

**ESTIMATION OF MARINE FISH LANDINGS DATA FROM THE
POTENTIAL IMPACT ZONES OF VIZHINJAM INTERNATIONAL
SEAPORT, KERALA, INDIA**



FINAL REPORT

Prepared for Adani Vizhinjam Port Pvt. Ltd. (AVPPL)

JUNE 2021-JULY 2022



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(ICAR)
VIZHINJAM REGIONAL CENTRE



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SUBMITTED TO:

Adani Vizhinjam Port Pvt. Ltd. (AVPPL)

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VIZHINJAM REGIONAL CENTER

CONTENTS

Sl.No	Title	Page no.
1	Preface	1
2	Executive summary	2
3	The team	5
4	List of tables	6
5	List of plates	8
6	List of figures	9
7	Back ground	12
8	Introduction	13
8.1	Objectives of study	14
9	Methodology for the estimation of marine fish landings in India	15
9.1	Study area and sampling site	16
9.2	Methodology of Multistage Stratified Random Sampling for fish catch estimation	18
9.3	Sampling plan and details	23
10	Results	30
10.1	General profile of fish landings from 2016-2020 (India, Kerala & Vizhinjam)	30
10.2	Monsoon Season	44
10.2.1	Fish population & its landing	44
10.2.2	Experimental fishing in monsoon season	64
10.3	Post monsoon Season	68
10.3.1	Fish population & its landing	68
10.3.2	Experimental fishing in post monsoon season	89
10.4	Pre-monsoon Season	94
10.4.1	Fish population & its landing	94
10.4.2	Experimental fishing in pre monsoon season	115
10.5	Fishing methods	121
10.6	Seasonal variations in fish catch and fishing operation	136
10.7	Comparison of the present landings with the baseline data	140
11	Summary	144
12	Conclusion & Recommendations	153
13	References	154

1. PREFACE

Adani Vizhinjam Port Private Limited (AVPPL) is currently developing an International Deepwater Multipurpose Seaport at Vizhinjam, Thiruvananthapuram District, Kerala State, in a Public-Private Partnership (PPP) with Government of Kerala, (GoK). The port is located 20 km south of the capital city of Thiruvananthapuram. AVPPL engaged CMFRI to conduct primary surveys, estimate marine fish landing data from the potential impact zones identified in the EIA, and compare with the baseline data. CMFRI signed MOU on the first week of April 2021 and initiated the study with literature review, sampling, and data collection from 01.06.2021 onwards. CMFRI also presented the proposed methodology for estimating marine fish landing study in the NGT committee meetings, and the committee approved the same. Detailed sampling was done with specific targets during the post-monsoon, monsoon, and premonsoon season. The sampling was mainly intended to estimate fish catch data from the potential impact zone, i.e., within the 10 km zone of the port. Twelve landing centres were identified and followed a multistage stratified random sampling design for the fish catch estimation. We thank Dr.Gopalakrishnan, Director, CMFRI, for the great support and encouragement. The support extended by Dr. M.K.Anil, HOC, Vizhinjam and Dr. N.K.Sanil, Chairperson of the consultancy cell (CPC), CMFRI, during the investigations, is also gratefully acknowledged.



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2. EXECUTIVE SUMMARY

During the reporting period (June 2021 to July 2022) for the project entitled ‘Estimation of Marine Fish Landings Data from the Potential Impact Zones of Vizhinjam International Seaport, Kerala, India’, sampling was carried out within 10 km of Vizhinjam International Sea Port project along the three areas, namely, Direct Footprint of development (Zone I), Potential Impact Zone (Zone II), and Control Zone (Zone III) of the project area to estimate the fish population and fish landings during Monsoon, Post-monsoon season and Pre-monsoon season. The study applied the methodology of Multistage Stratified Random Sampling for landing centre and zone-wise fish catch estimation. The work programme involved extensive field studies and sample collections on marine fishery resources within 10 km of the Vizhinjam International Sea Port project, covering three seasons. The month's sampling plan and methodology of estimation are detailed in the report. During the reporting period (June 2021-May 2022), an estimated 23934.03 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise catch analysis depicted that the top landings were recorded during August, followed by December, and the minor catch was recorded during June 2021. Monsoon season (39%) contributed more to the fish landings, followed by post-monsoon (32%) and pre-monsoon season (29%). Landing centres located in zone I (Direct footprint zone) contribute more to the landings (55%), followed by zone II (26%) (Potential impact zone) and zone III (19%) (Control zone). Outboard Gillnet (OBGN), Outboard Hook and Line (OBHL) and Outboard Boat seine (OBBS) were the significant gears operated during the study period. The percentage contribution of OBBS was maximum to the total landings during all the months except October and May. The CPUE analyzed for different gears depicted the peak contribution by OBBS during all the months except May. During monsoon season, the highest landing was reported in August (3417030 kg) followed by September, June and July. The dominant species that landed in June 2021 was *Mene maculata*, with a catch of 115943 kg. In July, August and September *Decapterus russelii* were reported as the dominant species. The zone-wise catch during monsoon season showed that zone 1, Direct Footprint Zone, solely contributed to the majority of catch (>80%) and the least contributed by Zone 3 (Control Zone). During post-monsoon season, Zone 2 (Potential impact zone) had reported maximum landing, and Zone 1 (Direct footprint Zone) reported the slightest catch. Analysis of landing centre-wise

catch data showed that Vizhinjam landing centre had reported the highest catch during all the post-monsoon months except December. In December Adimalathura landing centre was registered with the highest catch. The zone-wise catch during pre-monsoon season showed that zone 1, Direct Footprint Zone contributed to the majority of catch. The Zone-2, Potential Impact zone contributed the least. The Vizhinjam landing centre had reported the highest catch during all the pre-monsoon months. The landings were dominated by *Amblygaster sirm* in February, *Euthynnus affinis* in March, *Sardinella gibbosa* in April and *Auxis rochei* in May. Experimental sampling was conducted season-wise to collect the fishing ground information and species composition of dominant fishing units. The fishing ground information for different seasons was plotted season-wise using the Geo coordinates collected from the fishers and experimental sampling and depicted in the report. The fish species composition during different seasons was analyzed and shown in the tables. A total of 337 fish species were identified from the present investigation of fish landing data along the potential impact zones of the project. A detailed account of the current fishing methods is included in the report.

Fish catch data collected during the present investigation were compared with the baseline collected during 2011-12 to elucidate the impact of port construction on the fishery activities along the potential impact zones of the project. The total fish catch estimated from June 2021 to May 2022 was 23934 tonnes, which is 3.35 % higher than the baseline catch estimated during 2011-12 (23156 tonnes). During the monsoon season, a total catch of 9283 tonnes of fish was reported in 2021, while during 2011, 7584 tonnes of fish were recorded and registered an 18% increase in fish catch in 2021. A total of 7658 tonnes of fish were recorded during 2021 post-monsoon season, while in 2011, a catch of 6773 tonnes and an increase of 11.5% were noted during 2021. In the pre-monsoon season, the situation varied and a reduction of 20% of catch happened during 2021 as we compared the data with the baseline information (2021- 6991 tonnes landed, 2011- 8798 tonnes landed). In Zone I, the catch was reported maximum during monsoon season, followed by Pre-monsoon and post-monsoon season during 2021-22, as well as 2011-12. During monsoon season, the highest catch was recorded during 2021-22, while in post-monsoon and pre-monsoon, the maximum catch was recorded during 2011-12. . In zone II, Post monsoon catches were more during 2011-12 and 2021-22, followed by pre-monsoon. There was absolutely nil catch reported from zone II in 2011-12 during the monsoon season while a few catches were reported from zone II during the monsoon season in

2021-22. Post-monsoon and pre-monsoon, catches were recorded high during 2021-22 than in 2011-12. In zone III, Pre-monsoon catches were more during both the study periods and there was no catch during monsoon season in 2011-12, while a few catches were reported during monsoon season in 2021-22. During post and pre-monsoon, the maximum catch was recorded during 2021-22 than 2011-12. During 2011, Vizhinjam (49%) contributed more to the landings, followed by Poonthura (14%), Puthiyathura (12%), Poovar (10%), Pallam (3%), Erayammanthura (3%), Adimalathura (3%), Chempakaramanthura (3%), Karumkulam (2%), Kochupally (1%), Kovalam (<1%) and Kochuthura (<1%). While in 2021, Vizhinjam (55%) contributed more to the landings, followed by Adimalathura (11%), Poonthura (11%), Puthiyathura (7%), Pulluvila (5%), Poovar (5%), Karumkulam (3%), Pallam (3%), Panathura (<1%), Kovalam (<1%), and Kochuthura (<1%). The experimental fishing conducted along the commercial fishing grounds helped to identify the present fishing ground and species composition of various gears. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam International seaport on the availability of fish resources. The present analysis on the estimation of fish landings from the potential impact zone of Vizhinjam International seaport depicted negligible effects on the fish landings and stated that the current phase of the port (construction phase) has insignificant impacts on the fish availability and landings along the 10 km zone. The impact assessment during the port's operational phase will reveal the fish landing's unique status and availability. Hence, studies need to be conducted during the operational phase to examine its effect on the marine habitat, flora, and fauna.

3. THE TEAM

Sl.No.	Name	Designation	Project role
1	Dr. A Gopalakrishnan	Director	Director
2	Dr.N.K.Sanil	Principal Scientist	Chair person, CPC
3	Dr. M. K. Anil	PS and Scientist In Charge, CMFRI, (Vizhinjam)	Project Associate
4	Dr. Somy Kuraikose	Principal Scientist	Project Associate
5	Dr. Santhosh B	Principal Scientist	Project Associate
6	Dr. Jasmine, S.	Principal Scientist	Project Associate
7	Dr. Saleela, K. N.	Senior Scientist	Project Associate
8	Dr. Shelton Padua	Scientist	Project Associate
9	Mrs. Surya S,	Scientist	Project leader
10	Mrs. Gomathi P	Scientist	Project Associate
11	Mr. Ambarish P Gop	Scientist	Project Associate
12	Dr. Reshma Gills	Scientist	Member CPC
13	Dr. Jose Kingsly,	Sr. Technical officer	Technical support
14	Dr. V. A. Leslie	Sr. Technical officer	Technical support
15	Mrs.Sindhu Augustine	Technical officer	Technical support
16	Mr. K.K. Suresh	Sr. Technical officer	Technical support
17	Shri. B. Raju	Sr. Tech. Asst	Technical support
18	Shri Albert Idu	Tech. Asst.	Technical support
19	Mrs. Arathy R Pillai	Supporting staff	Skilled support
20	Mr. Hareesh Nair	Chief Administrative Officer	Administrative Assistance
21	Mr. Prashant Kumar	Chief Finance & Accounts Officer	Financial assistance
22	Mr. P.S. Anilkumar	AC.TO	Member secretary, CPC
23	Ms. Angel Gomez	Young professional	Data collection and reporting
24	Mr. Dispin Das Y	Field Assistant	Data collection

4. LIST OF TABLES

Table No.	Title	Page No.
9.1	Work Schedule	15
9.3.1	Sampling Plan and details	23-27
10.1.1	No. of fishing units operated along the K1 zone (year wise)	35
10.1.2	CPUE (kg) of different gears (year wise)	36
10.1.3	Landing center wise fish catch data (in tonnes) during June 2021- May 2022	38
10.1.4	No. of fishing units operated along the zone (OBBS- Boat seine, OBGN- Gillnet, OBHL. Hook and Line, OBOTHS- outboard other gears, NM- Non motorized units)	41
10.1.5	Fish catch landed by different gears during the reporting period (OBBS- Boat seine, OBGN- Gillnet, OBHL. Hook and Line, OBOTHS- outboard other gears, NM- Non motorized units)	42
10.1.6	Catch per unit effort of different gears during June 2021-May 2022	43
10.2.1.a	Fish species landed and its catch in Kg (June 2021)	48-52
10.2.1.b	Fish species landed and its catch in Kg (July 2021)	52-56
10.2.1.c	Fish species landed and its catch in Kg (August 2021)	56-60
10.2.1.d	Fish species landed and its catch in Kg (September 2021)	60-63
10.2.2.a	Gear details of Boat seine	64-65
10.2.2.b	Species details of Boat seine sampling	65
10.2.2.c	Gear details of Disco net	66-67
10.2.2.d	Species details of Disco net sampling	67
10.3.1.a	Fish species landed and its catch in Kg (October 2021)	72-75
10.3.1.b	Fish species landed and its catch in Kg (November 2021)	76-79
10.3.1.c	Fish species landed and its catch in Kg (December 2021)	79-84
10.3.1.d	Fish species landed and its catch in Kg (January 2022)	85-89
10.3.2.a	Gear details of boat Seine	90
10.3.2.b	Species details of boat Seine sampling	90
10.3.2.c	Gear details of gill net	91
10.3.2.d	Species details of gill net sampling	92
10.3.2.e	Gear details of Shore seine	93
10.3.2.f	Species details of Shore seine sampling	93
10.4.1.a	Fish species landed and its catch in Kg (February 2022)	98-102
10.4.1.b	Fish species landed and its catch in Kg (March 2022)	102-107
10.4.1.c	Fish species landed and its catch in Kg (April 2022)	107-111
10.4.1.d	Fish species landed and its catch in Kg (May 2022)	111-114
10.4.2.a	Gear details of Jiggs	116

10.4.2.b	Species details of Jiggs sampling	116
10.4.2.c	Gear details of Hook & Line	117
10.4.2.d	Species details of Hook & Line sampling	117
10.4.2.e	Gear details of Drift Gill net	118
10.4.2.f	Species details Drift Gill net sampling	119
10.4.2.g	Gear details of Shore seine	120
10.4.2.h	Species details of Shore seine sampling	120

5. LIST OF PLATES

Plate no.	Title	Page no.
9.3.1	Photographs of the landing centres-Vizhinjam, Poovar, Puthiyathura & Karumkulam	27
9.3.2	Photographs of the landing centers -Erayamanthura , Adimalathura, Poonthura & Pallom	28
9.3.3	Photographs of the landing centers -Panathura, Chempakaramanthura & Kovalam	29
10.2.2.a	Photograph showing the experimental fishing using Boat seine during Monsoon season	64
10.2.2.b	Photograph showing the experimental fishing using Disconet during Monsoon season	66
10.3.2.a	Photograph showing the experimental fishing using Boat seine during Post-monsoon season	89
10.3.2.b	Photograph showing the experimental fishing using Gillnet during Post-monsoon season	91
10.3.2.c	Photograph showing the experimental fishing using Shore seine during Post-monsoon season	92
10.4.2.a	Photograph showing the experimental fishing using Jiggs during Pre-monsoon season	115
10.4.2.b	Photograph showing the experimental fishing using Hook &Line during Pre-monsoon season	116
10.4.2.c	Photograph showing the experimental fishing using Drift gillnet during Pre-monsoon season	118
10.4.2.d	Photograph showing the experimental fishing using Shore seine during Pre-monsoon season	119
10.5.1	Boat seine catch & its operation	122
10.5.2	Boat seine fishing using lights & its catch	123
10.5.3	Bottom set Gillnet	128
10.5.4	Hand lines	130
10.5.5	Squid Jiggs & its catch	131
10.5.6	Long liners used to catch Tuna, Shark, seer fishes and big carangids (a)	133
10.5.7	Long liners used to catch Tuna, Shark, seer fishes and big carangids (b)	133
10.5.8	Shore seine operating gear and its catch	135

6. LIST OF FIGURES

Figure No.	Title	Page No.
8.1	Map showing the location of Vizhinjam port	13
9.1.1	Study area of the project during June 2021-May2022	16
10.1.1	Marine fish landings in India from 2015 to 2020	31
10.1.2	Marine fish landings in Kerala from 2015 to 2021	32
10.1.3	Marine fish landings in Thiruvananthapuram district, (K1 and K2 zone)(2016 to 2021)	34
10.1.4	Marine fish landings at K1 zone (2016-2021)	34
10.1.5	No. of units operated along the Thiruvananthapuram coast (2016-2021)	35
10.1.6	Gear distribution trends from 2016-2021 along the K1 zone	36
10.1.7	Trends in the CPUE of different gears from 2016-2021 along the K1 zone	37
10.1.8	Month wise fish catch(kg) during the reporting period	38
10.1.9	Season wise fish catch during the reporting period	39
10.1.10	Zone wise total catch (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone)	39
10.1.11	Zone wise (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch during different seasons	40
10.1.12	No. of fishing units operated during the reporting period	40
10.1.13	Percentage contribution of different gears in fish landing center from the period of June 2021-May2022	41
10.1.14	CPUE of different gears during the reporting period	42
10.2.1	Landing centre-wise fish landings during monsoon season	44
10.2.1.a	Zone wise fish catch (Kg) during monsoon season	45
10.2.1.b	Gear wise fish landings during monsoon season	45
10.2.1.c	Fish landings (kg) during June 2021 at different landing centers	46
10.2.1.d	Fish landings (kg) during July 2021 at different landing centers	46
10.2.1.e	Fish landings (kg) during August 2021 at different landing centers	47
10.2.1.f	Fish landings (kg) during September 2021 at different landing centers	47
10.2.1.g	Fishing ground information on major gears operating during the monsoon season	48
10.3.1	Landing centre wise fish landings during post-monsoon season	68

10.3.1.a	Zone wise Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone)fish catch during post monsoon season	69
10.3.1.b	Gear wise fish landings during post monsoon season	69
10.3.1.c	Post monsoon landings (October 2021) at different landing centers	70
10.3.1.d	Post monsoon landings (November 2021) at different landing centers	70
10.3.1.e	Post monsoon landings (December 2021) at different landing centers	71
10.3.1.f	Post monsoon landings (January 2022) at different landing centers	71
10.3.1.g	Fishing ground information of major gears during the post monsoon season	72
10.4.1	Landing centre wise fish landings during pre-monsoon season	94
10.4.1.a	Zone wise catch during pre-monsoon season	95
10.4.1.b	Gear wise fish landings during pre monsoon season	95
10.4.1.c	Fish landings (kg) during February 2022 at different landing centers	96
10.4.1.d	Fish landings (kg) during March 2022 at different landing centers	96
10.4.1.e	Fish landings (kg) during April 2022 at different landing centers	97
10.4.1.f	Fish landings (kg) during May 2022 at different landing centers	97
10.4.1.g	Fishing ground information of major gears during the pre monsoon season	98
10.5.1	Ayala vala	124
10.5.2	Netholi vala	125
10.5.3	Chala vala	125
10.5.4	Chala vala catch	125
10.5.5	Idakettuvala	126
10.5.6	Detangling of idakettuvala	126
10.5.7	Drift gillnet	127
10.5.8	Trammel net used to catch shrimp	129
10.6.1	Fishing locations by different gears during different seasons	136
10.6.2	Graph shows the Fish catch, No. of efforts, CPUE and average CPUE during monsoon season from zone I	137
10.6.3	Graph shows the Fish Catch, No. of efforts, CPUE and average CPUE during monsoon season from zone II	137

10.6.4	Graph shows the Fish Catch, No. of efforts, CPUE and average CPUE during monsoon season from zone III	138
10.6.5	Total fish catch, season wise-zone wise	138
10.6.6	Average fish catch, Season-wise, zone wise	139
10.7.1	Fish catch data 2011-12 & 2021-22	140
10.7.2	Season wise fish catch data(kg)	140
10.7.3	Season wise fish catch data in Zone I during 2011-12 & 2021-22	141
10.7.4	Season wise fish catch data in Zone II during 2011-12 & 2021-22	141
10.7.5	Season wise fish catch data in Zone III during 2011-12 & 2021-22	142
10.7.6	Comparison of month wise Fish catch data 2011-12 & 2021-22	142
10.7.7	Landing center wise fish catch during 2011-2012	143
10.7.8	Landing center wise fish catch during 2021-2022	143

7. BACKGROUND

Adani Vizhinjam Port Private Limited (AVPPL) is currently developing an International Deepwater Multipurpose Seaport at Vizhinjam, Thiruvananthapuram District, Kerala State, in a Public-Private Partnership (PPP) with the Government of Kerala (GoK). Appeals challenging the Environmental and CRZ Clearance (EC) granted to the Vizhinjam project were filed as per the NGT Act, 2010. The Delhi Bench of NGT has upheld the EC granted to the project vide its judgment dated 02.09.2016. An expert committee has been constituted to oversee compliance and adherence to the NGT judgment and also compliance with the EC issued by MoEF&CC (F.No.11-122/2011-IA.III dated 03.01.2014) for Vizhinjam Port.

