Field Guide for
Digitally Smart
Marine Fisheries Production
Data Management

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Digitally Smart
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Fishery Resources Assessment,
Economics & Extension Division

Indian Council of Agricultural Research
Central Marine Fisheries Research Institute

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Foreword

Marine fisheries management has evolved into an evidence-based data intensive scientific exercise of higher intensity in recent times. With India being a major contributor to the world marine fish production kitty, the responsibility maintaining marine fisheries at a sustainable level of production is highly imperative. ICAR–CMFRI is uniquely placed to play a more pronounced role in supporting the endeavours of the Government especially Ministry of Fisheries, Animal Husbandry and Dairying. Having etched an impeccable record during the past seven decades in the area of marine fish landings, effort estimation and related developments, ICAR-CMFRI has the double-edged responsibility cum advantage of quantify national marine fishery production and lending guidance to policy makers. I am happy to learn that more and more state fishery departments are collaborating with the Institute to enhance the coverage and precision which are vital to arrive at a robust assessment of Indian marine fish stocks. Having packaged a perfected methodology of estimation of marine fish production, it is just a logical extension to exploit data analytics options in an exhaustive and speedy manner. Fish Catch Survey and Analysis (FCSA) Version 2 is a mile stone achievement of the Institute in that direction. Now I can record immense pride that ICAR-CMFRI has got a digital product which is scalable and replicable. For achieving highest productivity of this Android app, a comprehensive guide cum manual is a necessity. I am happy that this field guide fulfils this requirement aplomb.

This document has been prepared by a meticulous combination of detailed exposition of modules of FCSA along with suitable methodological commentary and pragmatic simple narration. The topics have been arranged dovetailing the app's work flow. Starting from the details pertaining to the landing centre's conditions on the day of survey to unequivocally defining common craft and gear combinations seen in Indian waters, this publication does a huge value addition to the user from the conceptual point of view. Thus, this field guide twines as a repository of common terms used in fishery context also. I have no hesitation in dedicating this publication both as a field guide as well as a referable scholastic document. This guide in combination with the app is a powerful tool in the hands of Fishery Management agencies who are in the lookout for credible unbiased quantification of marine fishery dynamics. This is as much a futuristic document as a chronicler of CMFRI's hallowed legacy.

While appreciating the team effort which has brought out this document I commend this for the enhanced scrutiny, utilization and evolution to the stake holders. I am sure that such kind of documentation of the key efforts made by ICAR-CMFRI will continue in the days to come towards fulfilling the grand goal of Viksit Bharath during Amritkal of our nation's independence.

Grinson George

Director

Preface

Indian marine fisheries have been witnessing added focus in recent times due to multitude of factors. The most important among them is the evidence or data-based management of the marine fishery resource production in a reassuringly sustainable manner that takes care of both the resource health and fishers' welfare simultaneously. ICAR-CMFRI has been a yeoman contributor towards this end for more than seven decades now, with its critically acclaimed and scientifically robust survey based unbiased assessment of landings and corresponding effort. The methodology has been evolving over time and has taken digital wings to soar newer heights in recent times. With the option of replicability under certain reasonable conditions, this has been one of the much deliberated, demystified and documented one from the stables of the Institute. This document, which is the latest and the most comprehensive from the practical point of view, is intended as a guide to help and support the work of survey staff, involved in the sustainable management of marine fisheries. Mainly focusing on the detailed description and practical explanation, this manual serves as an essential resource, offering clear guidance for the collection of marine fishery data.

At the core of this document is the application of the Fish Catch Survey and Analysis (FCSA) version-2, a pioneering tool that is vital for modern fishery management. This tool automates the process of conversion of what is observed by the survey official onto a multi-dimensional data repository, named National Marine Fishery Resources Data Centre (NMFDC) in ICAR-CMFRI context, with minimal points of review intervention. By presenting step-by-step instructions and explanations of key modules within the FCSA, this guide ensures that users are well-equipped to collect, understand, the intricate details related to fishing crafts and gears used in Indian waters. The manual spans a broad range of topics, from the initial Landing Centre Survey to the identification and classification of fishing crafts and gear types commonly encountered in Indian fisheries. Along with this we have collated the different modes of fishery spread out in diverse parts of India, with special emphasis on key points to differentiate between various crafts and gear. Moreover, this guide underscores the importance of unbiased, credible data collection as a cornerstone for effective data interpretation. By focusing on a simple yet logical approach, it enables the survey staff to accurately comprehend the marine fishery landing data by the various dynamic combination of craft and gear.

This book is not only an objective documentation of the throes of an efficient functional tool but also a tribute to the legacy of the Central Marine Fisheries Research Institute (ICAR-CMFRI), especially the Fishery Resources Assessment wing (FRAEED- erstwhile FRAD). It sets the foundation for future advancements in marine fishery survey and its rightful understanding. As much a record of progress as it is a guide for the future, and hope that this manual bridge the gap between traditional practices and innovative

methodologies, by adding up as a learning cum evolutionary treatise.

We hope that this document, alongside the companion app, proves to be a powerful and reliable tool in the ever-evolving marine fishery data collection, and thus contributing to the sustainability of our precious marine resources for generations to come. This has been drafted in such a way to be a synergistic companion to any relevant production estimation methodology primer. Written in simple prose and peppered with suitable pictorial depictions this would be the perfect foil for both the first timer and those who face unique situations on the field. The style of narration and the compilation is aimed at provoking critical inputs among the readers, which may lead to furtherance of technical correctness. With marine fishery gadgets set of improvisation bordering innovation every other day, this manual as the rule book for the methodology it propounds is set to add those field developments and get refreshed periodically. Our sincere endeavour has been towards enabling this kind of flexibility while presenting things in a structured manner.

We, members of the team that authored this manual, take immense pride and happiness in reliving the contributions of all the senior colleagues who mentored us to be in a position to present this unique duo of technology-concept with clarity and purpose. We also take this opportunity to thank our Institute's Director, Dr. Grinson George, who has a comprehensive ringside view of what this stuff is made of, and thereby inspiring enthusiasm in us to complete this assignment to mark the anniversary of the release of updated version of FCSA.

