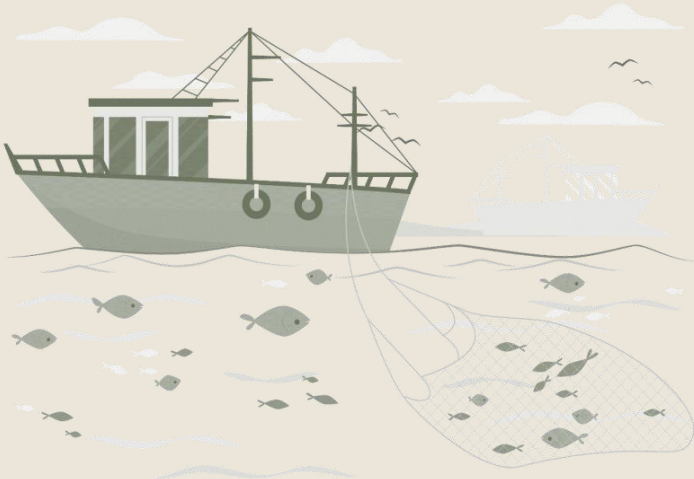




19TH WORKING PARTY ON DATA COLLECTION AND STATISTICS MEETING (WPDCS19)



Methodology for the Estimation of Marine Fishery Resources in India



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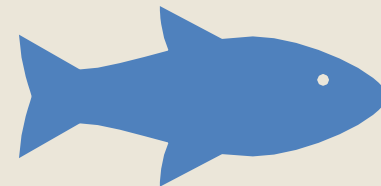


ICAR- Central Marine Fisheries Research Institute



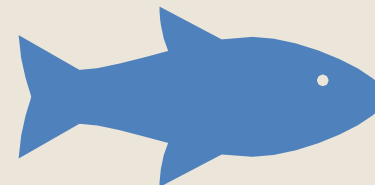
Fisheries scenario

- **India - third largest fish-producing country**
- **Contributes 8 per cent to the global fish production**
- **Ranks second in aquaculture production.**
- **The fish production in 2021-22 (April-March) is 16.24 Million Tonnes comprising of marine fish production of 4.12 Million Tonnes and 12.12 Million Tonnes from Aquaculture.**
- **Fisheries contribute 1.1% to India's economy**

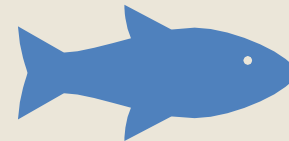


Fisheries scenario

- **Marine fisheries – mainly artisanal/small-scale**
- **All vessels are <24 m OAL**
- **Deploys both mechanized and motorized boats, using a variety of gear**
- **The Lakshadweep group of Islands located in the Arabian Sea (FAO Area 51) use artisanal pole and line targeting the surface swimming oceanic species, primarily the skipjack tunas.**



Fisheries scenario



- **India - long coastline of 8118 km**
- **Continental shelf area 0.53 million square km**
- **Have exclusive rights over the marine living and non-living resources of 2.02 million square km EEZ.**
- **Marine fisheries - important role in the food and nutritional security, livelihoods and economic prosperity of the nation.**
- **Major source of employment and livelihoods for one million coastal fishermen and households**
- **Multiplier employment in the ancillary activities like fish processing and marketing.**
- **Government of India had been keen on the sustainable harvest for perpetuity of fisheries resources**

Monitoring and Assessment of Indian Marine Fishery Resources

Accomplished by two approaches

- Sampling done at Landing Centres (by Central Marine Fisheries Research Institute (CMFRI) & Fisheries Departments of State Governments/Union Territories (UT)):- **Marine Fish Landings Estimation in India**
- Exploratory surveys at Sea (by Fishery Survey of India, FSI)

Monitoring and Assessment of Marine Fishery Resources



Information on

- **catch**
- **effort**
- **biological aspects**
- **socio-economic aspects**

Essential requirements for
assessing the exploited stock

Monitoring and Assessment of Marine Fishery Resources

Why monitoring of resources ?

Marine fisheries resources are invisible, frequently migrating and easily affected by the changes in the sea. These characteristics make it unique and complex and hence difficult to monitor, manage and intervene.

- **Productivity of the seas**
- **The availability of fish at given point of time**
- **The fishing effort expended**
- **Accessibility and vulnerability of the resources**



Marine Fisheries Data Collection

India is one among few countries where a system based on sampling theory is used to collect marine fish catch statistics.

H HISTORY.



Initiated the process of collection of data on marine fish catch, effort, biological parameters etc.

1947



Pilot surveys along the Malabar coast by IASRI based on a three stage stratified sampling

1949



Initiated marine fish landings data collection along the west coast through stratified multistage sampling design

1959



The stratified multistage random sampling design for the entire coast became operational

1961



Sampling scheme evaluated by independent statistical experts (NIO)

1972

Marine Fisheries Data Collection

Why Sampling ?

