the 'borsi body' is locally called '*ahnwik'* since the heavy wooden mooring bollard stands at this end is worshipped every morning by the vessel master during the entire duration of the fishing expedition. The bollard is imagined as the abode of different deities responsible for safe voyage and good amount of haul. However, mooring bollard so worshipped is used to secure ropes for towing, mooring and other purpose. It is exactly cylindrical, but typically has a larger diameter near the top to discourage mooring warps (docklines) from coming loose.

After the bollard there remains an open area on the deck of the vessel which is used to keep the diesel barrels. Usually the barrels are made of plastic and each barrel contains 600 litters of diesel. The quantity of diesel carried in a particular expedition again depends on the duration of the respective pre-scheduled trip.

The aft or stern end of the borsi body is locally called '*pacha'* (Bengali equivalent of buttock). The toilet and privy of the vessel is located at the extreme margin of this end. Next to the toilet towards the fore part or forward of the vessel a manually operated iron steering oar locally called '*haal'* is installed. The total length of the steering oar including the blade and the shaft varies from 4 to 4.5 meter depending on the size of the vessel. The rectangular blade of the steering oar remains submerged in the sea and its cylindrical shaft is inserted vertically through the stern post of the vessel to reach the deck. The portion of the shaft that stands on the deck has the height of about 0.8 meter. An iron tiller of about 1.5 meter length is horizontally welded with the tip of the shaft of the steering oar to rotate the oar as and when necessary.

By the side of the tiller of the oar there is a covered place on the deck which is used as kitchen of the fishing unit during their fishing expedition. The kitchen is equipped with Kerosene stove or clay made oven within a metal drum, fuel wood, crockery, stone mortar and pestle, chopper, knife, plastic jars for spices etc. Moreover, six big plastic drums each containing about 250 litre sweet water are also stored in the kitchen for the purpose of drinking and cooking. The kitchen is also used to store the ration required during the hook and line fishing expedition. The ration includes rice, lentils and pulses, spices, mustered oil, limited quantity of vegetables (primarily pumpkin, potato, onion, garlic, lemon etc.). Apart from these, the ration also includes betel leafs and nuts, first-aid medicines like digestive, anti-nausea and pain killer tablets etc. The amount of ration varies according to the pre-scheduled duration of the expedition.

After the iron tiller and the kitchen there is a passage on the deck of the vessel for the movements of the fishermen. Next to the passage there is the rest room for the unit members. The room is about 2.5 meter in length 1.5 meter in breadth with a height of about 1.5 meter. The rest room has a door with low height entrance and two small windows on either side of the wall with the provision of sliding door. In the rest room there are the spaces allotted to keep GPS, Magnetic Compass, and Television set etc. In one corner of the rest room a spot is specially allotted for the vessel master or Majhi who keeps statues and photographs of some Hindu Gods and Goddesses and worship them daily at noon after taking a bath. No offerings are made before the deities apart from placing burning incense sticks.

On the roof of the rest room a make-shift rectangular shade is erected with serried wooden railing and the top of the same is covered with a sheet of tin. The height of this shade is about 1.5 meter and the length and breadth is almost equal to the floor space of the rest room. This shade is used for storing different types of ready-to-use tackle namely floats (jerrycan and hard plastic balls), grapnel-type iron anchors (used against drifting of the fishing line), buoy, kerosene lamp etc.

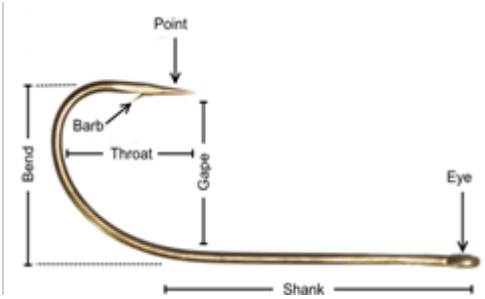
Just below the rest room there is another room located within the hold of the vessel. This room is called machine room since this is where the engine of the vessel is installed. However, the machine room is also used to store the fuel/diesel for the engine, standby floats and sinkers etc.