During the NGT Expert Committee dated 06.09.2019, the committee suggested that Fishery data shall be collected with proper methodologies and procedure as per discussion with CMFRI and Fishery Department and During the NGT Expert Committee dated 24.09.2020. Dr. Anil, Principal Scientist and Head, CMFRI, informed that the secondary fishery data of the project area is not available with CMFRI. Therefore, since secondary fishery data is unavailable with CMFRI and they do not have continuous data regarding the landing centres of the study area, AVPPL engaged CMFRI to conduct primary surveys and estimate marine fish landing data from the potential impact zones. CMFRI initiated the study with a literature review, sampling, and data collection from 01.06.2021 onwards.

CMFRI also presented the proposed methodology for the estimation of marine fish landing study in the NGT committee meetings, and the same was approved by the committee.

8. INTRODUCTION

As part of its various programs for the state's development, the Government of Kerala (GoK). has identified the development of Vizhinjam International Deepwater Multipurpose Seaport. GoK has formed a separate company, viz. Vizhinjam International Seaport Limited (VISL) is a special purpose company that would act as implementing agency for the development of the green field port at Vizhinjam in Thiruvananthapuram district, Kerala. The location of the Vizhinjam port is given below; (Fig. 8.1)

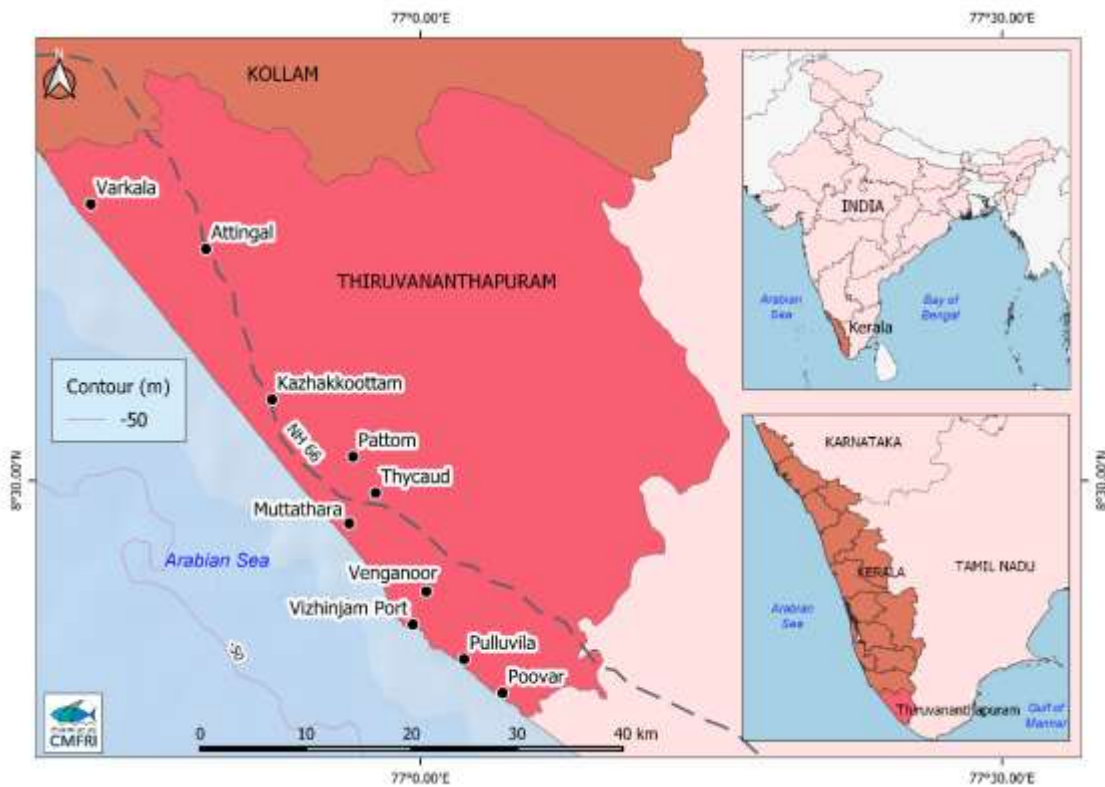


Fig.8.1. Map showing the location of Vizhinjam Port

NGT appointed expert committee has been constituted to oversee compliance and adherence to the NGT judgment and also compliance with the EC issued by MoEF. During the NGT Expert Committee dated 06.09.2019, the committee suggested that fishery data shall be collected with proper methodologies and procedures as per discussion with CMFRI to assess the impact of port construction on the fish availability along the potential zones. CMFRI is the nodal agency in India to monitor and evaluate the commercial exploitation of marine fishery

resources. CMFRI also suggests policy decisions on craft and gears operated along Indian waters to respective state governments. CMFRI was involved in the baseline data collection during the EIA stage for Vizhinjam Port in 2011-12. The result of the study elucidated the total fish landings by fishing sector from the Vizhinjam fishing harbour and adjacent fishing villages. A comparative statement on fish landings recorded before the construction of Vizhinjam port and present fish landings will elucidate the effects of development activities along the project area. With the background information, CMFRI Vizhinjam Regional Centre studied the estimation of marine fish landings data from the potential impact zone of Vizhinjam port. MoU was signed during the first week of April 2021 and a team of scientific personnel of CMFRI with expertise in different themes related to marine capture fisheries and biodiversity was entrusted the work.

8.1 OBJECTIVES OF STUDY

- The objective of the project is to estimate the fish population and fish landings within 10 km of Vizhinjam International Sea Port project for three seasons such as monsoon, pre-monsoon and post-monsoon from three areas, namely, Direct Footprint of development, Potential Impact Zone, and Control Zone of the project area.
- Assessment of Fishery resources, landings and species composition of the study area based on commercial as well as experimental fishing.

9. METHODOLOGY FOR THE ESTIMATION OF MARINE FISH LANDINGS IN INDIA

The work programme involves extensive field studies and sample collections on marine fishery resources within 10 km of the Vizhinjam Port project, covering three seasons (Monsoon, Post-monsoon and Pre-monsoon). The result of the studies conducted along the above areas would prove whether any quantifiable change is visible in the status of the fishery due to the construction of Vizhinjam port.

The work is scheduled as follows;

Table No. 9.1. Work Schedule

June 2021	Literature review & Initial arrangements for the project.	
1 st June 2021- 31 st May 2022	Sampling and Data collection.	
	Monsoon season	1 st Jun- 30 th Sep 2021
	Post monsoon season	1 st Oct 2021- 31 st Jan 2022
	Pre-monsoon season	1 st Feb- 31 st May 2022
1 st June 2022- 31 st July 2022	Data analysis and preparation of project report.	
31 st July 2022	Submission of Project Report	

During the reporting period (June 2021 to July 2022), marine fisheries surveys have been conducted off the Vizhinjam coast covering three zones: the Direct Foot Print Zone, Potential impact Zone and Control Zone of the Vizhinjam port from Poovar in the north to Poonthura in the south zone. The estimation of fish landings data from June 2021 to May 2022 is narrated in the present report. The analysis of fish catch data estimated the assessment of the availability of fishery resources landed at the landing centres, its nature of exploitation and species composition of landings

9.1 STUDY AREA AND SAMPLING SITE

The study area was divided into three zones depending on the distance from the project site: the study area of three impact zones is given in Figure 9.1.1.

- **Zone 1 (Core Zone): 0-2 km** from the proposed project site
- **Zone 2 (Moderate Impact Zone): 2-5 km** from the proposed project site
- **Zone 3 (Low Impact Zone): 5-10 km** from the proposed project site



Fig .9.1.1. Study area of the Project

Landing centres selected for the present study and their coordinates

• POONTHURA	8°26'06.5"N 76°56'58.1"E
• PANATHURA	8°24'27.8"N 76°58'07.9"E
• KOVALAM	8°23'44.7"N 76°58'23.5"E
• VIZHINJAM	8°22'41.6"N 76°59'28.7"E
• ADIMALATHURA	8°20'57.0"N 77°01'27.9"E
• KOCHUPALLI	8°20'43.7"N 77°01'47.8"E
• CHEMPARAMANTHURA	8°20'34.9"N 77°01'59.0"E
• ERAYAMANTHURA	8°20'23.4"N 77°02'14.8"E
• PALLAM	8°20'14.2"N 77°02'25.1"E
• PUTHIYATHURA	8°19'57.4"N 77°02'44.6"E
• KOCHUTHURA	8°19'42.1"N 77°03'04.0"E
• KARUMKULAM	8°19'27.9"N 77°03'21.9"E
• POOVAR	8°19'00.9"N 77°03'55.7"E

The estimation of marine landings from the potential impact zone of Vizhinjam port is a separate project and it is not under the objective of CMFRI's all-India data collection project. The data thus generated will be for this project specifically and won't be a part of CMFRI's national landings estimation. The procedure and sampling design followed by CMFRI to estimate the national landings data will be followed in the present study to estimate the landings data from the potential impact zones. Two field staff were recruited exclusively under this project for data collection and they are specifically working on the data collection, experimental sampling and species composition analysis.

9.2 Methodology of Multistage Stratified Random Sampling for fish catch estimation

The stratification over time is a calendar month. One zone and a calendar month is a space-time stratum and primary stage sampling units are landing centre days. If in a zone, there are 20 landing centres, there will be $20 \times 30 = 600$ landing centre days in that zone for that month (of 30 days). For observation purposes, a month is divided into three groups, each of 10 days. From the first five days of a month, a day is selected at random, and the next five consecutive days are automatically selected. From this, three clusters of two consecutive days are formed. Normally, in a month, there will be 9 clusters of two days each. Among the total number of landing centres in the given zone, 9 centres are selected with replacement and allotted to the 9 cluster days described earlier. Thus in a month, nine landing centre days are observed. The observation is made in a center from 1200 hrs to 1800 hrs on the first day and from 0600 hrs to 1200 hrs on the second day. For the intervening period of these two days, the data are collected by an inquiry from 1800 hrs of the first day of observation to 0600 hrs of the second day of observation of a landing center-day, which is termed as 'night landing'. The 'night landing' obtained by inquiry on the second day covering the period of 1800 hrs of the first day to 0600 hrs of the next day are added to the day landings to arrive at the landings for one (landing centre day) day (24 hours).

Selection of units and recording of landings

It may not be practical to record the catches of all boats landed during an observation period if the number of boats/craft landings is large. A sampling of the boats/craft becomes essential. When the total number of boats landed is 15 or less, the landings from all the boats are enumerated for catch and other particulars. When the total number of boats exceeds 15, the following procedure is followed to sample the number of boats (Alagaraja, 1984). From the boats, the catches are normally removed in baskets of standard volume. The weight of fish contained in these baskets is known, and the weight of fish in each boat under observation is obtained.

Procedure for estimating marine fish landings during a month

Monthly estimate for a zone

Without stratification of a zone (also applicable to single centre zone)

Let N be the number of days (fishing days) in a month, Q be the number of centres in the zone and n be the number of selected landing centre days. Let p be the number of periods of observation for the selected landing centre day.

$p = 1$ corresponds to 1200 – 1800 hrs on the first day of observation

$p = 2$ corresponds to 0600 – 1200 hrs on the second day of observation

$p = 3$ corresponds to night landings obtained by enquiry of the boats, landing after 1800 hrs on the first day and before 0600 hrs on the second day

Let N_{gdp} be the total number of craft (boat) of gear type g (from now on referred to as unit) landed during d^{th} selected landing centre day in the p^{th} period of observation.

Let n_{gdp} be the number of selected units of type g on the d^{th} landing centre day during the p^{th} period of observation.

Let y_{sgdpi} be the catch of the species s landed by the i^{th} selected unit of g^{th} type unit on d^{th} selected day during p^{th} period of observation.

Let \hat{Y}_{sgdp} be the estimated total landings of species s by unit type g on the d^{th} landing centre day during p^{th} period of observation.

Then,

$$\hat{Y}_{sgdp} = \frac{N_{gdp}}{n_{gdp}} \sum_{i=1}^{n_{gdp}} y_{sgdpi} \dots\dots\dots (1)$$

Let \hat{Y}_{sgd} be the estimated total landings of species s by g^{th} type of unit on d^{th} day and

$$\hat{Y}_{sgd} = \sum_{p=1}^3 \hat{Y}_{sgdp} \dots\dots\dots (2)$$

[Note : The night landings (p=3) are obtained by enquiry and usually estimated by enquiry from the number of each type of unit landed and average catch per unit]. The estimated total landings (sg Y) of species s by gth type of unit for the month is obtained as

$$\hat{Y}_{sg} = \frac{NQ}{n} \sum_{d=1}^n \hat{Y}_{sgd} \dots\dots\dots (3)$$

Estimated total landings (d W) for the selected landing centre day is obtained as

$$\hat{W}_d = \sum_s \sum_g \hat{Y}_{sgd} \text{ (summed over all gear and for all species) } \dots\dots\dots (4)$$

The estimated total landings g Y of all species by gth type of unit for the month is obtained as

$$\hat{Y}_g = \sum_s \hat{Y}_{sg} \text{ (Summed over all species landed by } g^{\text{th}} \text{ type of unit) } \dots\dots (5)$$

The estimated total landings Ys of species landed by all types of units for the month is

$$\hat{Y}_s = \sum_g \hat{Y}_{sg} \text{ (Summed over all types of units) } \dots\dots\dots (6)$$

Estimated total landings Y for the month overall types units and all species are given by

$$\hat{Y} = \sum_g \hat{Y}_g = \sum_s \hat{Y}_s \dots\dots\dots (7)$$

Using the above formulae, fish catch details of landing centre is calculate in monthly basis.

Instructions to the field staff during data collection

The work programme for a month will be issued to the field staff towards the third week of the previous month. The place, date and time of observation will be indicated in the programme.

- The official should reach the landing centre at least 15 minutes before the commencement of the observation time and the official will have to make a local inquiry on the number of units gone for fishing and the number of units expected to land during his observation period. This information is required to determine the number of units selected for observation.
- Whether there is fishing or no fishing, the work schedule should be strictly adhered to and the official should be at the landing centre during the entire period of observation.
- In the case of landing centres comprising more than one landing point, the official may collect data at the point where a maximum number of units are expected to land. The number of units landed at the other point(s) should be indicated with a plus (+) sign along with the total number of units landed at the point where he makes the observation.
- The data to be collected comprise (i) the total number of fishing units landed by actual count and their time of arrival (ii) the detailed species-wise breakup of landings and other ancillary information about a selected number of fishing units and (iii) data on 'night landings'. The landings after 1800 hrs. of the first day of observation and before 0600 hrs of the second-day observation have been termed 'night landings', which have to be collected in the morning of the second day by inquiry.
- The actual load of landings must be weighed. In case the landings are heavy, at least one basket of various groups of fish should be weighed and the total weight should be obtained by multiplying this weight by the total number of baskets as far as practicable.

Recording of details of landings

- Names of species of all commercially important fishes and shellfishes should be recorded. In case identification up to species, level is not possible, at least a generic name should be indicated. The names of fishes that come under 'Miscellaneous' may be given in a footnote. Indicating fisheries resources by common names like prawns, tunnies, sharks, rays, skates etc. should be avoided. In case of doubt, local names may be used and the specimens are collected and identified at the laboratory wherever such facilities exist or sent to the headquarters for identification.
- Name of the centre, date and time be given if the number of species does overlap to the next page/sheet.

- The type of gear is to be specified along with the local name. Expansions of the abbreviations used for gear shall be indicated at the bottom of the form.