Contents

Introduction

Data collection is a crucial element of fisheries management. The ICAR-Central Marine Fisheries Research Institute is mandated with the monitoring and assessment of India's exploited marine fish resources for deriving management measures to keep the harvest of the resources at sustainable levels since its inception in 1947. Ongoing monitoring provides the scientific and technical information needed to understand fishery operations, assess the status of exploited stocks, evaluate the ecological impacts of fisheries, and create effective management regulations. Estimation of fish catch and effort is done using stratified multistage random sampling design (SMRSD), a unique and robust system developed by the Institute.

In 2018, CMFRI shifted from a paper and pencil method of fish catch data recording to an electronic mode by developing a web based application software named Fish Catch Survey and Analysis (FCSA) (Mini et al., 2023). FCSA has two modules, one at the field observer level and the other at the server level. The server-end module has a combination of frontend interface

and a database (PostgreSQL/ Oracle) for the data collation, verification, estimation, and summarization of catch and effort estimations. A new architecture for FCSA, FCSA-2.0, with a fully functional Android app as its field module, was released in 2023.

In this data collection system, dedicated field observers with expertise in species identification visit the landing centres, according to work schedules generated using a two-stage stratified sampling scheme, and gather various essential fishery information from sampled boats. Seventy seven technical officials are employed by the Institute along the coastal area covering approximately 1200 fish landing centres. Around seventy four field officials of different state governments are also a part of the system wherein joint data collection is done in order to enhance the landing centre coverage and increase the precision of the estimation process. As the fishery data collected by them from the landing centres being the base of entire process of the assessment, it is very important to give proper training to the field officials on different types of data such as status of fishery, specifications of craft and gear, fishing ground, species composition, etc.

This publication is intended to be helpful to the field officials to identify the type of fishing craft and gear, select suitable samples from the fleet of landed units in a landing centre and collect accurate information regarding the catch and effort details from the sampling units. Multiple types of fishing craft and gear are used by the fishermen of the country depending on their geographical and traditional methods. Detailed lists of such common fishing craft and gear are included in this guide.

General procedure for data collection

The online process initiates with the allotment of dates and landing centre to the survey official, the key seeding input are the month-wise dates and landing centres, which form the work program. Thus, the online tab-based version too has the same as the point of start for the process of landings and effort data collection and upload.

The work program for a month can be fetched in the Tab on the 1st day of each month using their respective user id and password. Work program lists the names of the Landing centres (LCs), dates and sessions. Normally eight or nine landing centre days are allotted in a month. Usually, one landing centre day includes two dates and three sessions viz 12.00-18.00, 18.00-06.00 and 06.00-12.00 hrs. On the first day, the official should be present at the landing centre from 12.00 noon to 18.00 hrs. On the second day, the observation starts from 06.00 to 12.00 noon. The survey data of the second session known as night landings (from 18.00 hrs on the 1st day to 06.00 hrs on the 2nd day) should be recorded by enquiring pertinent detail on the second day 06.00 hrs–12.00 hrs.

It is mandatory for the official to mark his/her attendance (IN and OUT) at the LC using the option given in the FCSA App. The official can enter the survey data directly in the App at the LC or note them in his/her field diary at the LC and later enter the noted data in the App after the survey hours. However, the field diary should be maintained as a backup of the data collected other than the data submitted by the App. As the field diary is the reference point when any clarification is needed after the submission of data by App, utmost care and due diligence must be taken while maintaining it. Thus, the diary will be the ultimate document of arbitration in the case of any dispute or disagreement and hence the data noted down should not be altered without due concurrence with Head of the Division (HOD)/Data Analyst.

Whether there is fishing or no fishing, the work program should be strictly adhered to and the official should be at the landing centre during the entire period of observation. No change in the work program, without prior approval of HOD/Scientist-in-charge (SIC) will be entertained.

The essential details to be collected in each session

◆   Weather conditions pertaining to the fishing status of the day

◆   Craft details of selected fishing units

◆   Species wise quantity landed by each selected unit

◆ Price data of each species caught

◆ Total number of fishing units that landed fish in the session under each craft and gear category.

The information to be collected in each of the above five categories are described below.

Weather conditions pertaining to the fishing status of the day

The six items to be collected in this section and the options available for each item are given below.

Sl No.	Item	Options
1	State of Sea	Calm
		Small swell
		Waves
		High waves
		Very rough
		Cyclonic
2	State of sky	Clear
		Partly Cloudy
		Cloudy
		Overcast
		Partially raining
		Rainy
3	Direction of Wind	North
		North-East
		East
		South
		South-East
		South-West
		West
		North-West
4	Current	North
		North-East
		East
		South
		South-East

SI No.	Item	Options
		South-West
		West
		North-West
5	No landings status (NLS)	It should be set to YES if no boats have landed in the LC during the period of observation. The reason for 'No landings' also should be clearly mentioned in the Remarks column
6	No fishing status	Unlike NLS status this item refers to whether any craft had gone for fishing from that LC during that particular day. If not, the reasons should be mentioned such as bad weather conditions, strike, accidents, poor catch, etc. There may be landings after fishing done on the previous days but there might be no fishing on that particular day. Thus, the clear distinction between "no landings" and "no fishing" to be noted and adhered to.

The first two items (State of sea and State of sky) can be easily recorded by the official and are mandatory. The 'Direction of the wind' means the direction from which the wind emanates and the 'Current' means the direction to which the sea current flows.

1. Craft details of selected number of fishing units

Selection of sample units

The survey methodology is based on two stages wherein selection of appropriate sampling blocks is selected giving reasonably equal chance of each to be included- first being the landing centre-day and the second being the unit/craft under each category on the day/session selected (M. Srinath *et al.,* 2005). There is a possibility that the crafts that land fish, on the given session could be high (more than 15 or so). If the data of all fishing units landed in a landing centre cannot be observed, a set of sample units can be selected and their detailed information should be collected. The selection of sample size can be done as indicated below.

No. of fishing unit landed	Sample units to be examined
Less than or equal to 15	All (100%)
Between 16 and 19	All the first 10 Nos. and the balance 50%
Between 20 and 29	1 in 2
Between 30 and 39	1 in 3
Between 40 and 49	1 in 4
Between 50 and 59	1 in 5
.....and so on	

First unit has to be selected at random (a proper statistical procedure based on probability of selection of the boat) and the remaining units systematically with a cycle of respective intervals. In case of landing centres where multiple types of craft and gear landings occur, a sufficient set of sample size should be taken for each category of craft and gear proportional to the total number of units landed in each category.