At the end of the machine room and the rest room the refrigerating chamber of the vessel is located. The chamber is in the shape of a cubicle that rises from the floor of the hold of the vessel with its upper rims touching the level of the deck. The entry to the refrigerating chamber is made through a rectangular opening which is covered with a movable wooden plank or lid. The length and breadth of the refrigerating chamber are respectively 1.5 meter and 2 meter whereas depth of the chamber is about 2.2 meter and the lid measures about 1 meter in length and 0.8 meter in breadth. This chamber is used to carry the ice slabs as well as to refrigerate the captured fishes during the expedition. The refrigerating chamber is insulated with varieties of materials. Thus, the outer walls of the chamber are made either of aluminium sheets or ply wood boards, whereas the inner walls of the chamber are insulated with one layer of ply wood board and one layer of thermocol board respectively.

As one looks forward, toward the bow of the vessel, one finds port and starboard on the left and right sides, respectively. The inner margins of the port and starboard respectively of the 'borsi body' are used for hanging the hooks on their points.

Hooks and their Varieties:

The type of hook used by the fishermen of Digha is called barbed J-hook. This is primarily simple single hook. The hooks they use are made of aluminium coated iron. The barbed J-hook consists of different parts namely: eye, shank, bend, crook, barb and point. The following diagram exhibits a barbed J-hook and its parts.



The parts and sectors of a fish hook referred to above are as follows: it's point — the sharp end that penetrates the fish's mouth or flesh; the barb — the projection extending backwards from the point that secures the fish from unhooking; the eye — the end of the hook that is connected to the gangion; the bend and shank — the portion of the hook that connects the point and the eye; and the gap — the distance between the shank and the point.

The size of the hook used by the fishermen of Digha varies from 5/0 to 8/0. The size of the hook is determined by the length of the shank excluding the eye. It is to be mentioned in this context that in general the higher number indicates a smaller hook and vice versa. Usually No. 20 is the smallest size and hooks increase in size from No. 20 to No. 1, beyond which larger hooks are designated 1/0, 2/0 and so on, sometimes running up to 12/0.

The following table shows the correlation between different groups of the fishes, the range of weight of the group of fishes and the size of the fishing hook used for catching those fishes.

English name of the fishes	Available local name of the each variety of fish	Range of weight of the fishes (kg.)	Size of hooks
Engraved catfish	Tangra/Kanta/ Samudrik aar	2–12	5,6,7
Blacktip shark	Hangor	3-15	6,7,8
Asian Sea Bass	Bhetki	3-22	4,5,6,
Cowtail Sting Ray	Shankar maach	4-20	7,8
Bullet tuna	Mackerel	5-15	7,8
Big Eye Tuna	Tuna	4-30	7,8

Lines and their varieties:

It is observed that the fishermen of Digha employ an almost unlimited number of hooks (locally called *borshi kanta*) with a form of set line called the long line (locally called *cod daon*) operated in a more or less horizontal configuration. About 100 of hooks are fixed to a particular main line with a short line locally called '*pichon*' at Digha. There are various English words for short line which are namely: cast, branch line, snood, leader, dropper-line, drop-line or dropper, gangion or gangin etc. One end of each gangion is knotted with the eye of the respective hook and the other end is tied with the main line. The fishermen of Digha have reported that they have observed that some fish can bite a line in two, especially after swallowing the hook, which may have a short shank. To avoid this, in most cases they use hooks with longer shanks which are respectively fixed to the gangion. The spacing of the gangions is maintained in such a fashion that their distances from each other remain at least twice that of their length to avoid entangling. Moreover, the fishermen of Digha have noticed that the bottom long lines with gangion set at larger spacings fish better than those with the branch lines set more closely together.

Fishing lines, either main or branch, used by the fishermen of Digha are of synthetic materials, especially transparent monofilaments of PA (polyamide) and twisted PE (polyethylene) which have

high tensile strength as well as high specific gravity. However, material and linear density of the main line and branch line vary greatly according to the fishing conditions and target species. The fishermen make sure that the breaking strength of lines is high enough to cope with the weight of the fish to be caught to avoid losses by breaking. They also ensure that the lines are not excessively thick because this can decrease their efficiency in fishing. Neither should they be too fine for ease of handling. The thickness of the long line varies from 10 to 12 m.m. and length of each long line used by the fishermen of Digha varies from 92 – 140 meter. Similarly, the thickness of the short line or gangion varies from 3 to 4 m.m. and a fixed length of 1.2 meter is always maintained for each of the gangion. The branch lines or gangions are usually of equal length.