Special instructions

- The total number of fishing units landed by actual count and their time of arrival
- The detailed species wise breakup of landings and other ancillary information about a selected number of fishing units.
- Data on ‘night landings’. The landings after 1800 hrs of the first day of observation and before 0600 hrs of the second-day observation have been termed ‘night landings’ which have to be collected in the morning of the second day by enquiry.
- Names of species of all commercially important fishes and shellfishes should be recorded.
- Type of gear & craft is to be specified.
- Length of craft
- Departure and arrival of fishing units.
- Distance of fishing ground is the shortest distance from the shore
- Direction from landing centre
- Depth of fishing ground
- No. of hauls
- Duration of actual fishing
- Manpower employed
- Species & its weight
- State of sea and sky
- Direction of wind
- Direction of current
- Price statistics
- In the case of multiple gear operations, data from individual gear may be recorded separately.

9.3 Sampling plan & details

The monthly sampling plan for landing centre visit and data collection is given in Table 9.3

Table No. 9.3.1 Sampling plan & details

The date and time of the landing centre visit are given below:

Sl no.	JUNE		JULY		AUGUST	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/06/2021	Karumkulam Erayammanthura	02/07/2021	Karumkulam Poovar	02/08/2021	Poovar Adimalathura
2.	03/06/2021	Karumkulam Erayammanthura	03/07/2021	Karumkulam Poovar	03/08/2021	Poovar Adimalathura
3.	05/06/2021	Pallom Kochuthura	05/07/2021	Pallom Kochuthura	04/08/2021	Pallom Kochuthura
4.	07/06/2021	Vizhinjam Adimalathura	07/07/2021	Kovalam Panathura	05/08/2021	Panathura Karumkulam
5.	08/06/2021	Vizhinjam Adimalathura	08/07/2021	Vizhinjam Erayammanthura	06/08/2021	Kochuthura Karumkulam
6.	10/06/2021	Poonthura Panathura	09/07/2021	Vizhinjam Erayammanthura	09/08/2021	Poonthura Puthiyathura
7.	11/06/2021	Poonthura	12/07/2021	Chemparamanthura Adimalathura	10/08/2021	Poonthura Puthiyathura
8.	14/06/2021	Kovalam Poovar	13/07/2021	Chemparamanthura Adimalathura	12/08/2021	Adimalathura Kovalam
9.	15/06/2021	Adimalathura Poovar	15/07/2021	Poovar Kovalam	13/08/2021	Adimalathura Karumkulam
10	16/06/2021	Adimalathura Pallom	16/07/2021	Poovar Poonthura	16/08/2021	Vizhinjam Erayammanthura
11	17/06/2021	Erayammanthura	19/07/2021	Kochuthura Poonthura	17/08/2021	Vizhinjam Erayammanthura
12	18/06/2021	Erayammanthura Karumkulam	21/07/2021	Panathura	18/08/2021	Kochuthura Panathura
13	19/06/2021	Karumkulam	22/07/2021	Adimalathura Karumkulam	24/08/2021	Puthiyathura Vizhinjam

14	21/06/2021	Kochuthura Kovalam	23/07/2021	Adimalathura Karumkulam	25/08/2021	Puthiyathura Vizhinjam
15	22/06/2021	Pallom	26/07/2021	Puthiyathura Vizhinjam	26/08/2021	Karumkulam Poovar
16	23/06/2021	Adimalathura Vizhinjam	27/07/2021	Puthiyathura Vizhinjam	27/08/2021	Karumkulam Poovar
17	24/06/2021	Adimalathura Vizhinjam	29/07/2021	Erayammanthura Chempamanthura	31/07/2021	Kovalam Panathura
18	26/06/2021	Panathura Kochuthura	30/07/2021	Erayammanthura Chempamanthura		
19	28/06/2021	Puthiyathura Chempamanthura				
20	29/06/2021	Puthiyathura Chempamanthura				

SI no.	SEPTEMBER		OCTOBER		NOVEMBER	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/09/2021	Poonthura Poovar	4/10/2021	Adimalathura Vizhinjam	02/11/2021	Poovar Karimkulam
2.	03/09/2021	Poonthura Poovar	5/10/2021	Adimalathura Vizhinjam	03/11/2021	Poovar Karimkulam
3.	06/09/2021	Puthiyathura Karimkulam	6/10/2021	Pallom Kochuthura	05/11/2021	Puthiyathura Erayammanthura
4.	07/09/2021	Puthiyathura Karimkulam	7/10/2021	Poonthura Poovar	06/11/2021	Puthiyathura Erayammanthura
5.	09/09/2021	Chempamanthura Erayammanthura	8/10/2021	Poonthura Poovar	08/11/2021	Adimalathura Vizhinjam
6.	10/09/2021	Chempamanthura Erayammanthura	11/10/2021	Kovalam Panathura	09/11/2021	Adimalathura Vizhinjam
7.	13/09/2021	Pallom Panathura	12/10/2021	Puthiyathura Karimkulam	11/11/2021	Chempamanthura Kovalam
8.	14/09/2021	Adimalathura	13/10/2021	Puthiyathura Karimkulam	12/11/2021	Chempamanthura
9.	15/09/2021	Kochuthura Adimalathura	16/10/2021	Kochuthura Kovalam	15/11/2021	Panathura Poonthura
10	16/09/2021	Vizhinjam Chempamanthura	18/10/2021	Panathura Pallom	16/11/2021	Poonthura
11	17/09/2021	Vizhinjam Chempamanthura	20/10/2021	Poovar Adimalathura	17/11/2021	Vizhinjam Adimalathura
12	20/09/2021	Panathura Poonthura	21/10/2021	Poovar Adimalathura	18/11/2021	Vizhinjam Adimalathura
13	21/09/2021	Poovar Poonthura	22/10/2021	Vizhinjam Chempakamanthura	20/11/2021	Kochuthura Pallom

14	22/09/2021	Poovar	23/10/2021	Vizhinjam Chempakaramanthura	22/11/2021	Karimkulam Kochupalli
15	23/09/2021	Vizhinjam Adimalathura	25/10/2021	Erayammanthura Puthiyathura	23/11/2021	Karimkulam Kochupalli
16	24/09/2021	Vizhinjam Adimalathura	26/10/2021	Erayammanthura Puthiyathura	25/11/2021	Kovalam Adimalathura
17	27/09/2021	Kovalam Kochuthura	27/10/2021	Karimkulam Poonthura	26/11/2021	Poonthura Adimalathura
18	27/09/2021	Karumkulam Poonthura	28/10/2021	Karimkullam Poonthura	27/11/2021	Poonthura Kochuthura
19	28/09/2021	Erayammanthura Puthiyathura			29/11/2021	Pallom Panathura
20	29/09/2021	Erayammanthura Puthiyathura				

Sl. No	DECEMBER		JANUARY		FEBRUARY	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/12/2021	Karimkulam Poovar	02/01/2021	Karumkulam Poovar	02/02/2021	Poovar Adimalathura
2.	03/12/2021	Karimkulam Poovar	03/01/2021	Karumkulam Poovar	03/02/2021	Poovar Adimalathura
3.	06/12/2021	Pallom Puthiyathura	05/01/2021	Pallom Kochuthura	04/02/2021	Pallom Kochuthura
4.	07/12/2021	Erayammanthura Puthiyathura	07/01/2021	Kovalam Panathura	05/02/2021	Panathura Karumkulam
5.	08/12/2021	Erayammanthura	08/01/2021	Vizhinjam Erayammanthura	06/02/2021	Kochuthura Karumkulam
6.	09/12/2021	Poonthura Kochupally	09/01/2021	Vizhinjam Erayammanthura	09/02/2021	Poonthura Puthiyathura
7.	10/12/2021	Poonthura Kochupally	12/01/2021	Chemparamanthura Adimalathura	10/02/2021	Poonthura Puthiyathura
8.	13/12/2021	Adimalathura Chemparamanthura	13/01/2021	Chemparamanthura Adimalathura	12/02/2021	Adimalathura Kovalam
9.	14/12/2021	Adimalathura Chemparamanthura	15/01/2021	Poovar Kovalam	13/02/2021	Adimalathura Karumkulam
10	17/12/2021	Poovar Karimkulam	16/01/2021	Poovar Poonthura	16/02/2021	Vizhinjam Erayammanthura
11	18/12/2021	Kochuthura Panathura	19/01/2021	Kochuthura Poonthura	17/02/2021	Vizhinjam Erayammanthura
12	20/12/2021	Vizhinjam Pallom	21/01/2021	Panathura	18/02/2021	Kochuthura Panathura
13	21/12/2021	Vizhinjam Poonthura	22/01/2021	Adimalathura Karumkulam	24/02/2021	Puthiyathura Vizhinjam

14	22/12/2021	Puthiyathura Poonthura	23/01/2021	Adimalathura Karumkulam	25/02/2021	Puthiyathura Vizhinjam
15	23/12/2021	Puthiyathura Adimalathura	26/01/2021	Puthiyathura Vizhinjam	26/02/2021	Karumkulam Poovar
16	24/12/2021	Adimalathura	27/01/2021	Puthiyathura Vizhinjam	27/02/2021	Karumkulam Poovar
17	27/12/2021	Pallom Kovalam	29/01/2021	Erayammanthura Chempammanthura		
18	29/12/2021	Panathura Kochuthura	30/01/2021	Erayammanthura Chempammanthura		

Sl no.	MARCH		APRIL		MAY	
	Date	Landing centre	Date	Landing centre	Date	Landing centre
1.	02/03/2021	Poonthura Poovar	4/04/2021	Adimalathura Vizhinjam	02/05/2021	Poovar Karimkulam
2.	03/03/2021	Poonthura Poovar	5/04/2021	Adimalathura Vizhinjam	03/05/2021	Poovar Karimkulam
3.	06/03/2021	Puthiyathura Karimkulam	6/04/2021	Pallom Kochuthura	05/05/2021	Puthiyathura Erayammanthura
4.	07/03/2021	Puthiyathura Karimkulam	7/04/2021	Poonthura Poovar	06/05/2021	Puthiyathura Erayammanthura
5.	08/03/2021	Chempammanthura Erayammanthura	8/04/2021	Poonthura Poovar	08/05/2021	Adimalathura Vizhinjam
6.	09/03/2021	Chempammanthura Erayammanthura	11/04/2021	Kovalam Panathura	09/05/2021	Adimalathura Vizhinjam
7.	13/03/2021	Pallom Panathura	12/04/2021	Puthiyathura Karimkulam	11/05/2021	Chempammanthura Kovalam
8.	14/03/2021	Adimalathura	13/04/2021	Puthiyathura Karimkulam	12/05/2021	Chempammanthura
9.	15/03/2021	Kochuthura Adimalathura	16/04/2021	Kochuthura Kovalam	15/05/2021	Panathura Poonthura
10.	16/03/2021	Vizhinjam Chempammanthura	18/04/2021	Panathura Pallom	16/05/2021	Poonthura
11.	17/03/2021	Vizhinjam Chempammanthura	20/04/2021	Poovar Adimalathura	17/05/2021	Vizhinjam Adimalathura
12.	20/03/2021	Panathura Poonthura	21/04/2021	Poovar Adimalathura	18/05/2021	Vizhinjam Adimalathura
13.	21/03/2021	Poovar Poonthura	22/04/2021	Vizhinjam Chempakaramanthur	20/05/2021	Kochuthura Pallom
14.	22/03/2021	Poovar	23/04/2021	Vizhinjam Chempakaramanthur	22/05/2021	Karimkulam Kochupalli
15.	23/03/2021	Vizhinjam Adimalathura	25/04/2021	Erayammanthura Puthiyathura	23/05/2021	Karimkulam Kochupalli
16.	24/03/2021	Vizhinjam Adimalathura	26/04/2021	Erayammanthura Puthiyathura	25/05/2021	Kovalam Adimalathura
17.	27/03/2021	Kovalam Kochuthura	27/04/2021	Karimkulam Poonthura	26/05/2021	Poonthura Adimalathura
18.	27/03/2021	Karumkulam Poonthura	28/04/2021	Karimkullam Poonthura	27/05/2021	Poonthura Kochuthura
19.	28/03/2021	Erayammanthura			29/05/2021	Pallom

		Puthiyathura				Panathura
20	29/03/2021	Erayammanthura Puthiyathura				

The photographs of the different landing centres selected from the direct foot print, potential impact zone and the control zones are given below



Plate 9.3.1 Photographs of the landing centres-Vizhinjam, Poovar, Puthiyathura & Karumkulam



Plate 9.3.2. Photographs of the landing centres -Erayammanthura , Adimalathura, Poonthura & Pallom



Plate 9.3.3. Photographs of the landing centres -Panathura, Chempakaramanthura & Kovalam

10. RESULTS

10.1 General profile of fish landings from 2016-2020

(India, Kerala & Thiruvananthapuram)

Fisheries are an important source of food, nutrition, employment and income in India. The sector provides livelihoods to about 16 million fishers and fish farmers at the primary level and almost twice the number along the value chain. Fish, an affordable and rich source of animal protein, is one of the healthiest options to mitigate hunger and malnutrition. India has rich and diverse fisheries resources ranging from deep seas to lakes, ponds, and rivers and more than 10% of the global biodiversity in terms of fish and shellfish species. The marine fisheries resources are spread along the country's vast coastline and 2.02 million square km Exclusive Economic Zone (EEZ) and 0.53 million sq.km continental shelf area. The sector has immense potential to more than double the fishers and fish farmers incomes, as envisioned by the government. The share of the fisheries sector in the total GDP (at current prices) increased from 0.40% in 1950-51 to 1.03% in 2017-18, recording an increase of 157%. The sector contributed Rs. 1,75,573 crore to the GDP (at current prices) during FY 2017-18 (Ministry of Statistics and Programme Implementation, 2020). The sector has been showing steady growth in the total Gross Value Added and accounts for about 6.58% share of Agricultural GDP. The total fisheries potential of India has been estimated at 22.31 million metric tons (in 2018), of this, the marine fisheries potential stands at an estimated 5.31 million metric tons and the inland fisheries potential been estimated at 17 million metric tons. In recent years, fish production in India has registered an average annual growth rate of more than 7%. The fish production in the country has shown continuous and sustained increments since 1947. The total fish production in the country rose from 0.752 million metric tons in 1950-51 to 13.42 million metric tons (provisional) during FY 2018-19. Of this, the marine fisheries contributed 3.71 million metric tons and the inland fisheries contributed 9.71 million metric tons. During FY 2018-19, 71% of marine fisheries potential has been harnessed and the inland fisheries potential harnessed during the same period stands at 58%. The marine fisheries sector is dominated by the socio-economically backward artisanal and small-scale fishers whose lives are closely intertwined with the oceans and seas. However, 75 percent of the total marine fish production comes from the mechanized sector, 23 percent from the motorized sector and only 2 percent from the

artisanal sector. Despite stagnation in the growth of marine capture fish production over the years, the dependency of traditional marine fishers on marine capture fisheries for livelihoods has been increasing. It is only imperative that sustainable alternative livelihood opportunities like mariculture activities are developed and promoted.

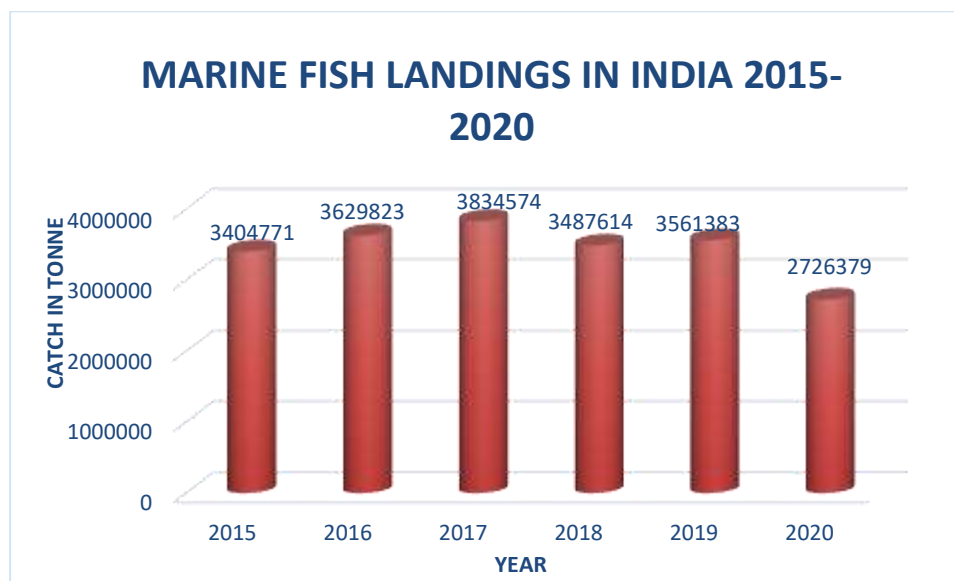


Fig. 10.1.1 Marine fish landings in India during 2015 to 2020

Kerala, one of the major maritime states of India, situated on the southwest coast of the Indian sub continent with an area of about 38863 Sq km, which makes about 1.27% of the Indian Territory. The state is separated from the rest of India by the western Ghats in the east and the Arabian Sea in the west. Kerala has a coastline of 589.5 kilometers, forms 10% of India's total coastline. With a coastline of over 590 kilometers, and an exclusive economic zone (EEZ) of 218536 Sq Km, Kerala has a significant marine fisheries sector that has long been an important source of occupation and livelihood for the coastal population of the state. It is estimated that about 8 lakh people earn their livelihood from capture and allied works in marine fisheries in the 222 fishing villages situated along the coastline of the state. The coastal line is spread over nine districts of Kerala and the state export fish products worth Rs. 5008.54 crores accounting for roughly 3% of the state revenue. Kerala's share in the national marine fish production is around 13%.

A very rich marine wealth with a large variety of fish and a highly skilled population of fishermen have made Kerala a leading producer and consumer of fish. The high rainfall and a large number of rivers make the Kerala coast especially fertile for fish. One specialty of the Kerala coast is the mudbanks, known as chakara in Malayalam. It is the formation of clay and organic matters on the coast after monsoon where the sea remaining calm, resulting in good harvest of fish.