Types of Fishing craft

Fishing craft can be categorized into three sectors.

- **Mechanized**
- **Motorized**
- **Non-motorized**

In mechanized craft, engine is permanently fitted inside and has a propeller with shaft and rudder. They use engine power both in propulsion and in the fishing process (casting or pulling the net), Eg. Trawler.

Motorized craft are traditional boats fitted with engine/engines which is used for propulsion only. The engine is not used in the fishing process. Two types of craft are available in motorized sector such as Inboard and Outboard. In Inboard craft, engine is permanently fitted inside. The engine is detachable and fitted outside in the case of Outboard craft.

Non-motorized craft are traditional craft without any engine.

Different types of craft are used in each of the above category depending upon the fishing gear used and the material used for making the craft. The common types of fishing craft available are listed below.

Mechanised (M)	Mechanized Dolnetter
	Mechanized Gillnetter
	Mechanized Liner
	Mechanized Purseseiner
	Mechanized Ringseiner
	Mechanized Trawler
Motorized (OB)	Outboard Catamaran
	Outboard Dugout canoe
	Outboard Fibre glass boat
	Outboard Plank built boat
	Outboard Plywood boat
	Outboard Teppa
Motorized (IB)	Inboard Fibre glass boat
	Inboard Plank built boat
Non-Motorized (NM)	Non-motorized Catamaran
	Non-motorized Dugout canoe
	Non-motorized Fibre boat
	Non-motorized Masula boat
	Non-motorized Outrigger canoe
	Non-motorized Plank built boat
	Non-motorized Thermocol boat

Types of Fishing gears

Fishing gears are categorized based on the mode of fishing used. Major types of fishing are trawling, seining/surrounding, gilling, lining, etc. Common types of fishing gears are listed below.

Bagnet (BN)
Boatseine (BS)
Bottomset Gillnet (BSGN)
Castnet (CN)
Drift Gillnet (DGN)
Dolnet (DOL)

Trawlnet (TN)	
Gillnet (GN)	
Hooks & Line (HL)	
Hand Picking (HP)	
Hand Trawlnet (HTN)	
Jigs (JG)	
Long Line (LL)	
Purseseine (PS)	
Ringseine (RS)	
Shoreseine (SS)	
Trapnet (TRAP)	
Trammel Net (TRM)	

Some fishing craft are using more than one type of gear (combination gears) in a single trip. Commonly used combination gears are available in the FCSA App.

Other characteristics of craft to be recorded

1	Sl No.	Serial no. of the craft selected as sample
2	Sample No	Number selected on random basis of the sampled unit
3	Name	Name or register number of the craft
4	Length of craft	Length of the craft is to be recorded in meters
5	Departure time & date	Date and approximate time when the fishing craft departed from the LC
6	Arrival time & date	Arrival time and date of the craft at the LC
7	Distance	Distance of the fishing ground from LC in kilometres
8	Direction	Direction of the fishing ground from LC
9	Depth	Depth of the fishing ground in meters
10	No. of hauls	Number of hauls
11	Actual Fishing Hours (AFH)	Duration of actual fishing is the interval between casting the net, hauling and drawing back the net to the craft. Care should be taken to record AFH as it is very important information regarding fishing effort. First enquire about the AFH of one normal hauling and multiply it with the number of hauls. AFH should be recorded in hours only. Eg. If AFH of a craft is 15 minutes, it should be recorded as 0.25 hrs; for 30 minutes, 0.5 hrs; for 45 minutes, 0.75 hrs, etc.
12	Manpower	Number of persons on board

13	Horsepower	Horse power of mechanized/motorized craft
14	Trawling speed	In case of trawlers only, speed of boat while trawling in km/hr
15	No catch flag	If a craft returns without any catch even after hauling the net, this flag should be set to **YES**. However, suppose a craft returns without hauling, that craft should not be taken as a sample unit or counted in the total number of units landed.

2. Species wise quantity of landings in each selected unit

◆ The names of fishes are to be recorded scientifically (binomial nomenclature). In case, if identification up to species level is not possible, at least generic name should be indicated.

◆ The species wise quantity of catch brought by each sample craft is the most important part of the data to be collected. The quantity is to be taken in kg. The weight of one basket of fish is to be obtained and multiplying it with the total number of baskets is the usual practice followed.

◆ Exceptional catch: There is a provision to mark a species catch as 'Exceptional' if a very rare landings is observed, such as a very rare species or unusual bumper catch landed.

◆ Bycatch (%): If the landings of a particular species contain very low value fish such as juveniles, damaged or mixed trash fish, its percentage in the total quantity is to be indicated here. Mixed catch of many species, juveniles that cannot be identified separately are usually entered as 'Miscellaneous'. Eg. (1) After recording the 'Miscellaneous' quantity, 100% can be entered in the Bycatch column, since it contains only low value fish. (2) If 1000kg of Ribbonfish is landed in a craft where 500kg are high value fish of big size and 500kg are very low value juveniles, 50% is to be entered in the Bycatch column to distinguish between the two types.

3. Price data of each species caught

The list of species recorded will be displayed at the Price section of the App. Price per kg of each species can be recorded as a range with the minimum and maximum values in Rupees.

4. Total number of fishing units landed in each craft & gear category wise

The last part of the data is very essential as it indicates the number of units

actually landed at the LC during the period under observation. The numbers have to be counted separately for each category of craft and gear and maximum care should be taken to record this data without mistakes.

Synchronization of survey data

It is mandatory for the field officials that they should submit the survey data of each month using the FCSA App within tenth of the following month. If there is any delay due to unexpected reasons, they should inform the HOD/Data analyst about it.

Additional notes

Field officials are mandated to monitor the fish landings and related matters from their respective area of survey and report about them to the office at right time. Some sample types of information they have to inform other than the usual landing data are indicated below.

◆ Addition/construction of new landing centres/harbours.

◆ Change of fishing intensity in any LC like considerable increase/ decrease in the number of fishing units operating at that particular LC.

◆ Closing/shifting of any LC due to climatic conditions or any other reason.

◆ Change in the landing pattern of LC such as shift in the landing timings, tidal landings, etc.

◆ Unusual landings of bulk catch or any rare species.

◆ Lost fishing days due to bad weather, strikes or any other unexpected events.