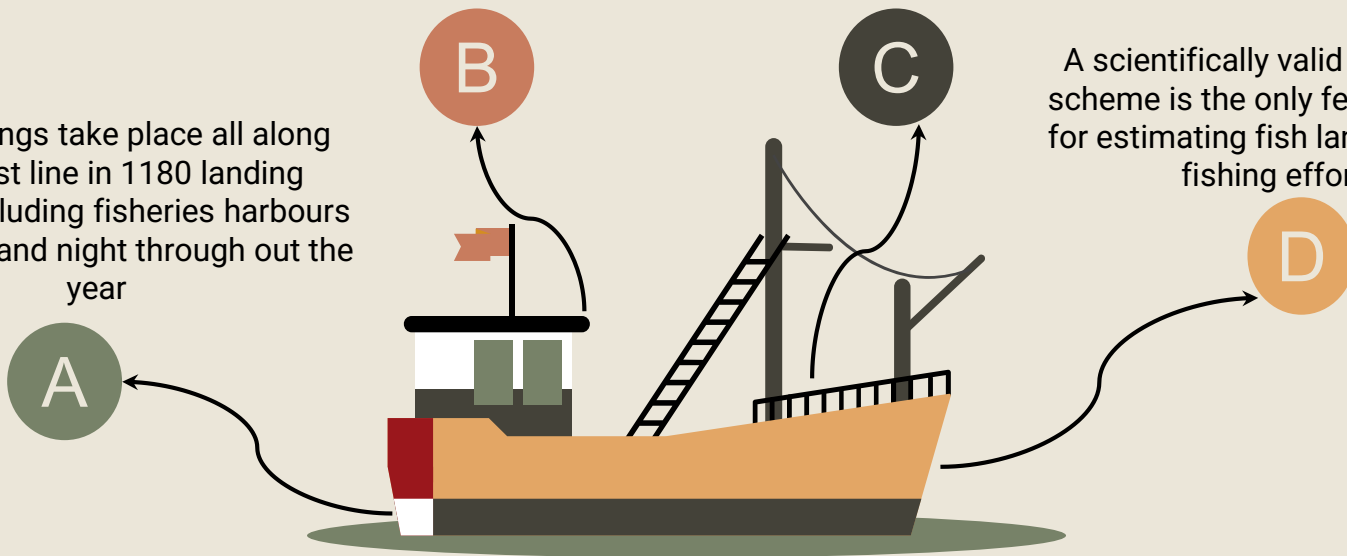
In 2022, there were 55,05,971 boat trips in the landing centres to be enumerated for arriving at exact landings figure