The fishermen of Digha use two types of long lines namely drift long line, bottom set long line. Drift long lines are operated close to surface or middle layers of the sea water for pelagic resources such as tunas, Indian mackerel, Spanish mackerel, pelagic sharks etc.; whereas, bottom set long lines are operated close to bottom for predatory demersal fishes such as sharks, groupers, snappers, cod, haddock, halibut.

Preparation of the hook and line:

During the beginning of the fishing season (i.e. 1st day of June as per Govt. Regulation) the already repaired vessel is worshiped in the morning of an auspicious day and the recruited members of the fishing unit except the vessel master/unit leader begin to stay and wait on the vessel for the forthcoming fishing expedition. During this period while Majhi remains busy in the harbour to collect ration, fuel, ice slab etc. required for the expedition, the other members of the unit remain busy on the vessel to make the lines and the hooks ready for fishing.

To make the hook and line ready for use the fishermen at the first stage knot one end of a particular gangion locally called *'pichon',* with the eye of a particular hook. In this way altogether 2000 – 2500 hooks are prepared by the members of the unit. Now the members join hands to prepare a section or "set" of long line which measures about 140 – 150 meter in length with 90 – 100 branch lines each bearing one hook. For this they knot the bare end of each of the branch line or gangion with the mainline at an interval of 3 – 4.5 ft. depending on the size of hooks. The size of the hook is determined not only by the targeted fish but by the intervals to be allowed between two branch lines of a particular mainline. In this way, about 20 to 25 sections or 'set' of long lines are prepared for a particular fishing season.

Operation of the longlines:

When the ration, fuel, ice slabs etc. are loaded on the vessel and the hook and lines are made ready to use, then the vessel master announces the date of the voyage for fishing in high sea.

Before the voyage begins the vessel master worships on the spot near the bollard located at the stern end of the vessel. At first he smears the bollard with the thick mixture of vermilion and oil and then offers some sweets and basil leaf to the gods and goddesses and prays before them for safe voyage as well as good haul.

After about two hours of voyage the fishing unit enters such a zone of the sea where as per the guess and perception of the vessel master the depth of the water may be about 15.5 meter and above. After arriving in such a zone, the vessel master asks the engine operator of the vessel (locally called 'driver' or *'side majhi'*) to stop and anchor the vessel. Then the master measures the depth of the water by plunging a 2 m.m. thick nylon rope with a heavy piece of iron knotted at its tip. It is to be mentioned in this context that the word *'baam'* is the indigenous term used by the fishermen of Digha to describe the measurement in terms of length, breadth, depth etc. According to them the total length of four *'haat'* or forearms constitutes one *'baam'* which is equivalent to 1.8 meter.

The vessel master ensures that the depth of the sea ranging from 15.5 – 48 meter is conducive to hook and line fishing. However, apart from the depth of the water of the sea the vessel master also considers the colour of the water since as per his experience and perception both the depth and the colour of the water has simultaneous bearing upon the availability of desired kind and amount of fishes.

After selection of the location for fishing and considering the suitable time and calmness of the sea the vessel master asks the engine operator to slow down the speed of the vessel. Thereafter, he directs the other members of the fishing expedition to throw one end of a 'set' or section of a main line attached with a Grapnel-type iron anchor weighing about 3 kg. and the first marker buoy bearing the flag (locally called *pataka*) and kerosene lamp locally called *tua.* Before throwing the lines into the water the hooks are kept baited with different type of fishes namely *bomla (Harpadon nehereus), fita (Lepturacanthus savala), fali (Sardinella gibbosa).*

The vessel master now directs the unit members to knot the other end of the said section of the long line with the tip of another set of long line. A float in the form of plastic jerrycan of 10 litre capacity and a Grapnel-type iron anchor are knotted in the joint of two sets of long line. In this way five to ten sets of main line joined together are thrown in the sea. Thus the sum total length of the joined sets of long lines becomes around 750 to 1500 meters. After throwing the entire connected sets of long line, its end (that is opposite to first marker buoy) is also attached with a Grapnel-type iron anchor and a float in the form of plastic jerrycan of 20 litre capacity. Thus the long lines remain in the sea water without any connection with the vessel and the team members wait on the deck of the vessel which floats near the end of the long line. After allowing a soak time of about 3 to 4 hours the joined set of main lines are hauled up by hand by the members of the fishing unit save the vessel master as well as the engine operator and fishes are removed as the branch line comes up.