◆ Change in the mode of fishing like addition of new fishing gears, methods, etc.

◆ If any new species is observed during your data collection record it as 'New species' and inform the data analyst.

Detailed description pertaining to crafts and gears prevalent in India is discussed in the following pages.

Marine fishing crafts and gears

Fishing Crafts

What is a craft?

◆ The floating and movable platforms used for fishing operation on which the fishers operate the fishing gears are called crafts.

◆ The front part of a craft is referred to as 'Bow' and rear part is referred to as 'Stern' or 'Aft'.

Based on the kinds of crafts and their modes of operation prevalent in Indian waters a conventional bifurcation as described below. These are popularly referred to as sectors too.

I.   **Mechanized**

II. **Motorized**

    a.   **Outboard**

    b.   **Inboard**

III. **Non-Motorized**

Mechanised (M)

◆ Mechanised vessels use engine power for cruising and fishing.

◆ In mechanized craft, engine is permanently fitted inside and has a propeller with shaft and rudder. They use engine power both for propulsion and in the fishing process (casting or pulling the net).

These two are the salient traits which must be deciding the type of sector. However, in the evolution of craft innovations, there may be situations where special weightages have to be given to these two, while deciding the sector.

Types of mechanised fishing vessels are:

Trawler

A trawler is a specialized fishing vessel designed to operate a trawl net, which is a large fishing net used for catching fish or other marine species by dragging it through the water or along the seabed.

Equipped with engines that provide sufficient power to tow the trawl net at the optimal trawling speed, which varies based on the target species and fishing location.

- Fitted with trawl winches and otter board to control the deployment and retrieval of the trawl net. Gallows (T-frame or rectangular frame) located at the rear of the vessel, used for guiding and supporting the net during deployment and retrieval. Pulleys are attached to the gallows to haul the net onboard and lift the cod-end onto the deck.

- Trawlers are made of wood and iron and by the presence of winches, otter board, gallows and pulleys at the back part of vessel we can easily identify the trawlers.

Purse Seiner

A purse seiner is a fishing vessel designed to capture aggregating fish species near the water surface using a purse seine net. This net encircles a school of fish, and its bottom can be drawn closed like a purse to trap the catch.

A crow's nest and the pulley are located at the front of the vessel, attached to a front pole. It serves as a high vantage point for spotting fish schools and guiding the net deployment.

A small auxiliary boat, or dinghy, is an essential component of the purse seiner setup. It helps in positioning and manoeuvring the net during the fishing operation, ensuring the shoal of fish is completely encircled.

This craft is predominately made of wood and iron and easily distinguishable by the location of crow's nest and pulley in the front part of wheelhouse.

Gillnetter

A gillnetter is a fishing vessel designed primarily for deploying and operating gillnets or drift gillnets, these are the nets which are used to catch fish by entangling them as they swim into the mesh. Some vessels may also use hooks and lines in combination with gillnets.

Externally similar in structure to trawlers and purse seiners, including a wheelhouse for navigation and control. Recognizable by the long poles located at the back of the wheelhouse. These poles are used to attach lights which are in turn attached to drift gillnets deployed in the sea during night and to hooks, used for pulling the fish caught by hooks and line into the deck.

Ring Seiner

A ring seiner is a fishing vessel similar in purpose to a purse seiner, designed for encircling fish schools near the surface using a ring net, which functions similarly to a purse seine. But nowadays the ring seiner craft is often longer than a purse seiner.

Older models lack a wheelhouse, while modern versions may have an open or minimally structured wheelhouse, which provides basic shelter and navigation functionality.

This craft (Mother boat) operates alongside an auxiliary carrier boat, usually a single or multiple outboard-powered craft (Carrier boat), which assists in transporting the catch or managing the net during fishing operations.

Liners

Liners are fishing vessels that employ hooks and lines or jigs, with or without bait to catch fish. They are versatile and used in various fishing operations, targeting specific species based on the fishing gear used.

Line Haulers are mechanized systems used to retrieve longlines efficiently, minimizing manual effort. Specialized systems to handle the catch safely, sorting tables are provided. To store and maintain the quality of catch, refrigerated storages are present in the modern liners.

Dol Netter

A dol netter is a fishing vessel designed specifically for dol net fishing; a method that uses stationary bag-like nets (dol nets) set in tidal waters to catch fish as they move with the currents.

Recognizable by the presence of big buoys, which are used to keep the dol net in position and provide buoyancy for the fishing operation. Equipped with crates, which are prominently visible on the deck and used for sorting the catch after retrieval.

Motorized crafts

Motorized crafts are traditional boats fitted with an engine/engines which is used for propulsion only. The engine is not used in the fishing process. Two types of craft are available in motorized sector viz Outboard and Inboard. The engine is detachable and fitted outside in the case of outboard craft. In Inboard craft, engine is permanently fitted inside.

a. Outboard crafts (OB)

The engine is detachable and fitted outside in the case of Outboard craft.

The common types of Outboard fishing craft available are listed below:

Outboard Catamaran

An outboard catamaran is a simple and traditional fishing craft consisting of 3 to 7 logs tied together with coir ropes, often equipped with a

detachable engine for propulsion. The logs are arranged to form a streamlined shape for easier navigation in coastal waters.

Outboard Dugout Canoe

An outboard dugout canoe is a traditional fishing craft carved from a single large tree trunk, with its interior hollowed out to create a boat structure. These canoes are often equipped with an outboard motor for propulsion. The craft is made from the trunk of a large tree, such as a mango tree in Kerala. The choice of wood varies by region based on availability and durability. The interior is carefully chiselled out to form a canoe shape, ensuring stability and buoyancy. Outboard dugout canoes have become rare due to the scarcity of suitable large trees and the increasing availability of modern fishing vessels.

Outboard Fiberglass Boat

An outboard fiberglass boat is a lightweight fishing craft constructed from plywood or wood, providing a base framework, reinforced with a high content of fiberglass material to enhance strength, durability, and resistance to environmental factors and hence the name.

Outboard Fibreglass craft with outrigger

The detachable outboard motor is easy to handle. This has improved its operational ability and speed compared to traditional non-motorized crafts. Durability and cost-effectiveness make them popular among fishers.

In some parts of Karnataka outboard crafts have been fitted with outrigger as shown in the picture.