We require 30,588 man days/year for complete enumeration

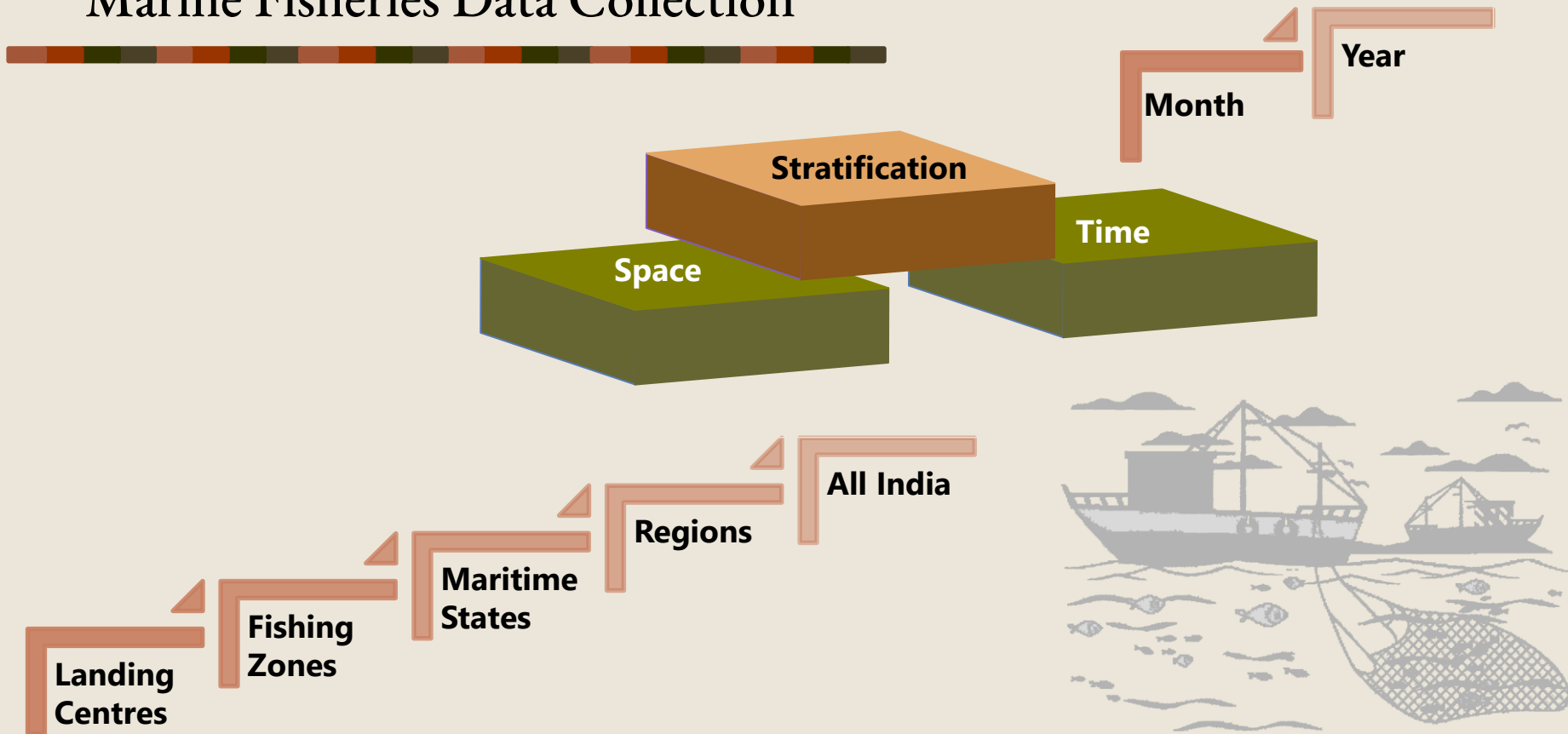


Fish landings take place all along the coast line in 1180 landing centres including fisheries harbours during day and night through out the year

A scientifically valid sampling scheme is the only feasible way for estimating fish landings and fishing effort



Marine Fisheries Data Collection



Stratification

Space

Time

Month

Year

Landing Centres

Fishing Zones

Maritime States

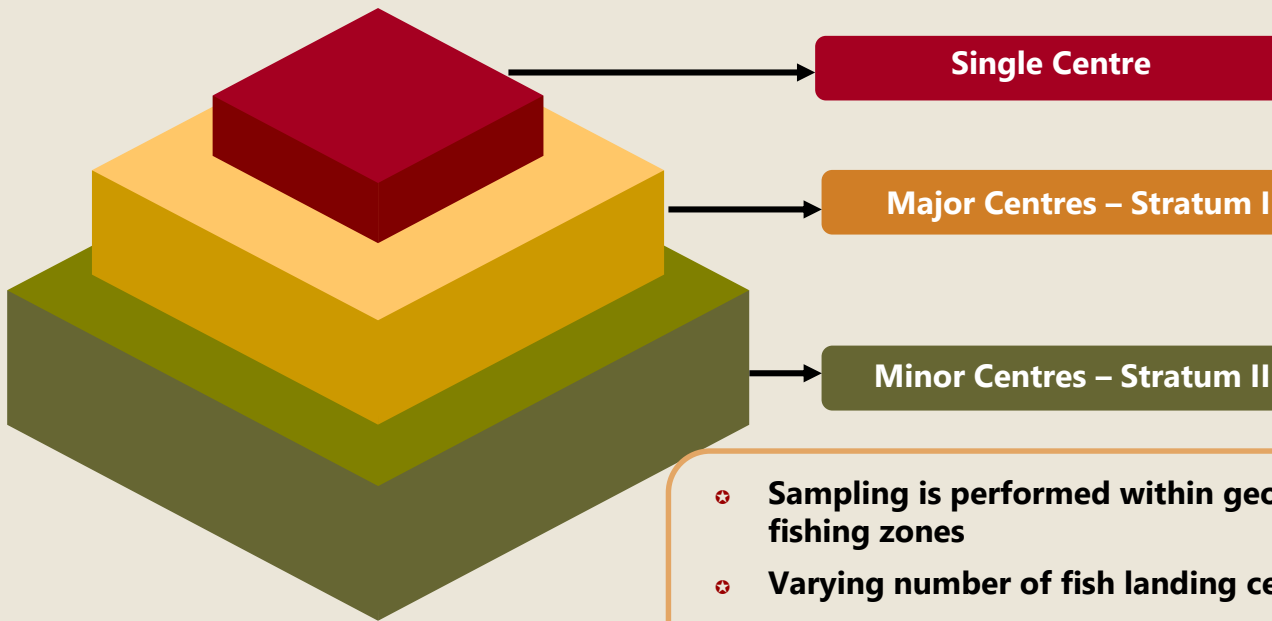
Regions

All India

Marine Fisheries Data Collection

Stratified Multistage Random Sampling Design

Number of landing centres



Criteria for stratification within fishing zones

- ✦ variation in fishing intensity
- ✦ type of fishing craft and fishing method
- ✦ Number of fishing crafts

- ✦ Sampling is performed within geographical areas referred as fishing zones
- ✦ Varying number of fish landing centres fall under fishing zones
- ✦ Single centre zones - Landing centres with relatively high intensity of fishing activity