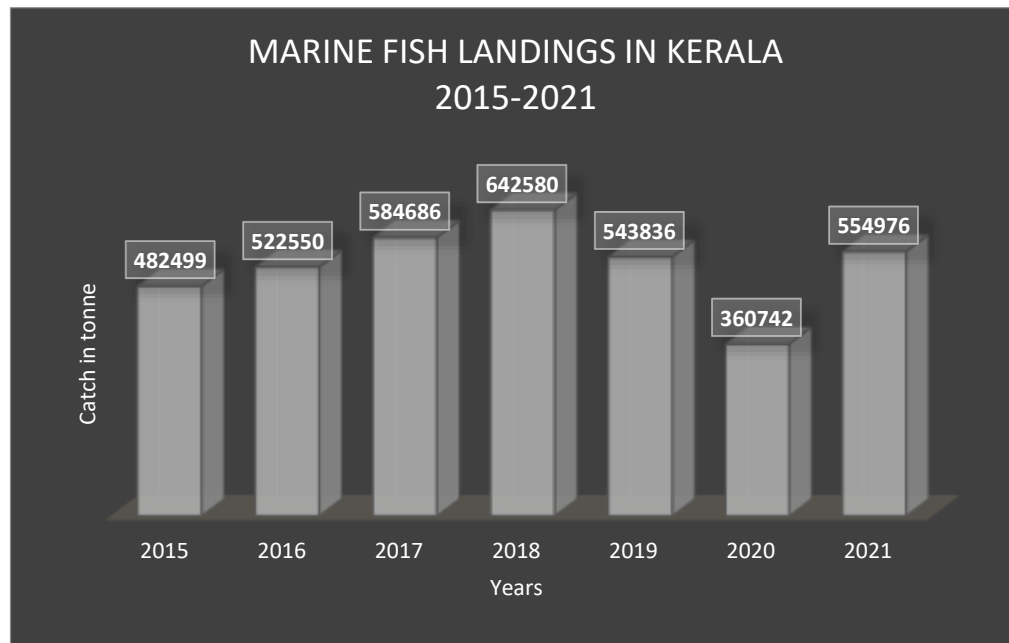


Fig. 10.1.2. Marine fish landings in Kerala during 2015 to 2021

Vizhinjam (Lat. 8°22'41.6"N 76°59'28.7"E), is one of southern Kerala's foremost vital artisanal fish landing centres, encased by two rocky promontories extending into the ocean, giving an ensured bay managing excellent openings for fishing operations indeed amid heavy monsoon. Two monsoon seasons prevail in this region: the southwest and the northeast. The southwest monsoon starts in May or June and continues until almost the start of August. The northeast monsoon is shorter-term and begins in October and closes by November. A more prominent portion of the precipitation is determined from the southwest monsoon. The fishery of this centre too changes concurring to the monsoon. Motorization started amid the centre of 1982 and has brought about the substitution of non-motorized crafts for motorised ones to a large degree.

Consequently, a decline in the effort by non-motorised traditional crafts was noticeable from 1984 onwards. Fishing is carried out at Vizhinjam throughout the year and is confined mainly to the inshore waters having a depth of 10-20 m and extending up to 24 km from the coast. The breakwater facility at Vizhinjam fishing harbour is an added advantage for berthing and launching the crafts, even during the monsoon months. Hence during the peak monsoon months, many fishermen from Anchengo to Colachel migrate to Vizhinjam along with their craft and gear for fishing. But construction of fishing harbours at Perumathura in the north and Thengaipatnam in the south has resulted in a decline in their migration and the failure of the southwest monsoon added to the decline in monsoon fishing activity in recent years. The inshore areas of the southwest coast between Vizhinjam and Cape Comorin are rich in young ones of both pelagic and demersal fishes. Pelagic finfishes continue to be the dominant group, constituted chiefly by tunas, clupeids, mackerels, carangids and ribbonfishes. Targeted fishing for the coastal tuna species, *Auxis rochei*, is being actively carried out by traditional and motorised units.

The annual marine landings in Thiruvanthapuram district during 2015-2021 are given in Figure 10.1.3. The sampling design divided the whole Thiruvananthapuram district into two zones namely K1 and K2. All of the landing centres for the current study were located within the K1 zone, which stretches from Kollencode in the south to Poonthura in the north. The annual landings of K1 zone during 2016-2021 are given in Fig. 10.1.4. Among the different landing centres of K1 zone, Vizhinjam contributes more to the annual landings. As a result of motorization, the area of fishing extended to 20-25 km off Vizhinjam coast at a depth range of 60-80 m, whereas the traditional crafts were confined to the 10 km range from the shore at a depth of 40-50 m. Due to the rocky bottom, trawl fishing is not undertaken, but a variety of traditional gears are operated in this centre to exploit the fishery, and resources, both pelagic and demersal, in different seasons depending on the types of fish available and the seasonal climatic changes. These included drift nets, other gill nets, hooks and lines, shore seines and boat seines. Major gears such as boat seine, drift net, hooks and lines, roll vala, and some minor gears such as chalavala, netholivala and konchuvalla are seasonal in their operation. Reduction in the effort of non-motorised crafts which operate gears like chalavala and netholivala together with the climatic changes can be a reason for the decline in the catch of resources like sardines, *Thryssa* and silverbellies.

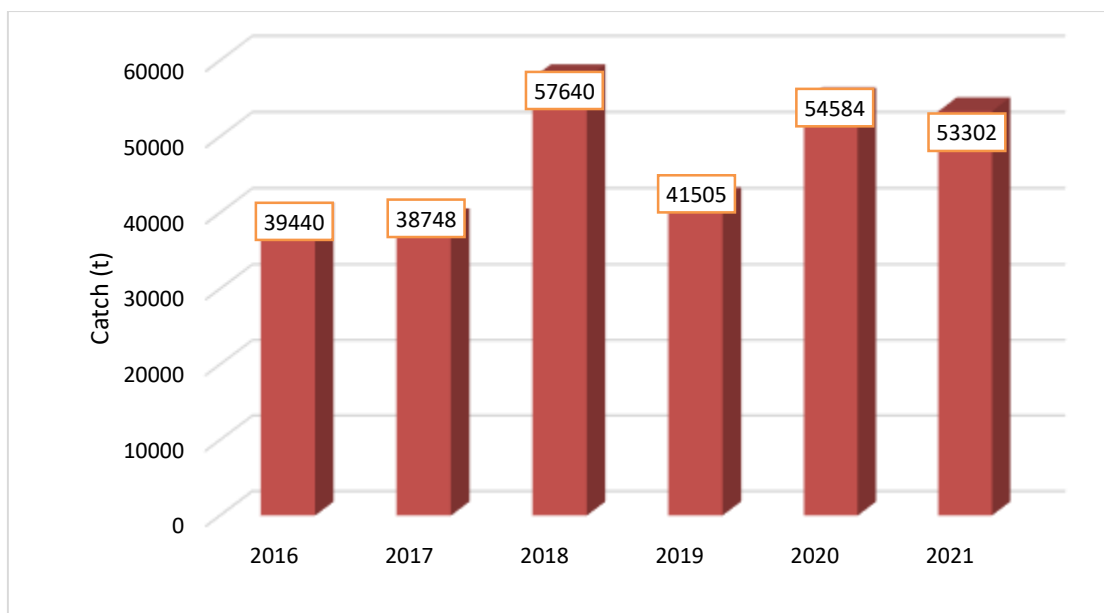


Fig. 10.1.3. Marine fish landings in Thiruvananthapuram (2016-2021) (K1 &K2 zone)

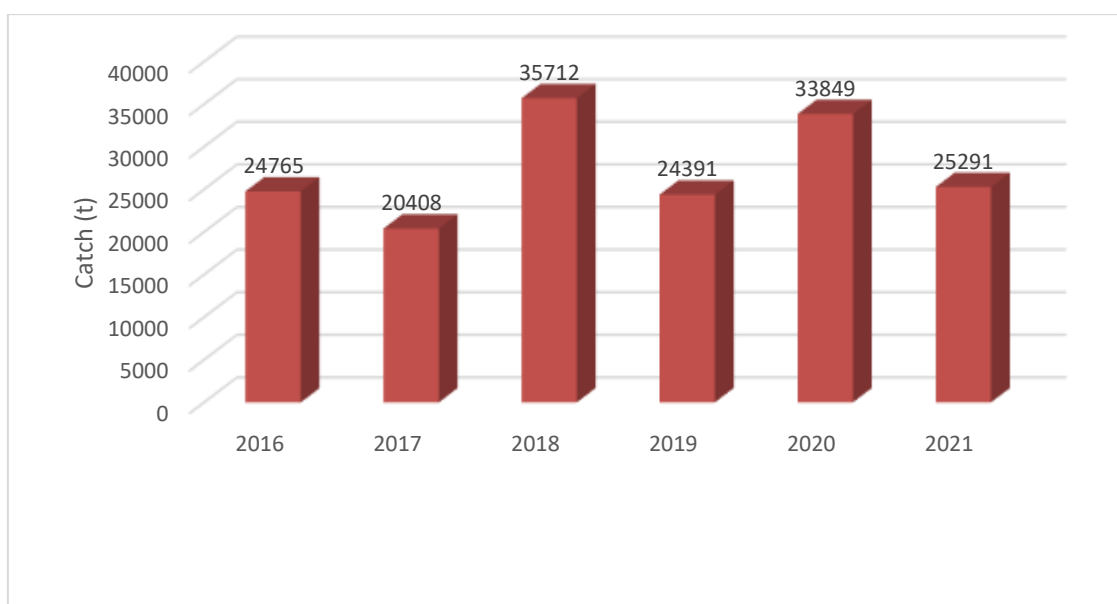


Fig.10.1.4. Marine fish landings at K1 zone of Thiruvananthapuram district (2016-2021)

The major fishing gears operated along the K1 zone comprised of OBBS (Boat seine), OBGN (Gillnet), OBHL (Hook and Line), OBSS (Outboard shore seine), OBOTHS (outboard

other gears), and NM- Non motorized units operating hand lines, gillnets and Hook and line. The No. of fishing units operated along the K1 zone is given in Fig. 10.1.5 and Table. 10.1.1.

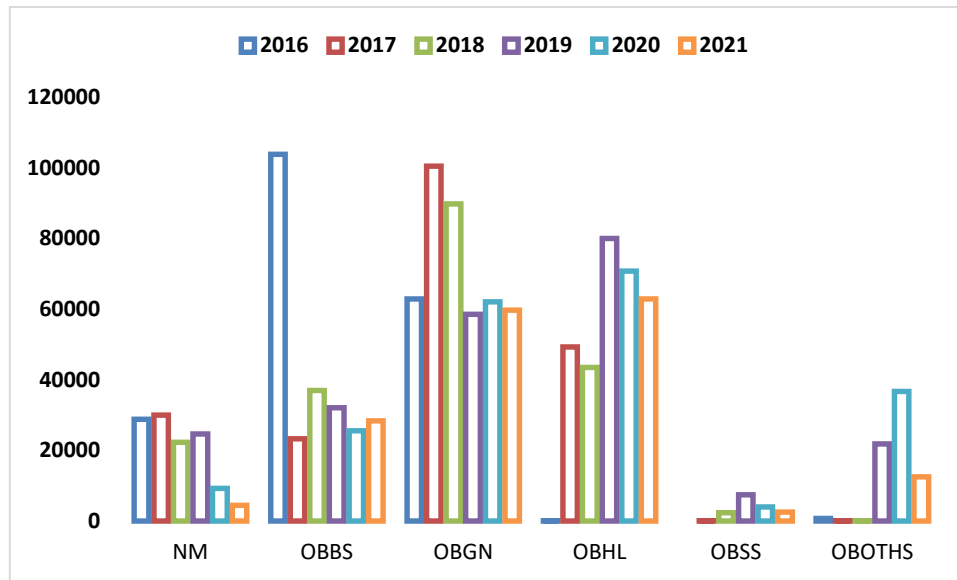


Fig. 10.1.5. No. of fishing units operated along the K1 zone of Thiruvananthapuram coast (2016-2021)

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine
OBOTHS- outboard other gears, NM- Non motorized units)

Table.10.1.1 No. of units operated along the K1 zone of Thiruvananthapuram coast (year wise)

Year	NM	OBBS	OBGN	OBHL	OBSS	OBOTHS
2016	28826	103879	62881	16	0	776
2017	30050	23328	100529	49316	173	178
2018	22364	37016	89874	43581	2377	70
2019	24729	32107	58572	80090	7515	21887
2020	9302	25631	62140	70766	4044	36776
2021	4493	28399	59743	62943	2553	12520

The general trend in the distribution of fishing gears operated from the K1 zone and the CPUE (Catch Per Unit Effort) of different gears are shown in Fig. 10.1.6, Fig. 10.1.7. and Table. 10.1.2.

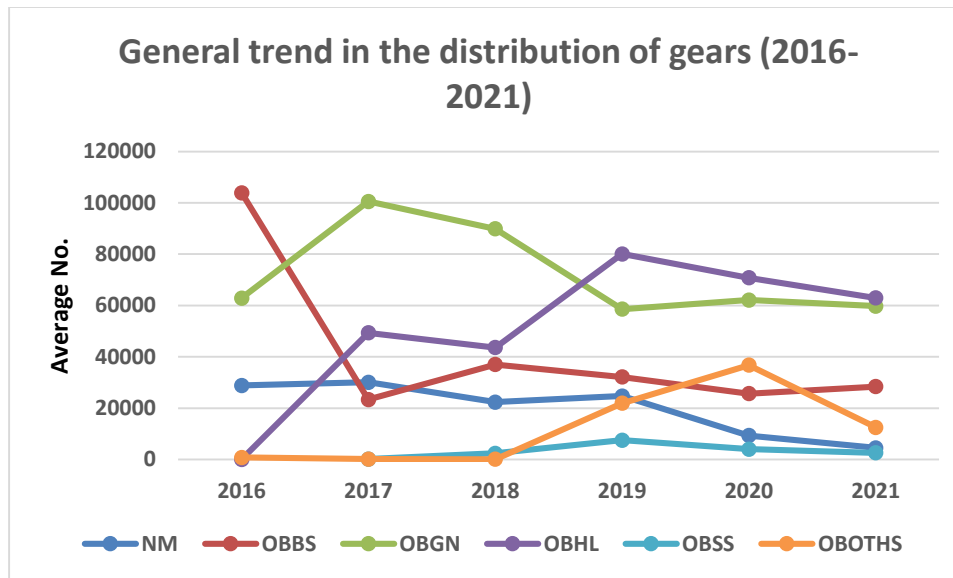


Fig.10.1.6. Gear distribution trends from 2016-2021

(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine
OBOTHS- outboard other gears, NM- Non motorized units)

Table.10.1.2 CPUE (kg) of different gears (Year wise)

Year	NM	OBBS	OBGN	OBHL	OBSS	OBOTHS
2016	-	293.7	84.91	71.46	71.1	-
2017	24.94	308.2	85.41	78.54	17.0	35.75
2018	35.73	524.0	114.15	109.64	186.3	521.61
2019	26.93	328.5	63.13	62.89	119.4	161.97
2020	27.72	410.2	134.31	77.12	144.8	236.28
2021	24.57	460.8	78.34	81.12	138.6	156.22

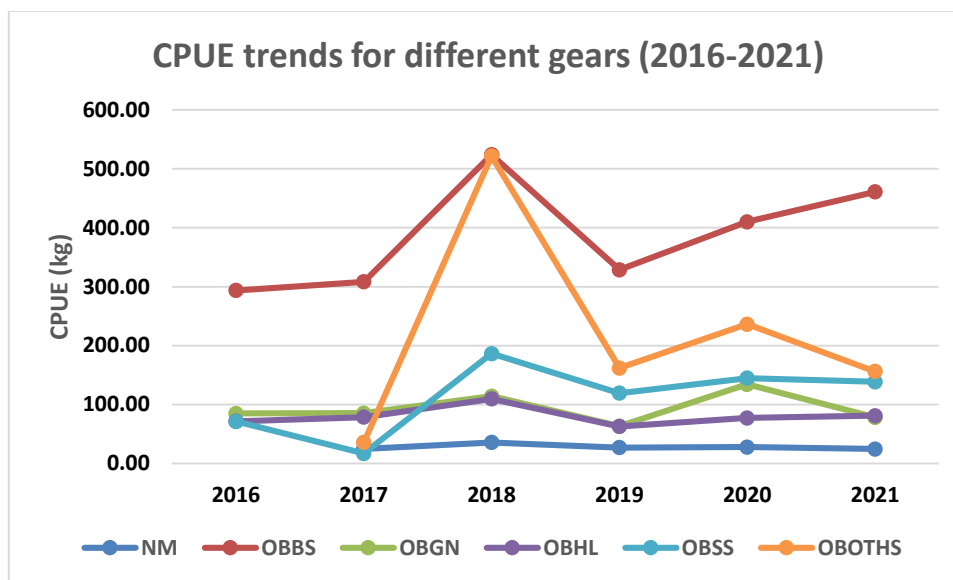


Fig.10.1.7 Trends in the CPUE of different gears from 2016-2021

An overview of the fish landings data estimated during the reporting period (June 2021-May 2022)

During the reporting period (June 2021-May 2022) an estimated 23934.033 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise- landing centre-wise catch data is shown in Fig.10.1.8 and table.10.1.3. The season-wise and zone-wise catch during the reporting period is shown in Fig.10.1.9. and Fig10.1.10. The annual catch per unit effort (CPUE) of major gears operated along the coast during the reporting period is given in Fig.10.1.14. and table 10.1.6. The number of fishing efforts (boats) operated along the zone during the reporting period is depicted in Fig.10.1.12. and table 10.1.4. and the annual catch gear-wise is depicted in Fig.10.1.13 table 10.1.5.