Outboard Plank-Built Boat

An outboard plank-built boat is a traditional fishing craft constructed by joining wooden planks using coir ropes and iron nails, with the gaps sealed using natural materials like cashew tree resin and coal tar.

Despite modern alternatives, these boats remain valued in regions where resources and skills for such craftsmanship are still prevalent.

Inboard craft (IB)

In Inboard craft, engine is permanently fitted inside.

The common types of Inboard fishing craft available are listed below:

Inboard Plank-Built Boat

An inboard plank-built boat is a traditional type of craft where planks are fastened to a framework, typically made of ribs or a keel, to form the hull. This design is similar to the outboard plank-built boat, but the primary distinction is that inboard plank-built boats are generally larger in size. The

inboard design offers better structural support, durability and capacity.

In northern parts of Karnataka some of the inboards have been fitted with outrigger as shown in the picture.

Inboard Fiberglass Boat

An inboard fiberglass boat is similar to an outboard fiberglass boat but larger in size. The main difference is that the engine is fitted inside the hull, rather than being mounted externally as in outboard boats. This helps in achieving better stability and weight distribution, which aides in balancing the boat, especially in rougher waters.

III. Non-Motorized (NM)

Non-motorized craft are traditional craft without any engines.

Non-Motorized Catamaran

A non-motorized catamaran (locally known as Kattumaram) is a traditional fishing craft made by tying together 3-5 logs rarely 7 logs (measuring about 3-6 m and rarely 7 m in length) to form a stable structure. It is propelled by paddles and sometimes uses a sail in windy conditions. The logs are often sourced from the Kapok tree, a lightweight, buoyant wood ideal for creating the raft-like structure. It is especially favoured for its ease of construction, requiring minimal materials.

Non-Motorized Dugout Canoe

A non-motorized dugout canoe is a traditional type of canoe made by hollowing out the inner part of a large tree trunk, typically using hand tools. The canoe is manually propelled with paddles and is often used for fishing in shallow waters. In Kerala, mango tree trunks are often used. Despite being functional and sustainable, the non-motorized dugout canoe is rare due to the rise of modern crafts and engines.
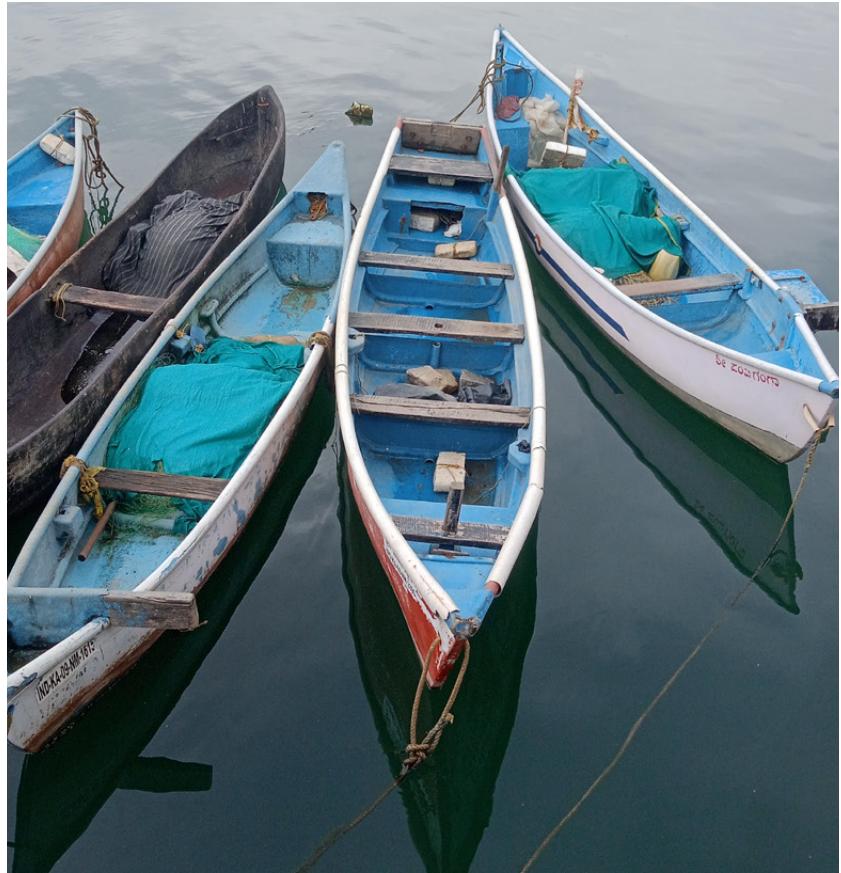
Dugout Canoe craft is second from the left

Non-Motorized Fibre Boat

The non-motorized fibre boat is a modern, lightweight craft that has rapidly gained popularity, especially in fishing communities, as an efficient replacement for traditional catamarans. It is commonly used for nearshore fishing.

This craft is constructed entirely from fiberglass using a mould. Fiberglass is durable, lightweight, and resistant to corrosion and decay, making it an excellent choice for marine environments. The craft's light weight ensures ease of handling and transport. These boats are typically streamlined and moulded for stability and efficiency in water, enabling smooth navigation.

Unlike wooden catamarans, fibre boats are resistant to rot, pests and is suitable for prolonged exposure to saltwater. It requires minimal maintenance and is cost-effective due to mass production using mould.

Non-Motorized Outrigger Canoe

A non-motorized outrigger canoe is a traditional type of canoe that is equipped with lateral support floats called outriggers, which are fastened to one or both sides of the main hull to provide additional stability and prevent tipping. They are manually propelled using paddles and are designed for small-scale fishing. Nowadays they are mostly found in the northern parts of Karnataka.

Non-Motorized Plank-Built Boat

A non-motorized plank-built boat is a traditional fishing craft made from wooden planks that are held together with coir ropes and iron nails, with gaps sealed using cashew tree resin and coal tar for waterproofing and durability. These crafts are made from wooden planks, typically sourced from trees like Artocarpus (in Kerala) and the use of natural materials like coir ropes and resin not only provides a sustainable option for boat construction but it is also environment friendly.

Non-Motorized Thermocol Boat

A non-motorized thermocol boat is a lightweight, simple craft made by combining thermocol (polystyrene foam) pieces, which are then wrapped in a thick plastic sheet to form the boat or raftlike structure. Typically used for near-shore fishing, this craft is incredibly lightweight, making it easy to handle and easy to repair. Typically, these are non-motorized, relying on manual propulsion using paddles but nowadays small engines are also

fitted changing their category into a motorized thermocol craft.