Marine Fisheries Data Collection

Stratified Multistage Random Sampling Design

Primary Stage Unit
Landing centre day



Second Stage Unit
Fishing boats

Selection of Second Stage Units

- Not practical to record the catches of all fishing units (boats) landed
- Sampling of the units becomes essential



Marine Fisheries Data Collection

Selection of Primary Stage Units

- ✧ A month is divided into 3 groups, each of 10 days
- ✧ From the first five days of a month, a day is selected at random
- ✧ Then, the next 5 consecutive days are automatically selected

Time strata	Days in a month									
1	1	2	3	4	5	6	7	8	9	10
2	11	12	13	14	15	16	17	18	19	20
3	21	22	23	24	25	26	27	28	29	30



Marine Fisheries Data Collection

Selection of Primary Stage Units

- ✧ From this, three clusters of two consecutive days are formed.
- ✧ In the remaining ten day groups, the clusters are systematically selected with an interval of 10 days.

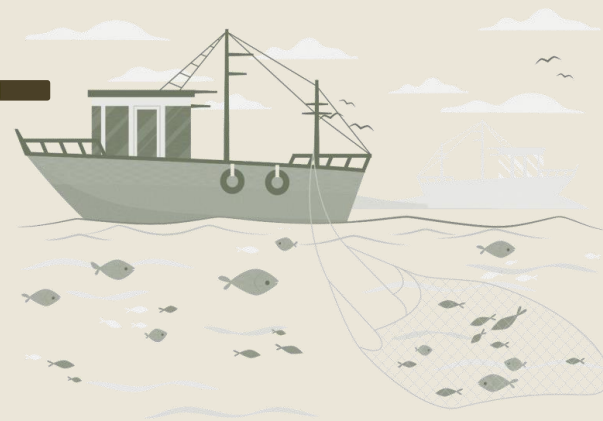
Time strata	Days in a month									
	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	11	12	13	14	15	16	17	18	19	20
3	21	22	23	24	25	26	27	28	29	30



Marine Fisheries Data Collection

Fishing unit - Secondary stage unit

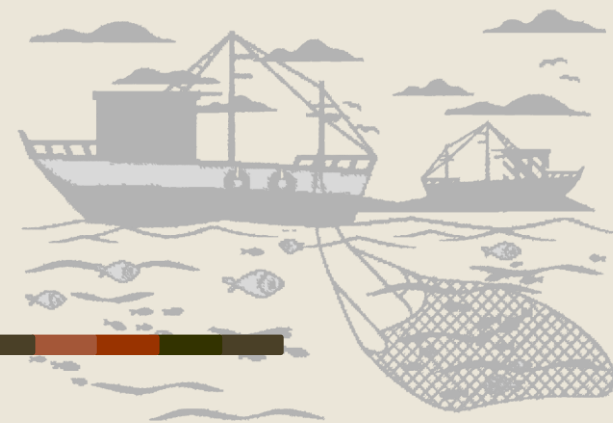
Period	Duration
Period 1	1200 to 1800 hours on 1 st day
Period 2	1800 hours to next morning 0600 hour
Period 3	0600 to 1200 hours on 2 nd day



Marine Fisheries Data Collection

Period of Observation

Number of Boats landed	Fraction to be observed
Less than or equal to 15	100%
Between 16 and 19	First 10 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



Marine Fisheries Data Collection

Recording of Fish Landings



Fishing Effort

Gears operated

Other details

1st

2nd

3rd

4th

5th

6th

Species wise catch

Type of Crafts

Hauls

Marine Fisheries Data Collection



Marine Fisheries Data Collection

FCSA Mobile App

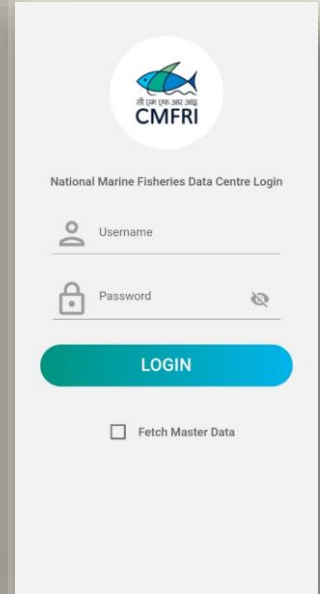
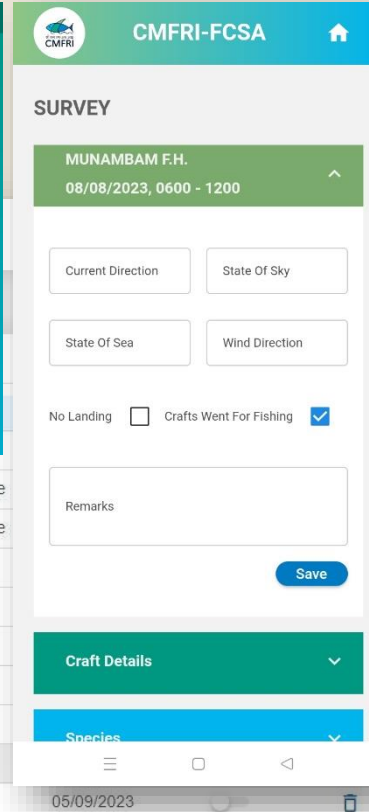
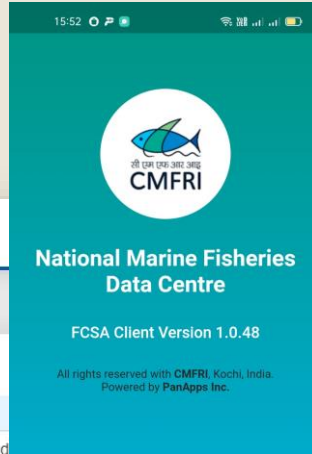