Sorting and Storing of Fishes:

While some members of the fishing unit are engaged in hauling and removing the fish from the hooks the others members of the unit remain busy putting each variety of fish in separate area of the floor of the refrigerating chamber. Since the hook and line method is primarily employed to catch large sized fishes therefore, it is not possible to store them in plastic crates since their available size are not suitable to store large sized fishes.

Division of Labour

'Matsyajibi' (or fisherman) is the common term used for all the members of fishing unit who go for deep sea fishing based on various technologies. The fishermen engaged in deep sea fishing with mechanized vessel are all employed by the owner of the vessel. The employment is offered on one year contract. The division of labour found among the unit members is as follows:

A person is appointed as the vessel master of the expedition team, locally called *majhi* whose advice is considered by the vessel owner in case of annual recruitment of the fishermen for deep sea fishing. Apart from this role, 'majhi' has the sole authority to take major decisions in the matters of scheduling each fishing expedition, selecting the spot and time for setting and hauling the hook and lines, steering the vessel during setting and hauling of hook and lines, time to be allowed to soak the hook and lines. Majhi is also solely responsible to select the size of hook, size of a 'set' of long line, total length of the joined long line, material and thickness of the lines. Apart from these, *majhi* also serves as the principal priest for daily worship on the vessel during fishing expedition.

Similarly, a person of the expedition team is assigned to operate the engine of the vessel and he is locally called *'side majhi'*. He is also responsible for the maintenance of the engine of the mechanized vessel. However, in case of exigency, the *side majhi* also steers the vessel.

Another person of the fishing unit/team is assigned the duty of cooking the food for the members of the unit during fishing expedition. However, apart from cooking he has also the obligation to participate in other works like setting and hauling of the hook and lines, removing the fishes from the hook as well as storing the captured fishes etc.

The other members of the unit are exclusively responsible for setting and hauling of the hook and lines, removing the fishes from the hook as well as storing the captured fishes.

Conclusion

An attempt has been made in the present paper to give an ethnographic account of the high sea fishing by hook and line method with mechanized vessel practiced by the fishermen functioning from

the indigenous fishing harbour of Digha on the coast of the Bay of Bengal in West Bengal. While doing so, the authors have considered technological aspects of such fishing not only in terms of tools and material culture but also in terms of resources, tasks, skills, labors and activities related with the practice with such fishing since all these elements are considered to be attributes of technology.

The account presented in the foregoing sections suggests that the material culture associated with the deep sea fishing with hook and line and the mechanized vessel is dominated by the presence of industrial products which include among many things the engine of the vessel, GPS, radio, wireless phone, rope, hooks, grapnel iron anchor, float in the form of plastic jerrycan, ice, thermocol, plywood etc. However, despite the use of so many industrial products the fishermen practising hook and line fishing in high sea with mechanized vessel largely depend on the indigenous knowledge, perception, skill and wisdom of a particular person. This person is locally called majhi who is on the one hand the leader of the fishing unit and on the other master of the vessel. Majhi is the ultimate or sole authority during every deep sea fishing expedition with the hook and line fishing with the help of mechanized vessel. Thus we find that the majhi is exclusively responsible for selecting fishing unit members for annual recruitment, scheduling each fishing expedition, collecting fuel and ration for expedition etc. Majhi also steers the vessel, directs the engine driver about the necessary control of speed of the vessel, selects the spot and types of hook to be used for long line fishing, schedules the time for setting and hauling the lines etc.

It is revealed from the present study that the passive method of fishing with hook and line is considered by the local people as the less expensive since much less amount of capital is required for the simple but effective gear and a vessel used for this method of fishing compared to trawling and gillnetting with mechanized vessel. Moreover, the method of fishing with hook and line is fuel efficient since no voyage is required during the soaking of the hooks and lines.

The present study is also reveals that there is lesser loss of marine biodiversity due to hook and line fishing since this method is useful to catch the fishes of large size only and thus the small size fishes and other aquatic animals of countless varieties as well as shrimps, crabs and molluscs etc. are spared.

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