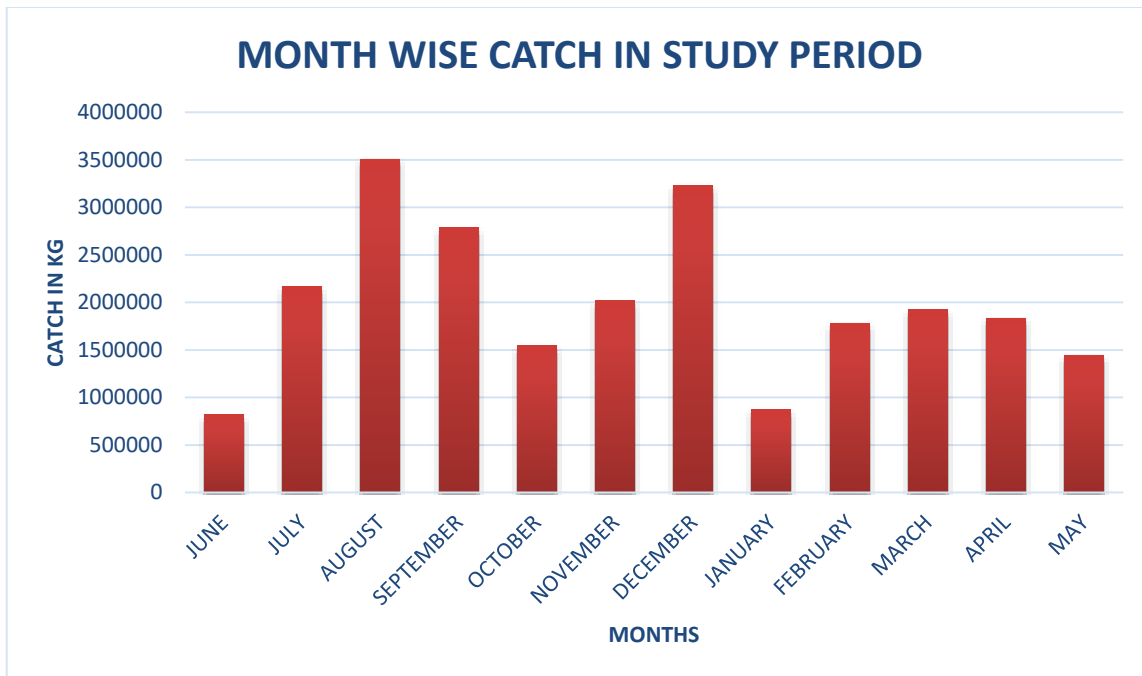


Fig.10.1.8. Month wise fish catch (kg) during the reporting period

Table. 10.1.3. Landing centre wise fish catch data (in tonnes)

Landing centres/ Months	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22
Poovar	17.9	0.9	17.2	45.5	89.2	37.2	189.8	69.8	360.2	233.9	145.6	129.3
Karumkulam	2.0	1.8	0.0	93.4	11.4	31.5	145.6	20.2	68.8	88.5	92.9	74.7
Kochuthura	0.0	0.0	0.0	0.0	0.0	3.1	5.0	3.4	2.5	11.3	1.5	11.3
Puthiathura	10.0	112.5	26.7	89.1	192	348.6	155.4	113	106	217	185	85.3
Pallam	2.4	61.4	33.6	0.0	53.4	74.9	49.0	29.8	76.2	234	19.5	70.9
Pulluvila	4.7	0.0	2.5	41.6	138	71.9	406.0	79.3	51.0	60.2	323	62.5
Adimalathura	10.1	13.4	13.9	85.1	87.7	329.5	1209	174	168	237	224	16.2
Vizhinjam	770.2	1975	3417	2431	749	644.1	530.1	205	588	448	547	890
Kovalam	0.4	1.9	0.0	0.0	0.0	1.8	6.6	6.4	2.7	3.3	2.6	0.0
Panathura	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.3	0.0	0.1	0.0
Poonthura	1.5	0.2	0.0	0.0	221.	472.3	533.8	168	358	393	294	104

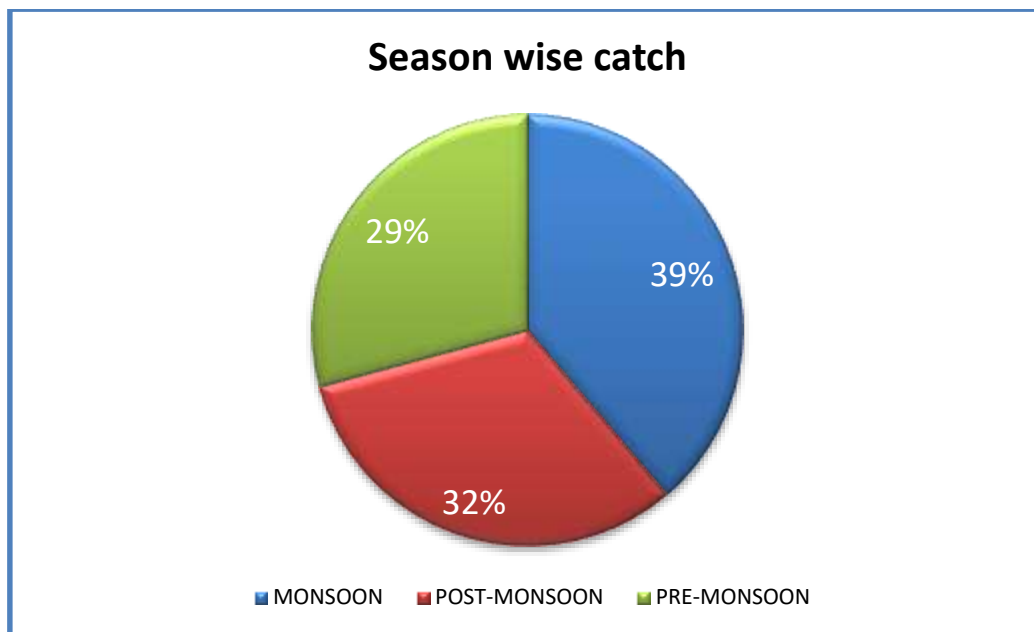


Fig.10.1.9. Season wise fish catch during the reporting period

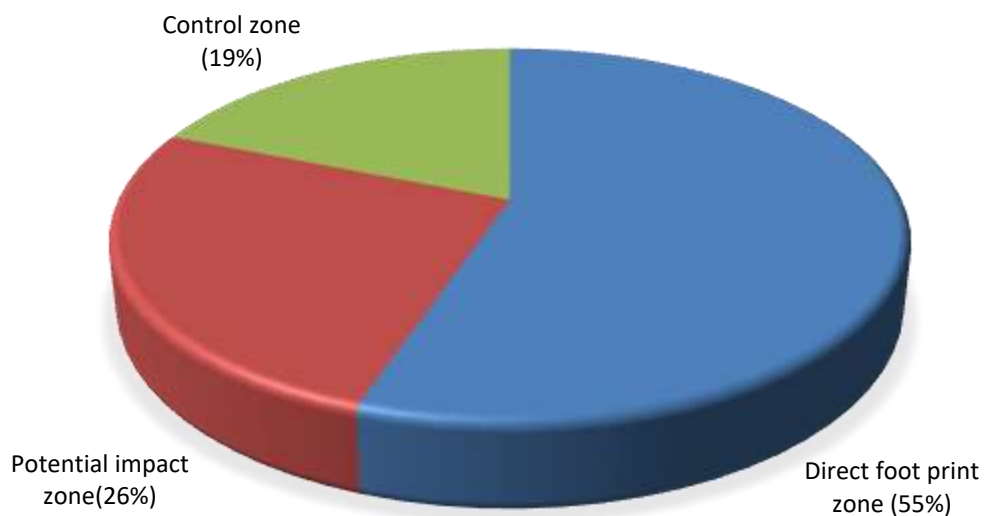


Fig.10.1.10. Zone wise total catch (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone)

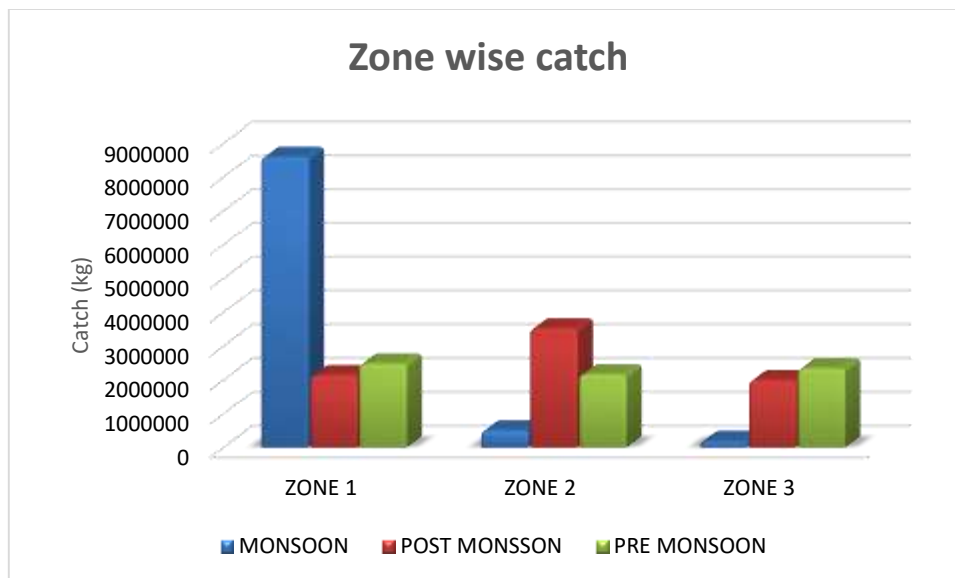


Fig.10.1.11. Zone wise (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch during different seasons

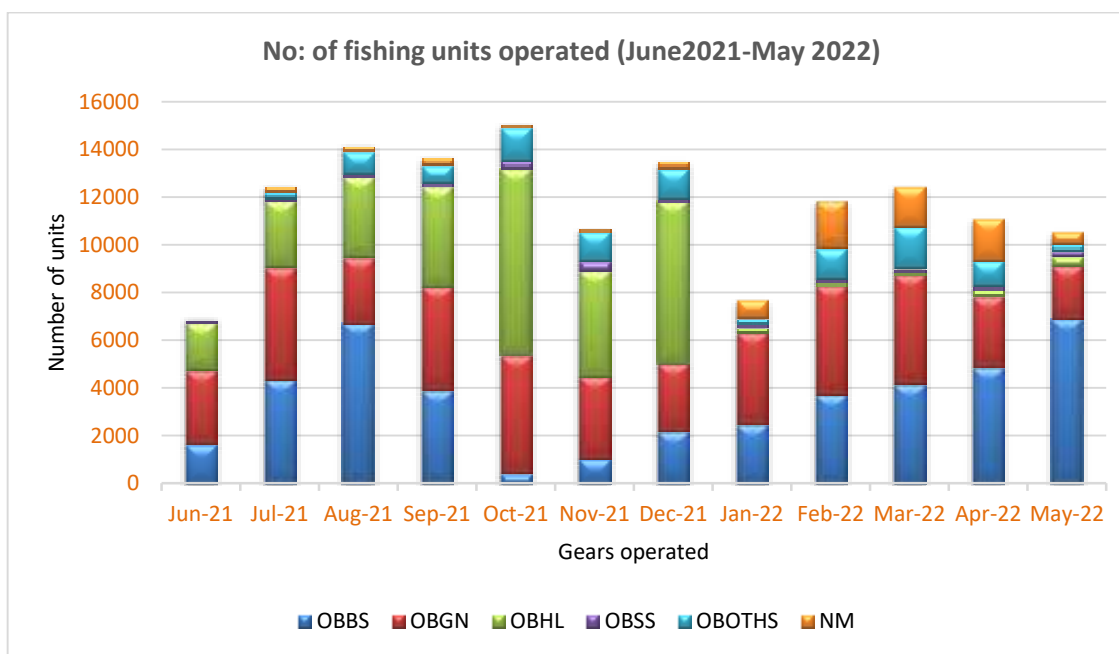


Fig.10.1.12. . No. of fishing units operated during the reporting period

Table. 10.1.4. No. of fishing units operated along the zone (OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBOTHS- outboard other gears, NM- Non motorized units)

MONTH	OBBS	OBGN	OBHL	OBSS	OBOTHS	NM
Jun-21	1652	3086	1992	109	-	94
Jul-21	4348	4718	2781	106	277	243
Aug-21	6690	2794	3368	126	945	273
Sep-21	3911	4345	4206	164	723	321
Oct-21	430	4947	7790	356	1407	153
Nov-21	1029	3452	4431	421	1222	161
Dec-21	2181	2832	6797	140	1246	331
Jan-22	2471	3850	218	144	247	772
Feb-22	3713	4567	163	132	1288	2005
Mar-22	4168	4578	131	148	1724	1712
Apr-22	4875	2987	249	175	1041	1781
May-22	6893	2235	408	198	301	531

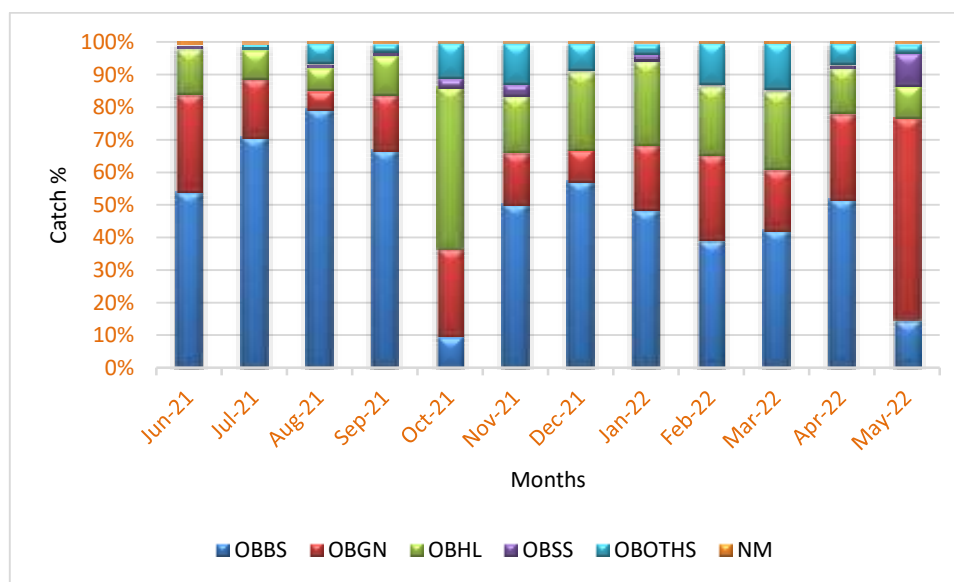


Fig.10.1.13. Percentage contribution of different gears in fish landing center from the period of June 2021-May 2022

**Table. 10.1.5. Fish catch (kg) landed by different gears during the reporting period
(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine
OBOTHS- outboard other gears, NM- Non motorized units)**

MONTHS/ GEARS	OBBS (KG)	OBGN (KG)	OBHL (KG)	OBSS (KG)	OBOTHS (KG)	NM (KG)
Jun-21	441242	247702	114917	10374	-	4914
Jul-21	1532237	393401	189897	4459	40143	7804
Aug-21	2785078	208822	246790	41109	221267	7798
Sep-21	1856803	480523	335970	29570	74377	8496
Oct-21	151090	413151	763351	46712	166341	1528
Nov-21	1010071	326516	349311	73735	253957	3595
Dec-21	1845279	319493	779916	16484	262509	6540
Jan-22	420439	174563	224893	18381	28584	2378
Feb-22	700797	465431	375437	11815	227326	2139
Mar-22	813700	361638	462252	11768	275461	2877
Apr-22	947535	488221	254805	20771	120046	4489
May-22	211730	897224	142137	148043	41307	4574

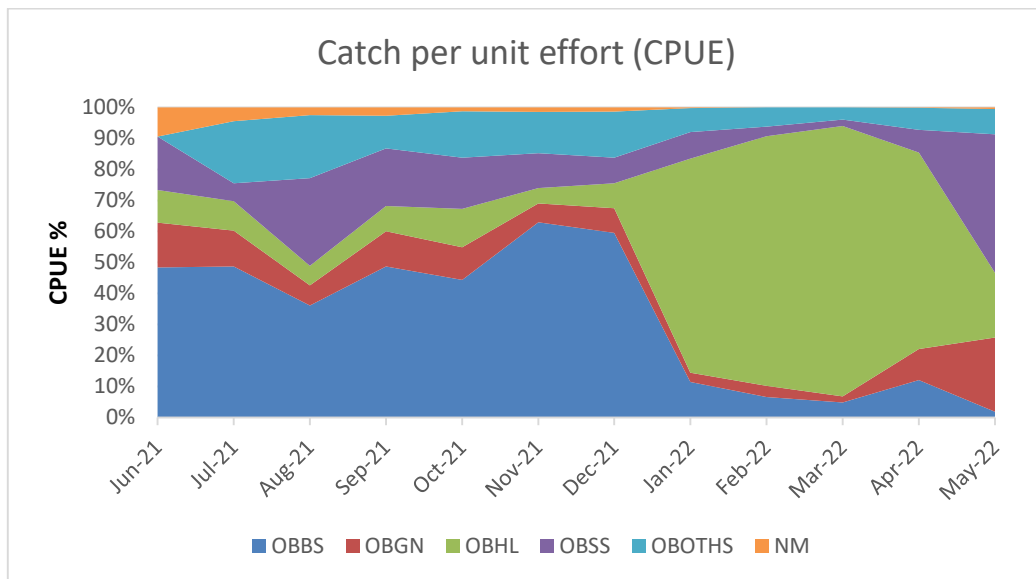


Fig.10.1.14. CPUE of different gears during the reporting period

Table No. 10.1.6 Catch per unit effort (KG) of different gears during June 2021-May 2022

**(OBBS- Boat seine, OBGN- Gillnet, OBHL- Hook and Line, OBSS- Outboard shore seine
OBOTHS- outboard other gears, NM- Non motorized units)**

MONTHS/ GEARS	OBBS (KG)	OBGN (KG)	OBHL (KG)	OBSS (KG)	OBOTHS (KG)	NM (KG)
Jun-21	267.10	80.27	57.69	95.17	0.00	52.28
Jul-21	352.40	83.38	68.28	42.07	144.92	32.12
Aug-21	416.30	74.74	73.27	326.26	234.14	28.56
Sep-21	474.76	110.59	79.88	180.30	102.87	26.47
Oct-21	351.37	83.52	97.99	131.21	118.22	9.99
Nov-21	981.60	94.59	78.83	175.14	207.82	22.33
Dec-21	846.07	112.82	114.74	117.74	210.68	19.76
Jan-22	170.15	45.34	1031.62	127.65	115.72	3.08
Feb-22	188.74	101.91	2303.29	89.51	176.50	1.07
Mar-22	195.23	78.99	3528.64	79.51	159.78	1.68
Apr-22	194.37	163.45	1023.31	118.69	115.32	2.52
May-22	30.72	401.44	348.38	747.69	137.23	8.61