Now a days mechanized crafts have indulged in a lot of innovations like the solar powered crafts, wherein the solar energy is utilised for the lights and storage, some of them do carry small generators for light fishing as observed in light fishing purse seiner crafts in some parts of India.

Fishing Gears

Fishing gear refers to the device used to catch fish, wherein the fish gets entangled, hooked or gilled owing to an interaction triggered by the motion of the animal and makeup of the device. Fishing gears are categorized based on the mode of fishing used. While observation, the field officials should note mesh size and material of the gear. It is very important for them to have a thorough knowledge about the fishing methodology involved in each gear.

◆ If the gear is pulled through the water by human or engine power it is known as Active gear. Eg. Trawlnet, Purseseine, Ringseine

◆ If the gear is stationary allowing the target species to approach the gear it is known as passive gear. Eg. Gillnet, Dolnet, Trammelnet.

Major types of fishing are trawling, seining/surrounding, gilling, lining etc.

Common types of fishing gears are listed below.

Trawl Net

The trawl net is one of the most widely used fishing gears in the modern fishing industry, particularly for commercial fishing operations. It is designed to capture fish by dragging a conical net through the water, either along the seafloor (bottom trawling) or in midwater (pelagic trawling). Various types of trawl nets are present but commonly found trawl net type is otter board trawl used in bottom trawling.

The net tapers from a wide opening at the front to a narrow cod-end at the rear, where the fish are collected. The head rope is fitted with floats, which keep the upper part of the net elevated. The foot rope is weighted with leads, ensuring the lower edge stays close to the seabed. Otter boards are flat, hydrodynamic panels attached to the net by ropes and maintain the horizontal opening of the net by spreading it apart as water pressure acts on them during towing. Long ropes called bridles and sweeps connect the otter boards to the towing cables and the trawl net, guiding fish into the net. The rear end of the net where the catch accumulates is called cod-end. The mesh size of the cod-end can be adjusted to allow smaller, non-target

species to escape. Nowadays instead of diamond shaped cod-end mesh square type cod-end mesh is preferred for reducing the capture of juveniles.

The trawl net is lowered into the water and towed by the fishing vessel. The otter boards spread the net horizontally, while the head and foot ropes keep the vertical opening wide. The net is dragged along the seafloor, disturbing sediment and flushing fish into the net. Fish and other marine organisms are funnelled into the cod-end, where they are trapped. The net is hauled back to the vessel, and the catch is emptied for sorting and storage. The Actual fishing hours (AFH) i.e. the time taken for one haul is usually 2-3 hrs for a normal trawling and 4-5 hrs in the case of a deep-sea trawling.

Demersal fishes, prawns and cephalopods are the usual targets. High efficiency and adaptability are the advantages while bycatch, habitat destruction and overfishing are the issues faced which could be reduced by mesh size regulations, closed seasons and Bycatch Reduction Devices (BRDs).

Shore Seine

The shore seine is a traditional fishing method, once popular, particularly in coastal areas, for capturing fish in shallow waters near the shore. It involves deploying a net from the beach by a craft and manually hauling it back to trap fish.

The net's construction allows it to conform to the shape of the sea bottom, minimizing escape routes for the fish. The front end has loose netting and the rear end of the net forms a bag or cod-end where the fish accumulate as the net is hauled in.

The fishing process begins with spotting a shoal of fish from the beach, often done by experienced fishers using visual observation. One end of the rope is held stationary on the beach. A boat or small craft carries the other end of the net, along with the bag-like part, out into the water to encircle the shoal. The boat returns to shore, bringing the free end of the net to the beach. Both ends of the net are then pulled simultaneously by fishers on the shore. The upper line is kept above the water surface while the lower line stays at the seabed, creating a funnel-like motion that directs fish into the bag-like portion at the end. The usually the operation will be over by 2-3 hrs(AFH).

Simple, requiring minimal equipment, operating close to shore, making it accessible to small-scale fishers and people's participatory are the advantages while labour-Intensive, risk of catching juveniles are the disadvantages observed.

Purse Seine

The purse seine is a highly effective fishing method for capturing large shoals of pelagic fish. It involves a coordinated effort to encircle and trap the fish using a specially designed net.

The net consists of a long vertical wall of mesh, designed to surround the shoal completely. The float line is equipped with floats arranged closely, to keep the net afloat. The lead line is weighted with larger leads to ensure the net sinks quickly and fully encircles the shoal. A purse line runs through these rings and is used to close the net underneath the shoal, like a drawstring on a purse.

Fish shoals are located visually or with the help of fish-finding equipment. A dinghy holds one end of the net, while the purse seiner boat encircles the

shoal with the other end, releasing the net to form a circular trap. Once the shoal is surrounded, the purse line running through the rings is pulled. This action tightens the net from below, closing it and trapping the fish inside. The net, now containing the trapped fish, is pulled towards the purse seiner boat. The fishes are then scooped from the net into the craft. The usual AFH observed is 2-3hrs depending on the shoal size and the fish caught.

The commonly observed mesh size of Purse seine is 35 – 40 mm, targeting the shoals of Tunas, Carangids and bigger size fishes of *Rastrelliger kanagurta* (Indian mackerel) and *Sardinella longiceps* (Oil sardine). This net is efficient for capturing large volumes of fish in a single operation, minimizes the escape of target species due to the purse line closure mechanism and suitable for targeting pelagic species but bycatch and juvenile catch could be regulated.

Ring seine

The ring seine net and fishing method bear similarities to the purse seine, a widely used gear for encircling and capturing shoals of fish. The operation involves a coordinated effort by the fishing crew and boats to encircle and trap fish schools efficiently.

The process begins with spotting a fish shoal, typically through visual observation. The carrier boat (smaller out board craft, accompanying the mother boat) plays a crucial role in surrounding the fish shoal by deploying the net. The net has rings through which the lower line (purse line) runs. After encircling the shoal, the purse line is pulled, causing the bottom of the net to close like a drawstring bag. This traps the shoal within the net. The upper line rope is hauled back toward the mother craft by a team of 40–50 crew members, ensuring that the fish are securely captured within the net. The trapped fish are scooped into outboard engine-fitted carrier boats, which transport the catch to the landing centre for sale.