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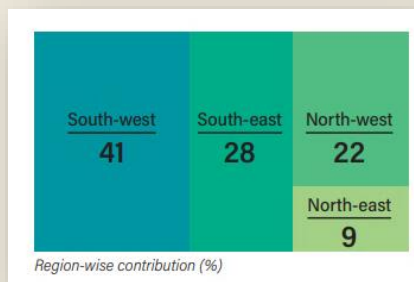
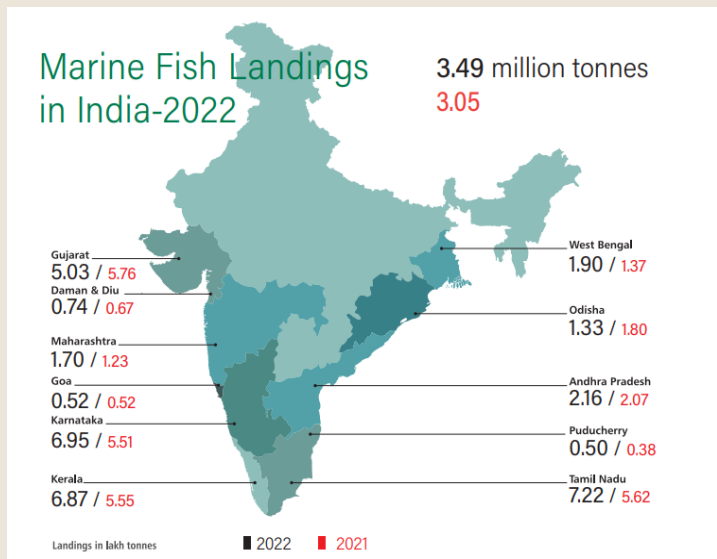
APPLICATION ▾

Work Program

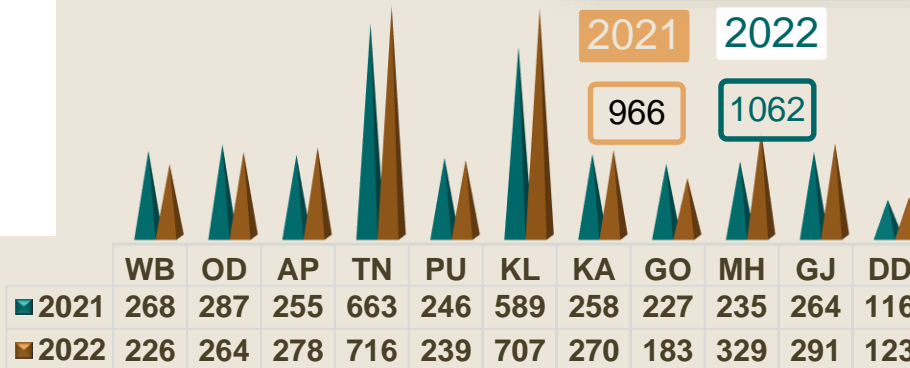
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<input type="checkbox"/> WP0863	Jishnudev	2023	September	Approved	
<input type="checkbox"/> WP0862	Kishor.T.G	2023	September	Approved	Sindhu K Augustine
<input type="checkbox"/> WP0861	Paulose Jacob Peter	2023	September	Approved	Sindhu K Augustine
<input type="checkbox"/> WP0860	Assyst Field Staff	2023	September	Approved	System Admin
<input type="checkbox"/> WP0859	Ravichandra Angadi	2023	September	Approved	System Admin
<input type="checkbox"/> WP0858	Suraj Surendra Kalgutkar	2023	September	Approved	System Admin
<input type="checkbox"/> WP0857	Nagaraj Keshav Kharvi	2023	September	Approved	System Admin
<input type="checkbox"/> WP0856	Mohan Kumar	2023	September	Approved	System Admin
<input type="checkbox"/> WP0855	Midhun Muthayan	2023	September	Pending	System Admin
<input type="checkbox"/> WP0854	R. Rajkumar	2023	September	Pending	System Admin