10.2 MONSOON SEASON

Fish landings data collected for the monsoon season started on June 2021 and ended in September 2021. Landing centre-wise fish landings (tonnes) during monsoon season are depicted in Fig. 10. 2.1

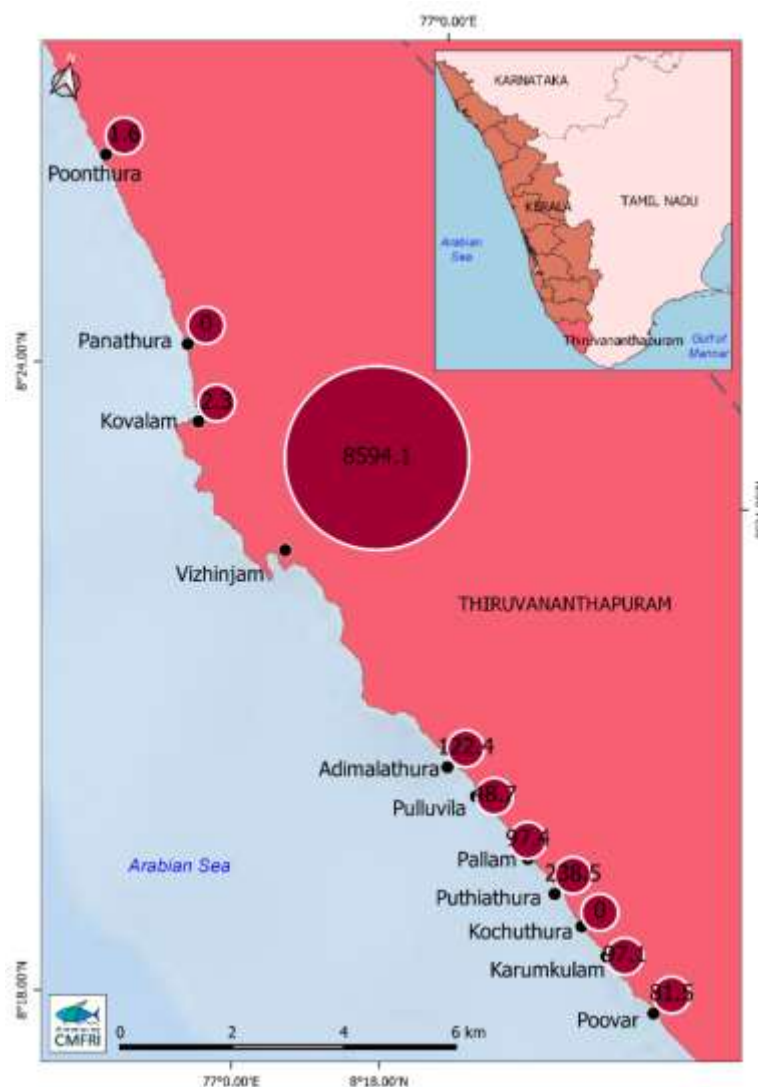


Fig. 10.2.1. Landing centre-wise fish landings (tonnes) during monsoon season

10.2.1 Fish population & its landing

During monsoon season, the catch was reported mainly from the Vizhinjam landing centre. Detailed landings on landing centre wise for June, July, August and September 2021

were given in Fig. 10.2.1.c, Fig. 10.2.1.d, Fig.10.2.1.e and Fig.10.2.1.f respectively. The zone-wise and gear-wise catch during monsoon season is depicted in Fig.10.2.1.a and Fig10.2.1.b

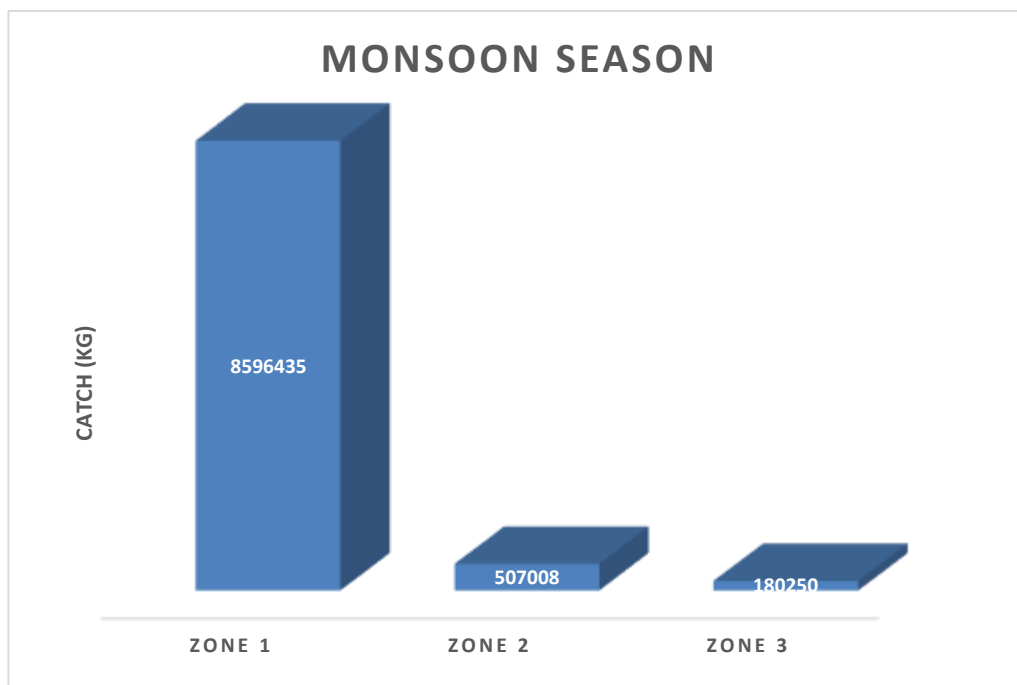


Fig.10.2.1.a Zone wise fish catch (kg) during monsoon season

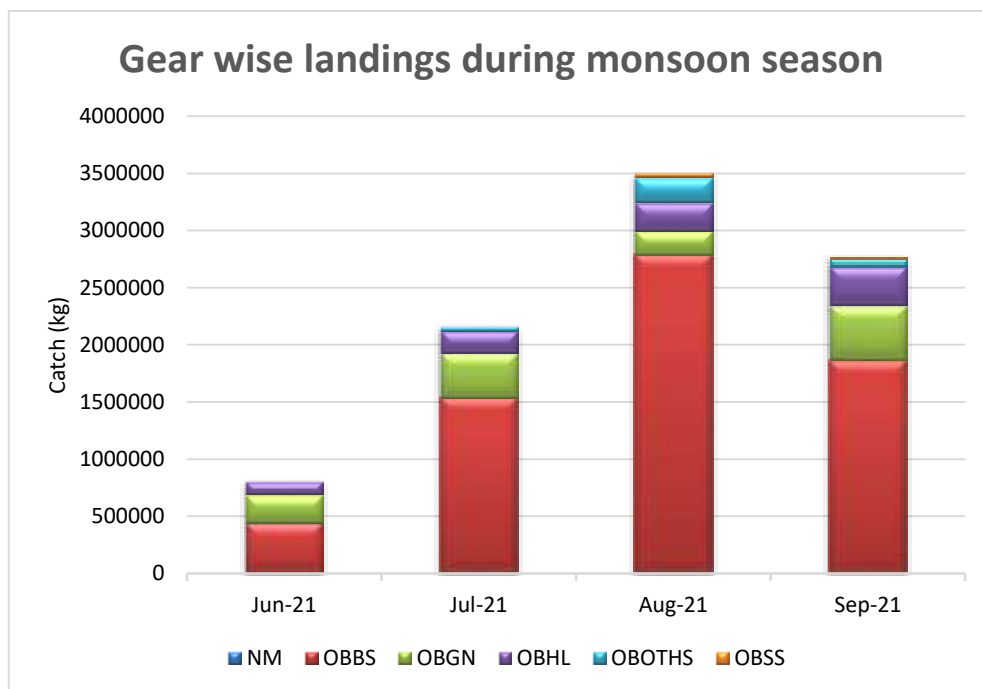


Fig.10.2.1.b Gear wise fish landings during monsoon season

Landing centre-wise fish catch data during the monsoon season

Detailed analysis of the month-wise fish landings at different landing centres during the monsoon season was carried out, and the results are given below.

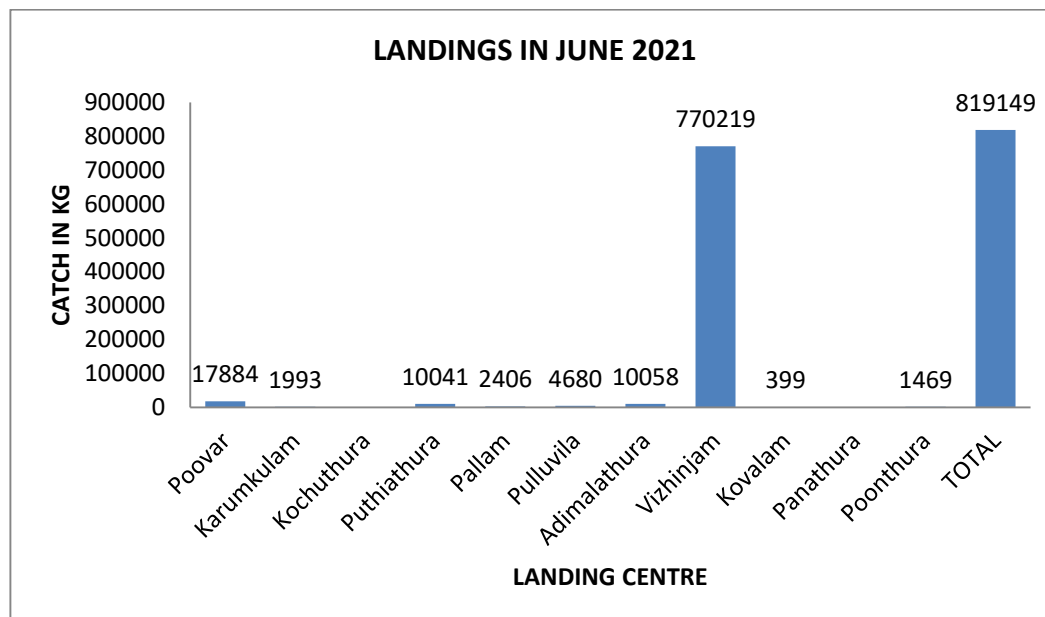


Fig.10.2.1.c Fish landings (kg) during June 2021 at different landing centers

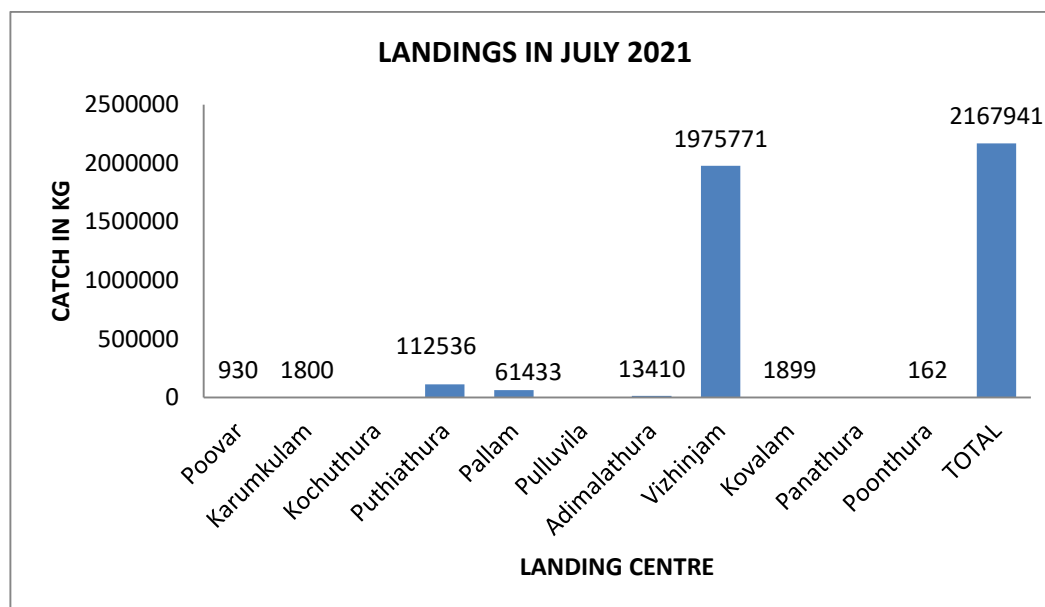


Fig.10.2.1.d Fish landings (kg) during July 2021 at different landing centers

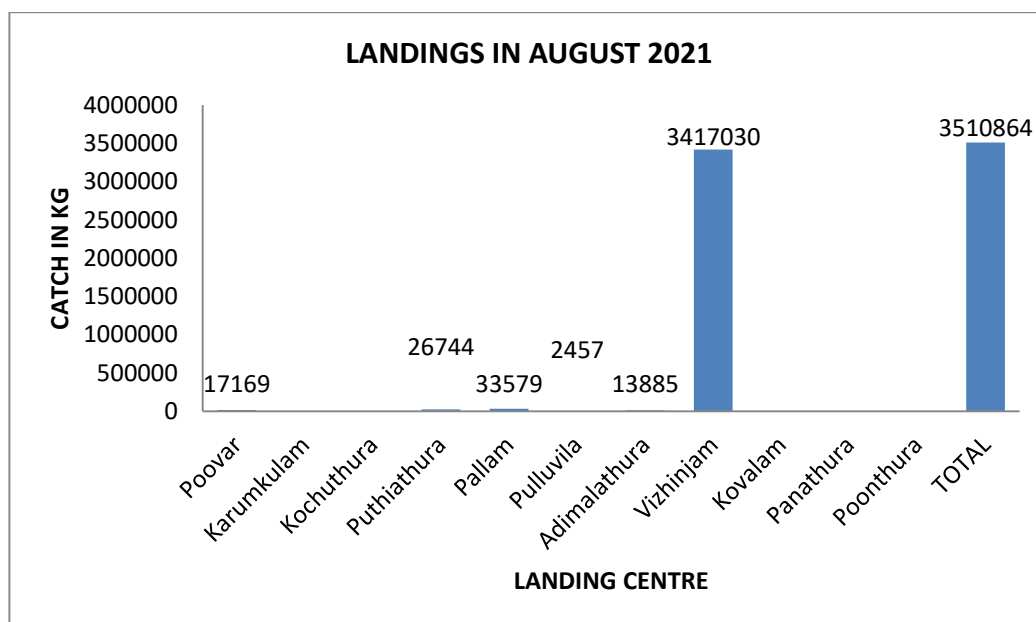


Fig.10.2.1.e Fish landings (kg) during August 2021 at different landing centers

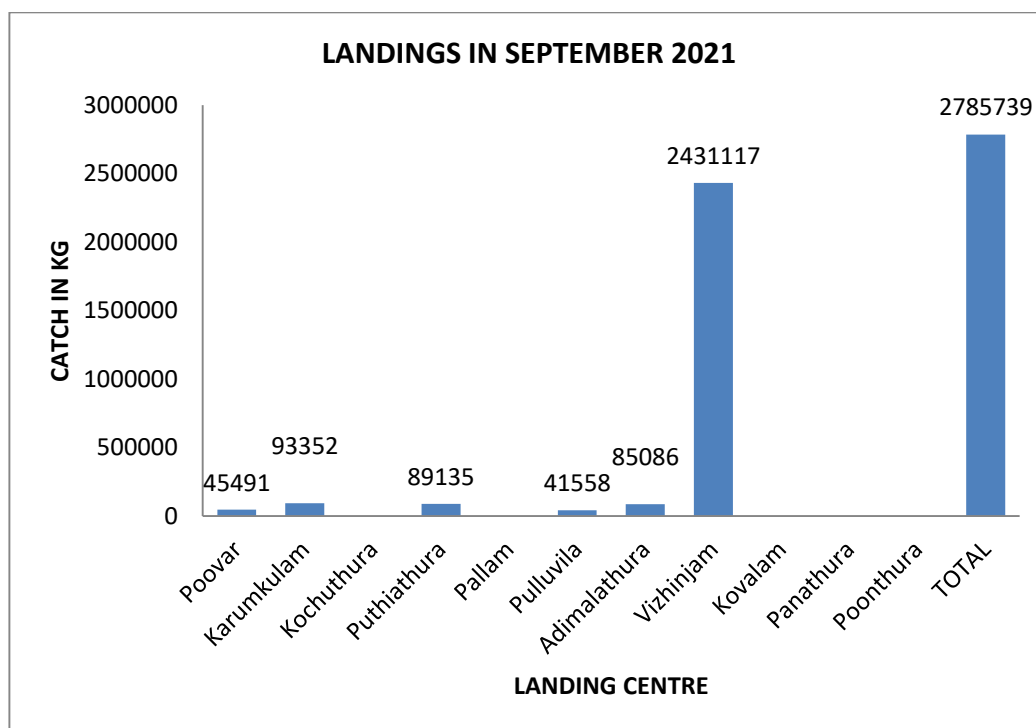


Fig.10.2.1.f Fish landings (kg) during September 2021 at different landing centers

The fishing ground information during the monsoon season is given in Fig. 10.2.1.g