The difference between the purse seine and the ring seine is in its targeted species, purse seine with its mesh size ranging between 35-40 mm targets bigger pelagic fishes while the ring seine with its mesh size range of two types 7-10 mm and 18-20 mm targets smaller pelagic fishes. In Kerala the foresaid types are locally called as Thangu vala and Chooda vala respectively and the ring seine nets are much longer than the purse seine net.

Gillnet

Gillnets are a widely used fishing gear designed to target specific fish species based on their size and body structure.

Gillnets are a versatile and widely used fishing tool, characterized by their design as a vertical wall of netting maintained by floats at the top (head rope or float line) and sinkers at the bottom (foot rope or sinker line). This configuration ensures that the net remains upright in the water column, effectively intercepting fish swimming through the area

Their operational efficiency and effectiveness in capturing fish are attributed to the four primary mechanisms of capture: gilling, snagging, wedging, and entangling.

Gilling is the primary capture mechanism. The mesh size is selected so that the fish can partially enter the net. When the fish attempts to withdraw, the mesh slips back over its gill covers, trapping it. Snagging, here the fish is caught when the twine of the mesh tightens around its head, preventing escape. Wedging occurs when the fish is tightly held by the net around its body. This depends on the fish's body shape and the mesh's dimensions. Entangling, here fish gets caught by teeth, spines, or other protruding features without fully entering the mesh. The AFH observed for this net is 1-2 hrs depending upon the availability of the fish.

The design and specifications of gillnets are often tailored to the fish species being targeted. The mesh size, in particular, plays a critical role in ensuring effective capture, as it determines which fish can be caught based on their size and shape. Species-Specific Gillnet, *Sardinella longiceps* locally called "Chala" in Kerala is caught by a gillnet of mesh size of 24-32 mm (ideal mesh size to catch bigger *Sardinella longiceps*) and is having a similar name as 'Chala Vala' locally.

This net reduces the bycatch, focus on economically important species and supports sustainable fishing practices.

Bottom-Set Gillnet

The bottom-set gillnet is a fishing gear designed to capture demersal or bottom-dwelling species. It is a stationary net fixed to the seabed, used widely in artisanal and small-scale fisheries.

The net is long and rectangular, with mesh sizes tailored to the target species. The net is anchored or weighted to ensure it stays fixed on the seabed. Floats may be attached to the head rope to keep the net upright, while the foot rope remains in contact with the bottom. Commonly observed mesh size is 70–110 mm, optimized for catching species like lobsters and crabs but at times often the waste nets of different mesh size is also joined together. In modern operations, GPS is often used to mark and retrieve the net location accurately.

Fisherfolk set out in the evening, deploy the net at the fishing ground, and return to shore. The net is left in the sea overnight. The next morning, they return to retrieve the net and the catch. Here in this case the Actual fishing

hours (AFH) will be almost 10-12 hrs. Another type of fishery observed is that of similar to the gillnet fishery wherein the fishers set out for fishing in the morning and return after 2-3 hrs.

There is an advantage of low manufacturing cost but strong currents can result in displacement of the gear and chances for this net to become a ghost net.

Drift Gillnet

The drift gillnet is a type of passive fishing gear that differs from the bottom-set gillnet in that it is not anchored to the seabed but instead drifts along with the current. This method is often employed for catching pelagic species, typically during the night, when many fish species are more active near the surface.

The net is not fixed to the seabed but is designed to drift freely with the ocean current. It is usually made of polyfilament cotton. Floats are attached to the head rope to keep the top of the net at or near the water's surface. The foot rope is often weighted, but it is not as fixed as in bottom-set gillnets, allowing the net to drift along with the current. Drift gillnets can be quite long, often several hundred meters, depending on the fishing operation. The AFH for this net ranges from 5-8 hrs usually and may be more.

The net typically comes in two mesh size ranges 60–80 mm, used for targeting smaller pelagic species and 100–130 mm, used for catching larger pelagic species. Efficient for Pelagic Species, low impact on seafloor habitat, flexible to cover large area and low chances to get juveniles but highly dependent on weather.

Trammel Net

The trammel net is a specialized type of fishing gear that is designed to capture fish, particularly in bottom-set operations. Unlike standard gillnets, the trammel net has a unique three-layer netting that allows it to catch target species using a combination of different fishing mechanisms, such as gilling, snagging, wedging, entangling, and pouching.

Outer Layers: The net consists of two outer layers with larger mesh sizes (usually made from polyfilament cotton or monofilament nylon). Inner Layer: A third inner layer, with a smaller mesh size, is placed between the outer layers. This inner net is where most of the pouching happens, as it forms the "pouch" that captures fish, crabs, cephalopods and prawns.

Two types of trammel nets are observed : one targeting the prawns and the other for squids. The net targeting prawns has outer mesh size of 50-55 mm and inner mesh size of 30-35mm with lesser AFH. The other one has an outer mesh size of 200-220 mm and inner mesh size of 90-110 mm.

Hooks and Lines

Hooks and line fishing is a traditional and widely used fishing method characterized by simplicity and effectiveness. The size of the hook is inversely proportional to the number of the hook i.e. the hook number one will be of the largest size.

In this gear, a fish is attracted using natural bait (like worms or small fish) or artificial bait (lures) attached to a hook. The hook is secured to the end of a line or snood (a short length of line connected to the mainline). The baited hook entices fish to bite. Once caught, the hook holds the fish securely. The system can be used individually (e.g., handline fishing) or in a large-scale setup with numerous hooks, as in longline fishing. Hooks and lines can actively target fish within a certain range (e.g., jigging) or passively wait for fish to bite (e.g., longlining).

Longline Fishing is an advanced form of hook-and-line fishing that uses a larger setup for efficiency. A main line or central line, often stretching for significant lengths. Snoods are shorter lines branching off the mainline, each fitted with baited hooks. Hooks are spaced at regular intervals along the mainline, maximizing coverage and catch potential.

Jig fishery is also observed in the Indian waters. Based on the type of fishery there are two types of jigs. The first one is used for the squids where the jig is immersed in a potential area where the squids could be detected. The squid getting attracted would hold onto the jig which would be lifted along with the jig out of the water. The second jig which is called fish jig has a resemblance to that of a fish. This jig is immersed and dragged along with the craft, the fishes especially *Scomberomorus commerson* would be attracted and get caught in this type of jig.