Monitoring and Assessment of Indian Marine Fishery Resources

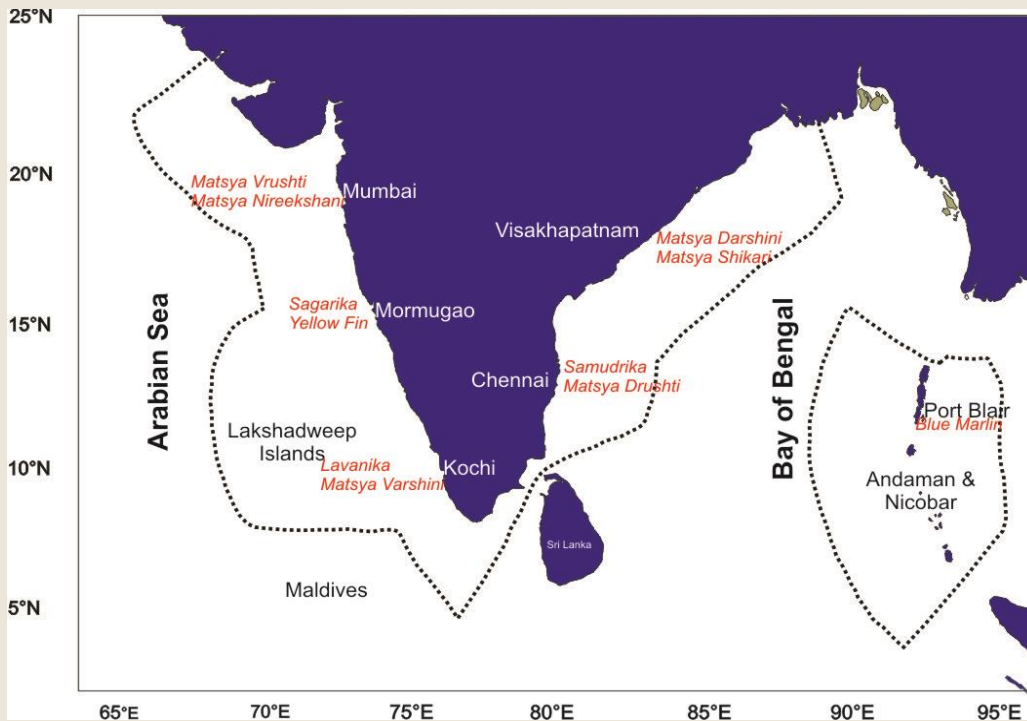


Estimates for the Mainland of India



Number of Species in Landings

Exploratory surveys at Sea (FSI)



11 survey vessels
operated from
bases distributed
all along Indian
coasts

Exploratory surveys at Sea (FSI)

Fishery Survey of India (FSI) operational Bases and survey vessels

Name of FSI Base office	Name of vessel	Vessel type	OAL (m)	GRT	BHP
Mumbai	<i>Matsya Vrushti</i>	Longliner	37.5	465	1215
	<i>Matsya Nireekshani</i>	Stern trawler	40.5	329.3	2030
Mormugao	<i>Yellow Fin</i>	Longliner	35.7	310	800
	<i>Sagarika</i>	Stern trawler	28.8	189	650
Kochi	<i>Matsya Varshini</i>	Trawler-cum-purse seiner	36.5	268.8	1160
	<i>Lavanika</i>	Stern trawler	24	151	500
Chennai	<i>Matsya Drushti</i>	Longliner	37.5	465	1215
	<i>Samudrika</i>	Stern trawler	28.8	189	650
Visakhapatnam	<i>Matsya Shikari</i>	Stern trawler	39.8	352.4	1740
	<i>Matsya Darshini</i>	Trawler-cum-purse seiner	36.5	268.8	1160
Port Blair	<i>Blue Marlin</i>	Longliner	35.7	310	800

Survey Components

A decorative horizontal bar with a repeating pattern of small squares in shades of brown, green, and orange.

- ✦ **Demersal resources survey and research programme along the coasts of India**
- ✦ **Survey of oceanic tuna and allied resources in the Indian EEZ**
- ✦ **Pelagic resources surveys in the continental shelf areas using pelagic trawls and drift gillnets and**
- ✦ **Experimental fishing with traps, hand line, purse seining, squid jigging, bottom set longlining, trawling and bottom set vertical long lining.**

Objectives

A decorative horizontal bar consisting of a series of small, alternating colored squares in shades of brown, green, and orange.