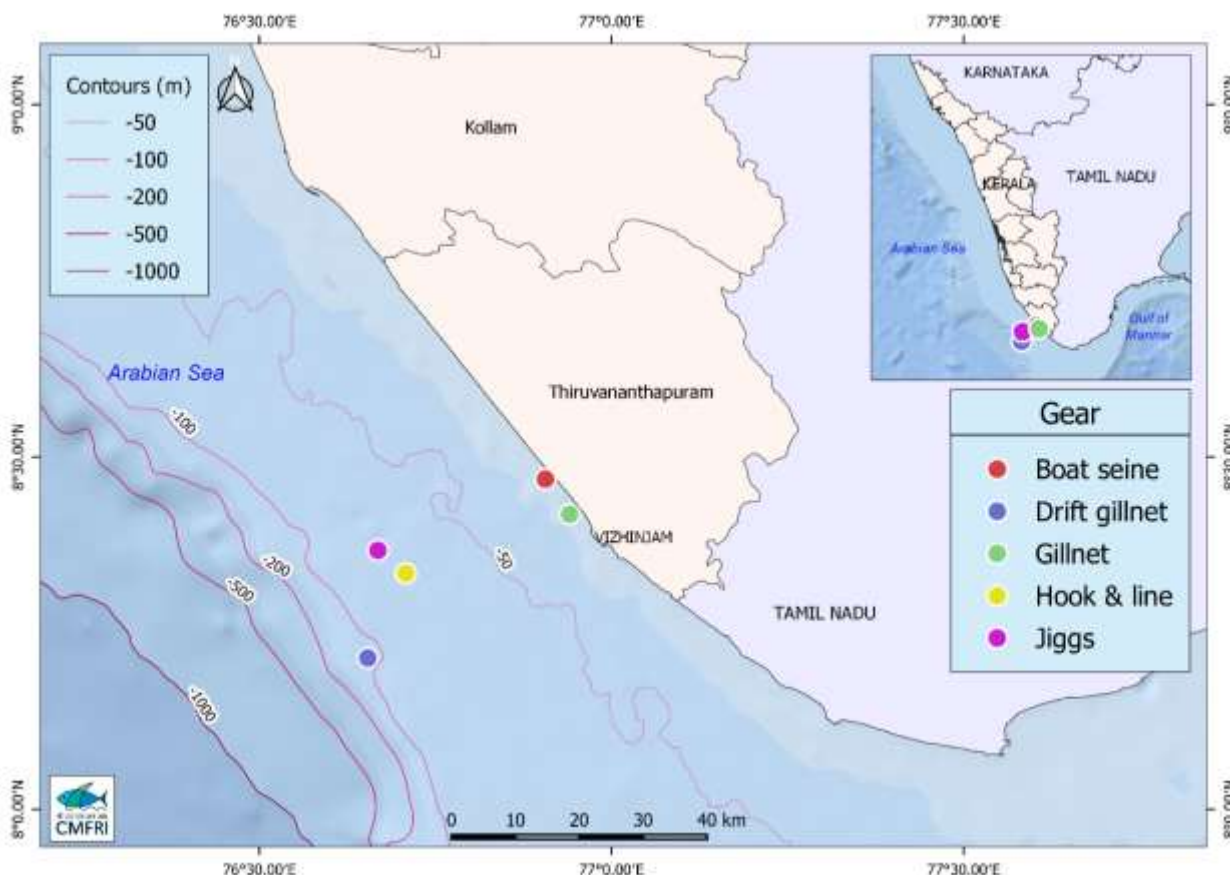


Fig.10.2.1.g Fishing ground information of major gears operating during the monsoon season

The monthly landings of different species during the monsoon season are given in Table 10.2.1.a, 10.2.1.b, 10.2.1.c. & 10.2.1.d.

Table. 10.2.1.a Fish species landed and its catch in June 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	95
<i>Acanthocybium solandri</i>	26
<i>Alepes djedaba</i>	7
<i>Alepes kleinii</i> (<i>A. kalla</i>) (<i>A. para</i>)	22
<i>Alutera monoceros</i>	1746
<i>Amblygaster sirm</i> (<i>Sardinella sirm</i>)	1849
<i>Anthias</i> spp.	2600
<i>Atule mate</i> (<i>Alepes mate</i>)	3069

<i>Auxis rochei</i>	112532
<i>Auxis thazard</i>	24481
<i>Caranx ignobilis</i>	1200
<i>Caranx sexfasciatus</i>	39
Caranx spp.	288
<i>Cephalopholis argus</i>	26
<i>Cephalopholis miniata</i> (<i>C. miniatus</i>)	26
<i>Cephalopholis sonnerati</i>	1440
<i>Coryphaena hippurus</i>	3733
Cynoglossus spp.	46
<i>Decapterus kurroides</i>	3588
<i>Decapterus macrosoma</i>	1387
<i>Decapterus russelli</i> (<i>D. dayi</i>)	49001
Decapterus spp.	1196
<i>Diodon hystrix</i>	2
<i>Dussumieria acuta</i>	96178
<i>Elagatis bipinnulata</i>	104
<i>Encrasicholina punctifer</i> (<i>Stolephorus punctifer</i>)	52883
Encrasicholina spp.	7061
<i>Epinephelus chlorostigma</i>	52
<i>Epinephelus coioides</i>	10
<i>Epinephelus diacanthus</i>	10
<i>Epinephelus longispinis</i>	104
<i>Epinephelus ongus</i>	3120
Epinephelus spp.	78
<i>Erythrocles schlegelii</i>	20887
<i>Euthynnus affinis</i>	20849
<i>Fistularia petimba</i> (<i>F. villosa</i>)	13
Gnathanodon spp.	867
<i>Hemiramphus lutkei</i> (<i>H. marginatus</i>)	35
Hemiramphus spp.	13979
<i>Hyporhamphus xanthopterus</i>	364
<i>Istiophorus platypterus</i>	2324
Johnieops spp.	1170
<i>Kajikia audax</i> (<i>Tetrapterus audax</i>)	3869

<i>Katsuwonus pelamis</i>	2132
<i>Lactarius lactarius</i>	395
<i>Leiognathus spp.</i>	8785
<i>Lethrinus lentjan</i>	78
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	104
<i>Lutjanus johnii</i>	26
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	156
<i>Lutjanus russelli</i>	156
<i>Manta birostris</i>	2678
<i>Mene maculate</i>	115943
<i>Mobula spp.</i>	1820
<i>Mugil cephalus</i>	51
<i>Myripristis spp.</i>	867
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	972
<i>Nemipterus japonicus</i>	4568
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	286
<i>Nemipterus spp.</i>	104
<i>Odonus niger</i>	108
<i>Otolithes cuvieri</i>	260
<i>Otolithes ruber</i>	1217
<i>Parascolopsis aspinosa</i>	1213
<i>Parupeneus indicus</i>	867
<i>Pellona ditchela</i>	7
<i>Penaeus indicus</i>	11753
<i>Penaeus monodon</i>	1130
<i>Platycephalus indicus</i>	260
<i>Pomadasys maculatus</i> (<i>P. maculatum</i>)	260
<i>Portunus pelagicus</i>	52
<i>Portunus sanguinolentus</i>	572
<i>Priacanthus hamrur</i>	1927
<i>Priacanthus spp.</i>	26
<i>Pristipomoides filamentosus</i>	218
<i>Rachycentron canadum</i>	3479
<i>Rastrelliger kanagurta</i>	34637
<i>Sarda orientalis</i>	7261
<i>Sardinella fimbriata</i>	3813

<i>Sardinella gibbosa</i>	3949
<i>Sardinella spp.</i>	271
<i>Sargocentron (Holocentrus) diadema (H. diadema)</i>	1213
<i>Saurida tumbil</i>	634
<i>Saurida undosquamis</i>	364
<i>Scomberoides commersonianus</i>	18
<i>Scomberomorus commerson</i>	6949
<i>Scomberomorus guttatus</i>	10684
<i>Secutor insidiator</i>	73
<i>Selar crumenophthalmus</i>	30635
<i>Sepia pharaonis</i>	947
<i>Sepioteuthis lessoniana</i>	49
<i>Sphyraena forsteri</i>	52
<i>Sphyraena jello</i>	99
<i>Sphyraena obtusata</i>	522
<i>Sphyraena putnamae</i>	2710
<i>Sphyraena spp.</i>	676
<i>Stolephorus commersonii</i>	15808
<i>Stolephorus indicus</i>	4299
<i>Stolephorus spp.</i>	40350
<i>Stolephorus waitei</i>	31440
<i>Sufflamen frenatum (S. capistratus)</i>	111
<i>Synaptura spp.</i>	156
<i>Synodus spp.</i>	104
<i>Terapon jarbua</i>	416
<i>Terapon theraps (Eutherapon theraps)</i>	1733
<i>Thryssa spp.</i>	2808
<i>Thunnus albacares</i>	3900
<i>Trachinocephalus myops</i>	130
<i>Trachinotus blochii</i>	35
<i>Trichiurus lepturus</i>	2600
<i>Tylosurus crocodilus (Strongylura crocodilus)</i>	78
<i>Upeneus spp.</i>	1846
<i>Upeneus sulphurous</i>	416

<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	940
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	6885
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	4712
TOTAL	819149

Table. 10.2.1.b Fish species landed and its catch in July 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	4860
<i>Acanthocybium solandri</i>	1620
<i>Alectis ciliaris</i>	135
<i>Alectis indica</i>	41
<i>Alepes djedaba</i>	765
<i>Alepes kleinii (A. kalla) (A. para)</i>	6177
<i>Alopias spp.</i>	855
<i>Alutera monoceros</i>	24144
<i>Anthias spp.</i>	
<i>Atule mate(Alepes mate)</i>	8008
<i>Auxis rochei</i>	103795
<i>Auxis thazard</i>	14577
<i>Carangoides coeruleopinnatus</i>	638
<i>Carangoides hedlandensis</i>	47
<i>Carangoides spp.</i>	306
<i>Caranx heberi (C. sem)</i>	162
<i>Caranx hippos</i>	872
<i>Caranx ignobilis</i>	5156
<i>Caranx sexfasciatus</i>	169
<i>Caranx spp.</i>	2012
<i>Caranx tille</i>	844
<i>Cephalopholis miniata(C. miniatus)</i>	14
<i>Cephalopholis sonnerati</i>	307

<i>Cephalopholis urodeta</i>	2535
<i>Chanos chanos</i>	1080
<i>Charybdis feriatus</i> (<i>C. cruciata</i>)	537
<i>Charybdis natator</i>	62
<i>Chirocentrus nudus</i>	51
<i>Cookeolus japonicus</i>	113
<i>Coryphaena hippurus</i>	18254
<i>Cynoglossus macrolepidotus</i> (<i>C. arel</i>)	1443
<i>Cynoglossus</i> spp.	3713
<i>Dasyatis microps</i>	450
<i>Decapterus macarellus</i>	72
<i>Decapterus russelli</i> (<i>D. dayi</i>)	504208
<i>Decapterus</i> spp.	2100
<i>Dussumieria acuta</i>	108092
<i>Encrasicholina devisi</i> (<i>Stolephorus devisi</i>)	1485
<i>Encrasicholina punctifer</i> (<i>Stolephorus punctifer</i>)	229990
<i>Encrasicholina</i> spp.	33502
<i>Epinephelus bleekeri</i>	41
<i>Epinephelus diacanthus</i>	2317
<i>Epinephelus malabaricus</i>	189
<i>Epinephelus radiatus</i>	1605
<i>Erythrocles schlegelii</i>	4613
<i>Euthynnus affinis</i>	60361
<i>Fistularia petimba</i> (<i>F. villosa</i>)	515
<i>Gerres filamentosus</i>	1048
<i>Gymnosarda unicolor</i>	248
<i>Gymnura poecilura</i>	855
<i>Hemiramphus</i> spp.	2813
<i>Himantura imbricata</i> (<i>Amphotistius imbricatus</i>)	1958
<i>Himantura</i> spp.	450
<i>Iniistius bimaculatus</i>	27
<i>Istiompax indica</i> (<i>Makaira indica</i>)	6368
<i>Istiophorus platypterus</i>	10683
<i>Johnius carutta</i>	720
<i>Johnius</i> spp.	10824
<i>Kajikia audax</i> (<i>Tetrapterus audax</i>)	8861
<i>Katsuwonus pelamis</i>	1664

<i>Lactarius lactarius</i>	2211
<i>Lagocephalus inermis</i>	7200
<i>Leiognathus brevirostris</i>	229
<i>Leiognathus equula</i> (<i>L. equulus</i>)	1292
<i>Leiognathus</i> spp.	11028
<i>Lepturacanthus savala</i>	27900
<i>Lethrinus lentjan</i>	604
<i>Lobotes surinamensis</i>	419
<i>Lutjanus johnii</i>	270
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	1679
<i>Lutjanus vita</i>	945
<i>Manta birostris</i>	38859
<i>Megalaspis cordyla</i>	5765
<i>Mene maculate</i>	205980
<i>Metapenaeus dobsoni</i>	129
<i>Mobula alfredi</i> (<i>Manta alfredi</i>)	270
<i>Mobula</i> spp.	2438
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	32664
<i>Nemipterus japonicus</i>	4327
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	4724
<i>Nemipterus</i> spp.	117
<i>Neotrygon kuhlii</i> (<i>Dasyatis kuhlii</i>)	450
<i>Nibea maculate</i>	54
<i>Odonus niger</i>	351
<i>Opisthopterus tardoore</i>	208
<i>Otolithes cuvieri</i>	5803
<i>Otolithes ruber</i>	15292
<i>Otolithes</i> spp.	50
<i>Pampus argenteus</i>	1890
<i>Parapenaeopsis stylifera</i>	450
<i>Parapercis alboguttata</i>	24
<i>Parascalopsis eriomma</i>	38
<i>Parastromateus</i> (<i>Formio</i>) <i>niger</i> (<i>F. niger</i>)	9018
<i>Parupeneus</i> spp.	225
<i>Pellona ditchela</i>	10117
<i>Pempheris</i> spp.	28
<i>Penaeus canaliculatus</i>	88

<i>Penaeus indicus</i>	12363
<i>Penaeus monodon</i>	718
<i>Photopectoralis bindus (Leiognathus bindus)</i>	54
<i>Pomadasys maculatus (P. maculatum)</i>	11250
<i>Portunus pelagicus</i>	719
<i>Portunus sanguinolentus</i>	8766
<i>Priacanthus hamrur</i>	2813
<i>Pristipomoides filamentosus</i>	900
<i>Pristipomoides typus</i>	356
<i>Rachycentron canadum</i>	5494
<i>Rastrelliger kanagurta</i>	105156
<i>Rhinobatos obtusus</i>	630
<i>Sarda orientalis</i>	20300
<i>Sardinella fimbriata</i>	11250
<i>Sardinella gibbosa</i>	21715
<i>Sardinella longiceps</i>	1406
<i>Saurida gracilis</i>	113
<i>Saurida spp.</i>	4814
<i>Saurida tumbil</i>	9631
<i>Saurida undosquamis</i>	16095
<i>Scoliodon laticaudus</i>	33
<i>Scolopsis bimaculata</i>	292
<i>Scomberoides tala</i>	233
<i>Scomberomorus commerson</i>	9377
<i>Scomberomorus guttatus</i>	789
<i>Secutor insidiator</i>	6874
<i>Selar crumenophthalmus</i>	27057
<i>Selaroides leptolepis</i>	28
<i>Sepia pharaonis</i>	6477
<i>Sepia spp.</i>	135
<i>Sepioteuthis lessoniana</i>	54
<i>Seriolina nigrofasciata</i>	243
<i>Sillago sihama</i>	52
<i>Sphyraena forsteri</i>	1125
<i>Sphyraena jello</i>	2778
<i>Sphyraena obtusata</i>	8165
<i>Sphyraena putnamae</i>	1324
<i>Stolephorus commersonnii</i>	55055

<i>Stolephorus indicus</i>	34696
<i>Stolephorus spp.</i>	41267
<i>Stolephorus waitei</i>	65178
<i>Sufflamen frenatum</i> (<i>S. capistratus</i>)	249
<i>Terapon jarbua</i>	9744
<i>Terapon theraps</i> (<i>Eutherapon theraps</i>)	56
<i>Thryssa mystax</i>	38
<i>Thryssa spp.</i>	10463
<i>Thunnus albacares</i>	608
<i>Torpedo marmorata</i>	270
<i>Trachinocephalus myops</i>	473
<i>Trichiurus lepturus</i>	6150
<i>Upeneus sulphureus</i>	1524
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>edulis</i> (<i>D. singhalensis</i>)	5400
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>singhalensis</i> (<i>D. sibogae</i>)	10119
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) <i>duvaucelii</i> (<i>L. duvaucelli</i>)	33932
<i>Xiphias gladius</i>	630
<i>Zebrias synapturoides</i>	23
TOTAL	2167941

Table. 10.2.1.c Fish species landed and its catch in August 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	448
<i>Acanthocybium solandri</i>	830
<i>Alectis ciliaris</i>	771
<i>Alectis indica</i>	50
<i>Alepes djedaba</i>	1937
<i>Alepes kleinii</i> (<i>A. kalla</i>) (<i>A. para</i>)	290
<i>Alutera monoceros</i>	24153
<i>Amblygaster sirm</i> (<i>Sardinella sirm</i>)	31
<i>Atule mate</i> (<i>Alepes mate</i>)	4628
<i>Auxis rochei</i>	57368
<i>Auxis thazard</i>	14874

<i>Caesio and Pterocaesio chrysozona</i> (<i>C. chrysozona</i>)	1240
<i>Carangoides malabaricus</i>	1535
<i>Carangoides spp.</i>	480
<i>Caranx heberi</i> (<i>C. sem</i>)	306
<i>Caranx hippos</i>	65
<i>Caranx ignobilis</i>	13616
<i>Caranx sexfasciatus</i>	65
<i>Caranx spp.</i>	1671
<i>Cephalopholis sonnerati</i>	316
<i>Charybdis</i> (<i>Goniohellenus</i>) <i>smithii</i>	93
<i>Charybdis feriatus</i> (<i>C. cruciata</i>)	217
<i>Chirocentrus dorab</i>	10
<i>Coryphaena hippurus</i>	18705
<i>Cynoglossus macrolepidotus</i> (<i>C. arel</i>)	888
<i>Cynoglossus spp.</i>	3250
<i>Dagetichthys commersonnii</i> (<i>Synaptura commersonnii</i>)	20
<i>Decapterus russelli</i> (<i>D. dayi</i>)	1464713
<i>Decapterus spp.</i>	191
<i>Dussumieria acuta</i>	71828
<i>Encrasicholina devisi</i> (<i>Stolephorus devisi</i>)	1033
<i>Encrasicholina punctifer</i> (<i>Stolephorus punctifer</i>)	45295
<i>Encrasicholina spp.</i>	124674
<i>Epinephelus chlorostigma</i>	108
<i>Epinephelus longispinis</i>	41
<i>Epinephelus ongus</i>	910
<i>Epinephelus undulosus</i>	230
<i>Euthynnus affinis</i>	185863
<i>Fistularia petimba</i> (<i>F. villosa</i>)	546
<i>Gazza minuta</i>	124
<i>Gazza spp.</i>	156
<i>Gerres filamentosus</i>	730
<i>Hilsa kelee</i>	16
<i>Iniistius bimaculatus</i>	44
<i>Istiompax indica</i> (<i>Makaira indica</i>)	1033
<i>Johnieops spp.</i>	1155
<i>Johnius borneensis</i> (<i>Johnieops vogleri</i>)	256