Hooks with lure

Squid jig

Fish jig

Bagnet

Bagnet is a type of fishing gear commonly used to catch nearshore fish species. Conical in shape with relatively very small mesh size. Primarily used to catch *Acetes* spp, small clupeids (e.g., sardines, anchovies). Typically operated by pulling the gear from the back of a craft.

Dol net

Dol net is a specialized type of fishing gear often referred to as fixed bag nets or set bag nets.

Traditionally made of cotton, but HDPE (High-Density Polyethylene) is now commonly used due to its durability and resistance to water and wear. Resembles a bag net, but it is designed to be stationary, fixed in place with poles or heaps of stones.

Deployed in tidal waters to take advantage of natural tidal currents. The net is securely tied to poles or to anchored structures. Fish that cannot swim fast enough to resist the tidal current are carried into the net. This makes the dol net a passive fishing method, relying on tidal flow to guide the fish into the cod-end (the terminal part of the net where fish are collected). Fishing activity is timed with the tidal cycle, utilizing the 4–5-hour interval between high and low tide for optimal catch so that just before the reversal of each tide the fish would be collected from the cod end of the net. Fisherfolk prefer periods of 4-5 days before the full moon or new moon, when tidal currents are strongest, ensuring better catch rates. This fishing activity can extend up to 10 days, depending on the lunar cycle.

Cast net

A cast net is a type of fishing net used to catch small fish, typically for bait or food. It is distinguished by its cone-shaped design and is constructed by joining multiple pieces of netting to form a cohesive, functional structure.

The net is assembled from separate pieces of mesh to create a cone-like shape. This shape allows the net to expand and spread out when thrown into the water. The edge of the net is lined with weights, usually made of lead or other dense materials. These weights help the net sink quickly to trap fish before they can swim away. A drawstring is attached around the perimeter of the net. When the drawstring is pulled, it closes the net at the bottom, trapping any fish caught inside.

The cast net is thrown by hand in a spinning motion to spread it open as it falls over a targeted area. Once the net hits the water, the weights cause it to sink and encircle the fish below. The fisher retrieves the net by pulling the drawstring, closing the net and securing the catch.

Trap nets

Trap Nets are an efficient and traditional fishing gear primarily designed to target crabs, *Babylonia* spp, and other bottom-dwelling species.

The trap net consists of an enclosure designed to capture marine species that enters but cannot easily escape. Decayed fish or other attractants like chicken waste are placed inside the trap to lure target species. The trap is sunk to the bottom of the water using ropes and weights to ensure it stays in place. After 2-3 hours (AFH), the trap is lifted to collect the catch.

Scoop net

Scooping is a simple and traditional fishing technique commonly practiced in regions like Tamil Nadu and Kerala, using either natural ambient light or artificial lighting to attract fish.

Fisherfolk manually scoop fish from sea surface using scoop net during periods of fish activity. Due to the abundance of fish, there were instances where the trigger fishes were scooped out of the surface of the sea.

Artificial lights (often lanterns or electric bulbs) are used to attract fish to

the surface, especially at night. Fish are drawn to the illuminated area due to their natural attraction to light (phototaxis). Once a sufficient concentration of fish gathers, a scoop net is used to capture them.

Handpicking

Handpicking is a traditional and sustainable fishing method used in coastal regions for harvesting specific marine resources like mussels and gastropods. Mainly observed in the near-shore waters of Tamil Nadu, Kerala, and Maharashtra.

Green mussels attach themselves firmly to sea rocks using byssal threads. Fishermen use chisels to carefully dislodge the mussels without damaging them or the rocks. This method ensures a selective harvest and helps maintain the ecosystem's balance.

Fishermen wear durable hand gloves to protect against the rough shells of gastropods. They manually pick gastropods from rocky or sandy substrates in shallow waters.

Fishery using shells as traps

These traps are made from the shells of gastropods like *Tona dolium* and *Chicoreus virgineus* which are used like beads along a long polythene rope which is immersed into the sea. The octopus *Amphioctopus aegina* has a unique habit of entering into an empty shell if available. Seeking shelter, the octopus enter into these shells. After 2-3 hrs the trap that is the shell along with the octopus would be taken back by the fisherfolks.

Tona dolium shells
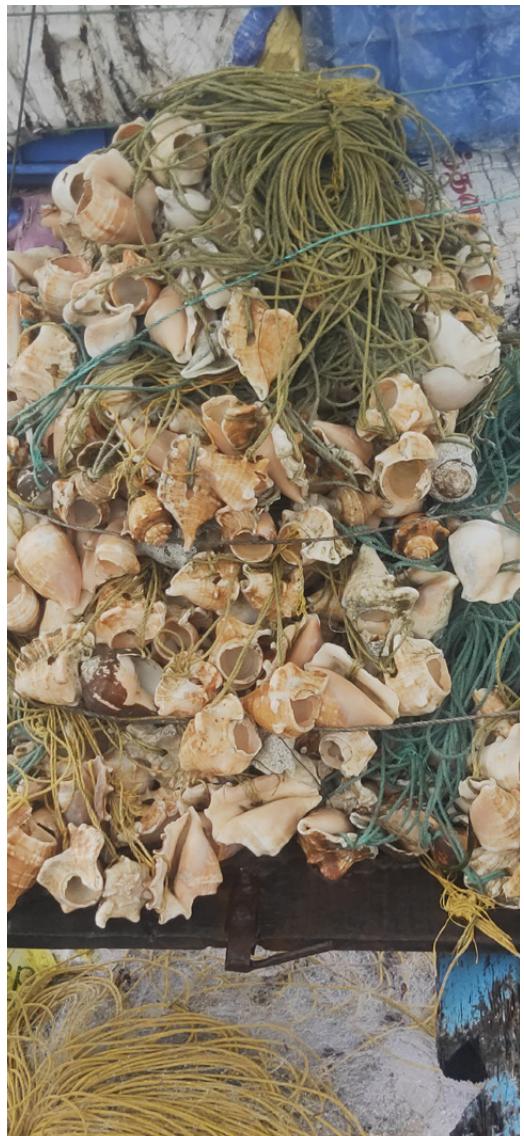
Chicoreus virgineus shells

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Notes

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