- ✧ **Spatio-temporal estimation of abundance indices**
- ✧ **Estimation of biomass of selected species**
- ✧ **Collection of length, weight and other biological data for studying diet, reproduction etc. and estimation of growth and mortality parameters**
- ✧ **Collection of environmental data**

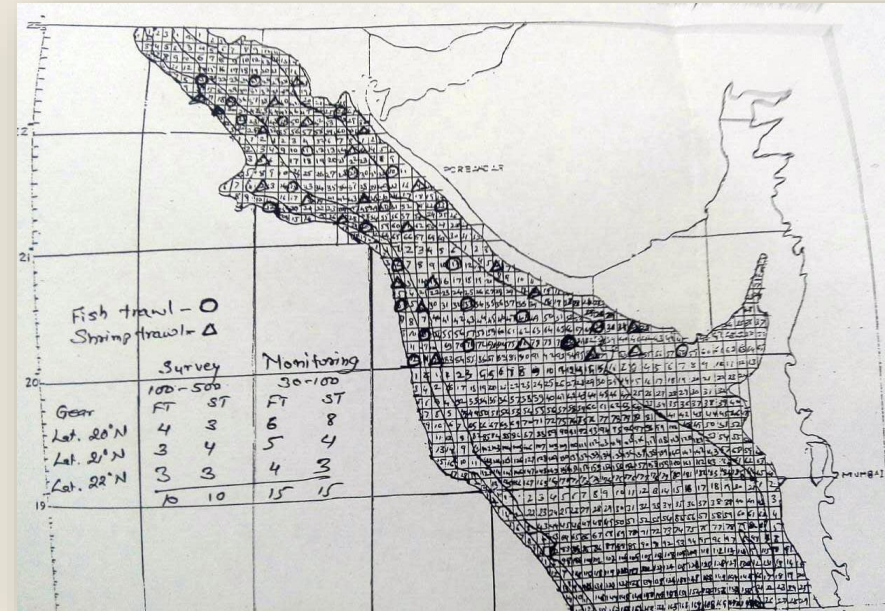
Biomass estimation

A decorative horizontal bar consisting of a series of colored squares in shades of brown, orange, and green.

- ✧ **Stratified random sampling design – stratification based on geographic location, bathymetry and month.**
- ✧ **The survey activities, except oceanic fishery survey is limited to the 500m depth contour**
- ✧ **Stratification in terms of bathymetry is 20-30m, 30-50m, 50-100m, 100-200m and 200-500m.**
- ✧ **The sampling units are demarcated on the basis of one degree latitude and one degree longitude, which is further divided into sub-areas at the level of 6 minutes latitude and 6 minutes longitude.**

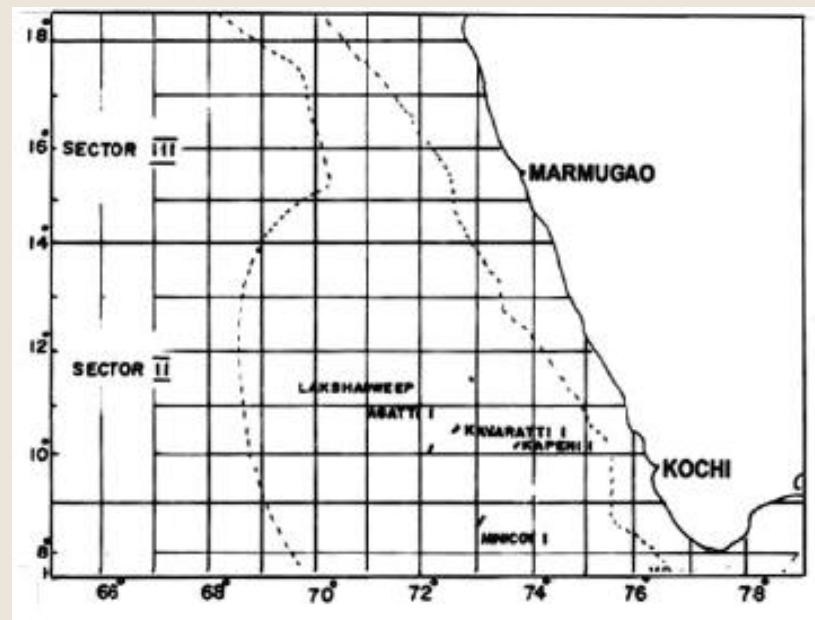
Biomass estimation

- ★ The unit sampling area will thus measure 36 sq. nautical miles (123.47 sq. Km).
- ★ The sampling stations are usually selected so as to ensure that sampling unit is sampled at least once in three months



Oceanic Survey

- For oceanic fishery survey, Systematic Sampling is employed in a given area by exploring each 1 degree latitude X 1 degree longitude square at least once in three months. The shore-ward limit for exploration in squares selected was 500m depth contour.



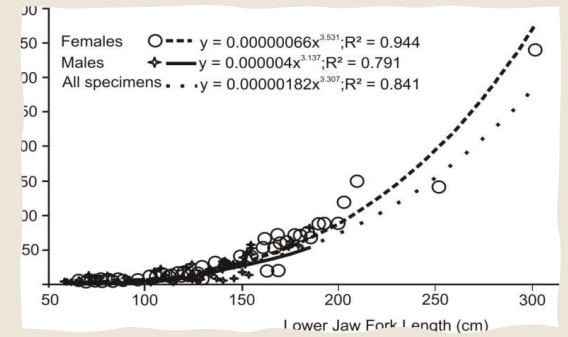
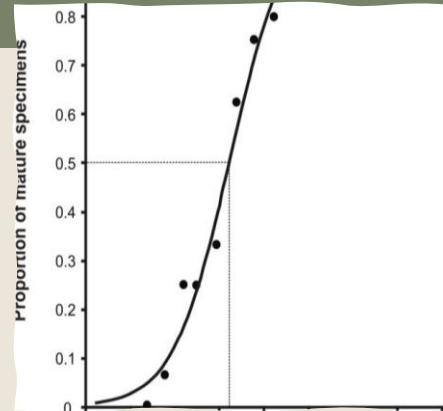
Every month, the survey vessels are deployed for fishing voyages lasting 20 days. At least one Scientist from FSI invariably participates in each voyage, who collects the crucial species-wise data on the catch and effort, length, biology and oceanographic data as per the log sheets designed for this purpose.



Biological/Growth Studies

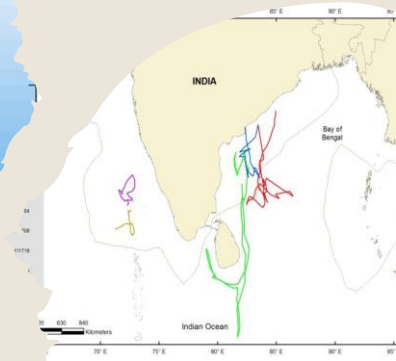
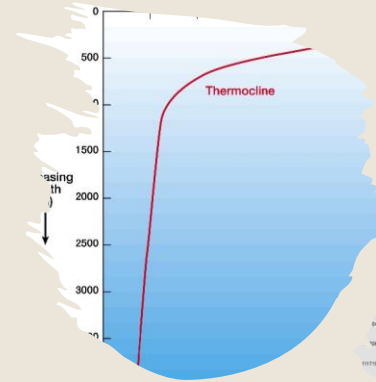
Length-weight, morphometry, food and feeding and reproduction of yellowfin tuna, sharks, sailfish, swordfish, marlins, dolphinfishes, lancetfish etc.

- Growth parameters studied mainly using length based models
- Yellowfin tuna, swordfish, sailfish, sharks etc.



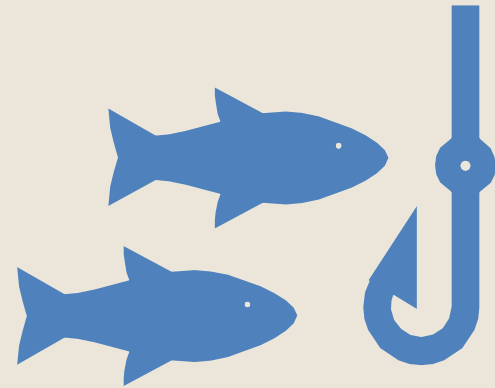
Ongoing Research

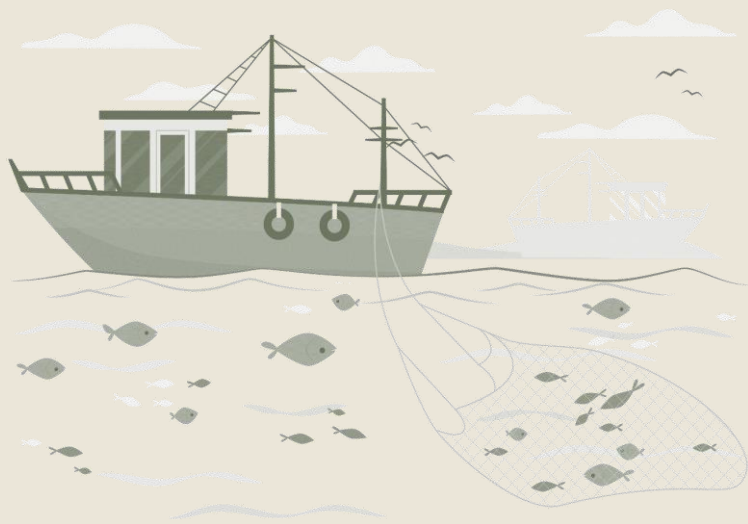
- Environmental preference of yellowfin tunas studied
- Relationship with SST, MLD and thermocline depth and tuna abundance established
- **Locating Tuna habitat through Satellite Remote Sensing** in collaboration with Space Application Centre (SAC)
- **Satellite Telemetry Studies on Migration Patterns of Tunas in the Indian Seas (SATTUNA)**
- Marine mammal Stock assessment in India project
- Predicting the areas of abundance of marine megafauna
- Research towards refining the fish ban period on east and west coasts



Latest developments

- 3477 *Sagar Mitras* (Friends of Sea) deployed, one each at every coastal fishing village to collect data on fish landing, welfare etc.
- Vessel tracking and communication system: transponders being installed onboard all mechanised fishing boats/vessels (mobile satellite services – MSS) to establish vessel communication and support system – two-way communication





Thank you