<i>Johnius sina (Johnieops sina)</i>	758
<i>Johnius spp.</i>	6058
<i>Kajikia audax (Tetrapterus audax)</i>	2080
<i>Lactarius lactarius</i>	325
<i>Lagocephalus inermis</i>	2113
<i>Leiognathus spp.</i>	21355
<i>Lepturacanthus savala</i>	508
<i>Lethrinus lentjan</i>	1289
<i>Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)</i>	173
<i>Lobotes surinamensis</i>	740
<i>Lutjanus johnii</i>	777
<i>Lutjanus lutjanus(L. lineolatus)</i>	7865
<i>Lutjanus russelli</i>	108
<i>Lutjanus spp.</i>	24
<i>Megalaspis cordyla</i>	1488
<i>Mene maculate</i>	69436
<i>Nemipterus bipunctatus(N. delagoae)</i>	5395
<i>Nemipterus japonicas</i>	11896
<i>Nemipterus randalli(Nemipterus mesoprion)</i>	27469
<i>Nibea maculate</i>	5922
<i>Odonus niger</i>	139
<i>Otolithes cuvieri</i>	8281
<i>Otolithes ruber</i>	5968
<i>Otolithes spp.</i>	325
<i>Pampus argenteus</i>	604
<i>Parapenaeopsis stylifera</i>	41
<i>Parapercis alboguttata</i>	73
<i>Parastromateus (Formio) niger(F. niger)</i>	4030
<i>Parupeneus indicus</i>	3404
<i>Pellona ditchela</i>	4396
<i>Pempheris spp.</i>	8
<i>Penaeus canaliculatus</i>	59
<i>Penaeus indicus</i>	21253
<i>Penaeus monodon</i>	108
<i>Penaeus semisulcatus</i>	167
<i>Pomadasy maculatus (P. maculatum)</i>	2708
<i>Portunus pelagicus</i>	1300
<i>Portunus sanguinolentus</i>	5009

<i>Priacanthus hamrur</i>	1479
<i>Priacanthus</i> spp.	1066
<i>Rachycentron canadum</i>	5338
<i>Rastrelliger kanagurta</i>	80982
<i>Sarda orientalis</i>	8415
<i>Sardinella fimbriata</i>	3416
<i>Sardinella gibbosa</i>	10762
<i>Sardinella</i> spp.	1495
<i>Sargocentron (Holocentrus) rubrum (H. ruber)</i>	7
<i>Saurida</i> spp.	1936
<i>Saurida tumbil</i>	47013
<i>Saurida undosquamis</i>	10612
<i>Scolopsis bimaculata</i>	78
<i>Scolopsis ciliate</i>	78
<i>Scomberoides commersonianus</i>	3640
<i>Scomberoides lysan</i>	72
<i>Scomberomorus commerson</i>	10253
<i>Scomberomorus guttatus</i>	35
<i>Selar crumenophthalmus</i>	21195
<i>Selaroides leptolepis</i>	101
<i>Sepia pharaonis</i>	15621
<i>Seriolina nigrofasciata</i>	1536
<i>Siganus canaliculatus(S. oramin)</i>	3467
<i>Sillago sihama</i>	3548
<i>Sphyræna obtusata</i>	66333
<i>Sphyræna putnamae</i>	28207
<i>Sphyræna</i> spp.	3663
<i>Stolephorus commersonii</i>	20398
<i>Stolephorus indicus</i>	21157
<i>Stolephorus</i> spp.	201097
<i>Stolephorus waitei</i>	199199
<i>Sufflamen frenatum(S. capistratus)</i>	426
<i>Synodus</i> spp.	758
<i>Terapon jarbua</i>	4847
<i>Thenus</i> spp.	12
<i>Thryssa</i> spp.	8659
<i>Thunnus albacares</i>	3796

<i>Trachinocephalus myops</i>	66
<i>Triacanthus biaculeatus (T. brevirostris)</i>	40
<i>Trichiurus lepturus</i>	161548
<i>Upeneus sulphureus</i>	1918
<i>Uraspis uraspis</i>	20
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	599
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	227332
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	58189
TOTAL	3510864

Table. 10.2.1.d Fish species landed and its catch in September 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	87
<i>Aesopia cornuta</i>	1
<i>Alepes djedaba</i>	2507
<i>Alepes spp.</i>	233
<i>Alutera monoceros</i>	26740
<i>Amblygaster sirm (Sardinella sirm)</i>	12965
<i>Amphioctopus marginatus</i>	87
<i>Atule mate(Alepes mate)</i>	25834
<i>Auxis rochei</i>	3241
<i>Auxis thazard</i>	7176
<i>Carangoides spp.</i>	199
<i>Caranx heberi (C. sem)</i>	7764
<i>Caranx hippos</i>	2020
<i>Caranx ignobilis</i>	7556
<i>Caranx sexfasciatus</i>	264
<i>Caranx spp.</i>	3478
<i>Caranx tille</i>	1011
<i>Cephalopholis sonnerati</i>	325
<i>Cephalopholis spp.</i>	28
<i>Chanos chanos</i>	61
<i>Chirocentrus nudus</i>	217
<i>Coryphaena hippurus</i>	16379

<i>Cynoglossus macrolepidotus (C. arel)</i>	173
<i>Dasyatis microps</i>	867
<i>Decapterus kurroides</i>	102200
<i>Decapterus russelli(D. dayi)</i>	870969
<i>Decapterus spp.</i>	375
<i>Drepane spp.</i>	3
<i>Dussumieria acuta</i>	31955
<i>Elagatis bipinnulata</i>	3380
<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	390
<i>Epinephelus bleekeri</i>	361
<i>Epinephelus diacanthus</i>	169
<i>Epinephelus malabaricus</i>	56
<i>Epinephelus spp.</i>	9
<i>Euthynnus affinis</i>	172356
<i>Fistularia petimba (F. villosa)</i>	930
<i>Gerres filamentosus</i>	488
<i>Istiompax indica (Makaira indica)</i>	11050
<i>Istiophorus platypterus</i>	4063
<i>Jellyfish</i>	867
<i>Johnius spp.</i>	428
<i>Lates calcarifer</i>	433
<i>Leiognathus berbis</i>	130
<i>Leiognathus spp.</i>	5229
<i>Lepturacanthus savala</i>	5339
<i>Lutjanus kasmira</i>	243
<i>Lutjanus lutjanus(L. lineolatus)</i>	172036
<i>Manta birostris</i>	22913
<i>Megalaspis cordyla</i>	10483
<i>Mene maculate</i>	203764
<i>Metapenaeus dobsoni</i>	2383
<i>Nemipterus bipunctatus(N. delagoae)</i>	24765
<i>Nemipterus japonicas</i>	8950
<i>Nemipterus randalli(Nemipterus mesoprion)</i>	47904
<i>Nemipterus spp.</i>	7656
<i>Nibea maculate</i>	4420
<i>Nuchequula spp.</i>	87
<i>Odonus niger</i>	706
<i>Ostorhinchus fleurieu</i>	1481

<i>Otolithes ruber</i>	5781
<i>Pampus argenteus</i>	214
<i>Paramonacanthus spp.</i>	122
<i>Parastromateus (Formio) niger(F. niger)</i>	25692
<i>Pellona ditchela</i>	45
<i>Photopectoralis bindus (Leiognathus bindus)</i>	195
<i>Platax teira</i>	289
<i>Portunus pelagicus</i>	806
<i>Portunus sanguinolentus</i>	3899
<i>Priacanthus hamrur</i>	1148
<i>Rachycentron canadum</i>	4629
<i>Rastrelliger kanagurta</i>	182693
<i>Rhinobatos obtusus</i>	607
<i>Sarda orientalis</i>	9153
<i>Sardinella fimbriata</i>	1408
<i>Sardinella gibbosa</i>	225198
<i>Sardinella longiceps</i>	2074
<i>Sardinella spp.</i>	101
<i>Saurida spp.</i>	5091
<i>Saurida tumbil</i>	4766
<i>Saurida undosquamis</i>	19546
<i>Scolopsis bimaculata</i>	37
<i>Scolopsis ciliate</i>	49
<i>Scomberoides commersonianus</i>	10204
<i>Scomberomorus commerson</i>	39161
<i>Selar crumenophthalmus</i>	25606
<i>Sepia aculeate</i>	139
<i>Sepia pharaonis</i>	32419
<i>Sepia spp.</i>	30
<i>Seriolina nigrofasciata</i>	1047
<i>Siganus canaliculatus(S. oramin)</i>	101
<i>Siganus javus</i>	61
<i>Sillago sihama</i>	4
<i>Sphyaena barracuda</i>	1668
<i>Sphyaena obtusata</i>	16806
<i>Sphyaena putnamae</i>	49860
<i>Stolephorus commersonii</i>	47621
<i>Stolephorus indicus</i>	534
<i>Stolephorus spp.</i>	901
<i>Stolephorus waitei</i>	10833

<i>Sufflamen frenatum</i> (<i>S. capistratus</i>)	181
<i>Synodus indicus</i>	260
<i>Terapon jarbua</i>	3429
<i>Terapon theraps</i> (<i>Eutherapon theraps</i>)	390
<i>Thenus unimaculatus</i> (<i>t. orientalis</i>)	40
<i>Thryssa</i> spp.	5275
<i>Trachinocephalus myops</i>	9
<i>Trachinotus blochii</i>	488
<i>Trichiurus lepturus</i>	89721
<i>Upeneus sulphureus</i>	1993
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>edulis</i> (<i>D. singhalensis</i>)	8938
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>singhalensis</i> (<i>D. sibogae</i>)	44125
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) spp.	343
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) <i>duvaucelii</i> (<i>L. duvaucelli</i>)	59742
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) spp.	2083
TOTAL	2785739

10.2.2 EXPERIMENTAL FISHING IN MONSOON SEASON

BOATSEINE SAMPLING



Plate 10.2.2.a Photograph showing the experimental fishing using Boatseine during Monsoon season

Table. 10.2.2.a Gear details of Boat seine

Gear	Boat Seine
Date	29/08/2021
Craft	Outboard plywood
Horse Power	19.8 hp
Direction	North-west
Departure	4.50 a.m

Arrival	5.45 p.m
No: Hauls	13
Distance	7 NM
Depth	16 m

Table. 10.2.2.b Species details of boatseine sampling

SPECIES	TOTAL WEIGHT (Kg)	LENGTH RANGE (cm)
<i>Sardinella gibbosa</i>	20	13-17.3
<i>Sardinella longiceps</i>	3	14.2-17.8
<i>Decapterus russelli</i>	130	14.3-20.2
<i>Trichurus lepturus</i>	12	44.1-45.7
<i>Mene maculata</i>	10	8-11.5
<i>Carangx heberi</i>	15	14.3-14.7
<i>Ratrelliger kanagurta</i>	2	22.3-24.8
<i>Megalapsis cordya</i>	1	16.8-17.3
<i>Dussumeria acuta</i>	6	14.6-15.2
<i>Loligo duvacelli</i>	73	33.8-36
<i>Stolephorus indicus</i>	1	9-10

DISCO NET SAMPLING



Plate.10.2.2.b Photograph showing the experimental fishing using Disconet during Monsoon season

Table.10.2.2.c Gear details of Disconet

Gear	Disco net
Date	July 29 2021
Craft	Outboard Plywood
Horse Power	9.9 + 9.9 hp
Direction	North West
Departure	5.15 am
Arrival	3.30 pm
No: Hauls	2

Distance	4 NM
Depth	8m

Table 10.2.2.d Species details of Disco net (Trammel net) sampling

SPECIES	TOTAL SAMPLE WEIGHT (Kg)	LENGTH RANGE (cm)
<i>Penaeus indicus</i>	35	9.0-11.0
<i>Penaeus monodon</i>	6	11-13.5
<i>Upeneus sulphureus</i>	3	12.2-14.6

10.3 POST MONSOON SEASON

Fish landings data collected for the post-monsoon season started in October 2021 and ended in January 2021. Landing centre-wise fish catch data (in tonnes) during monsoon season is depicted in Fig. 10.3.1

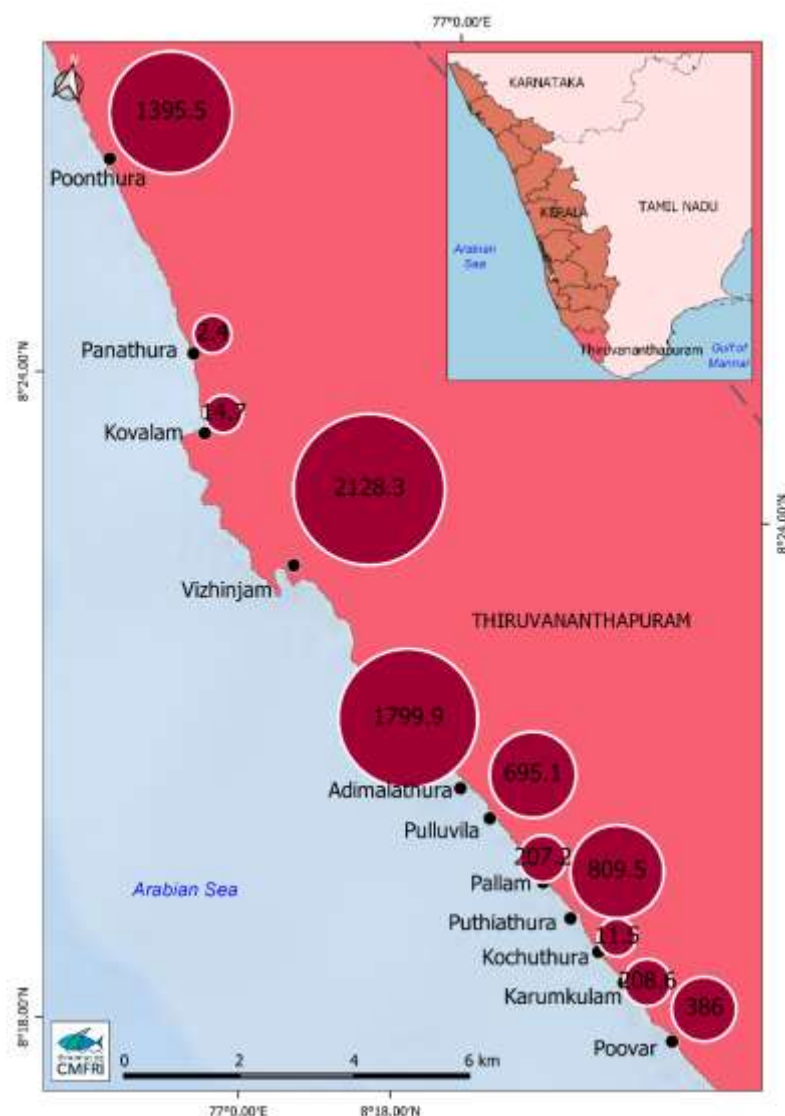


Fig.10.3.1.Landing centre wise fish landings (tonnes) during post-monsoon season

10.3.1 Fish population & its landing

During the post-monsoon season, the catch was reported from all the landing centres. Detailed landings on landing centre-wise for October, November, December 2021 and January 2022 were given in Fig. 10.3.1.c, Fig. 10.3.1.d, Fig. 10.3.1.e., and Fig. 10.3.1.f., respectively. Zone

wise (Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch data and the gear wise landings were given in Fig.10.3.1.a and fig.10.3.1.b

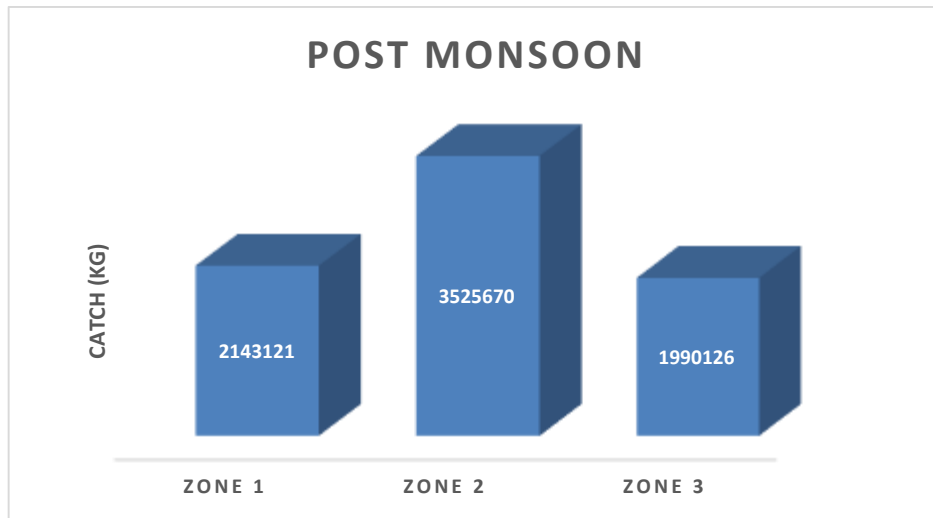


Fig.10.3.1.a Zone wise Zone 1- direct foot print zone, Zone 2- Potential impact zone, Zone 3- Control zone) fish catch during post monsoon season

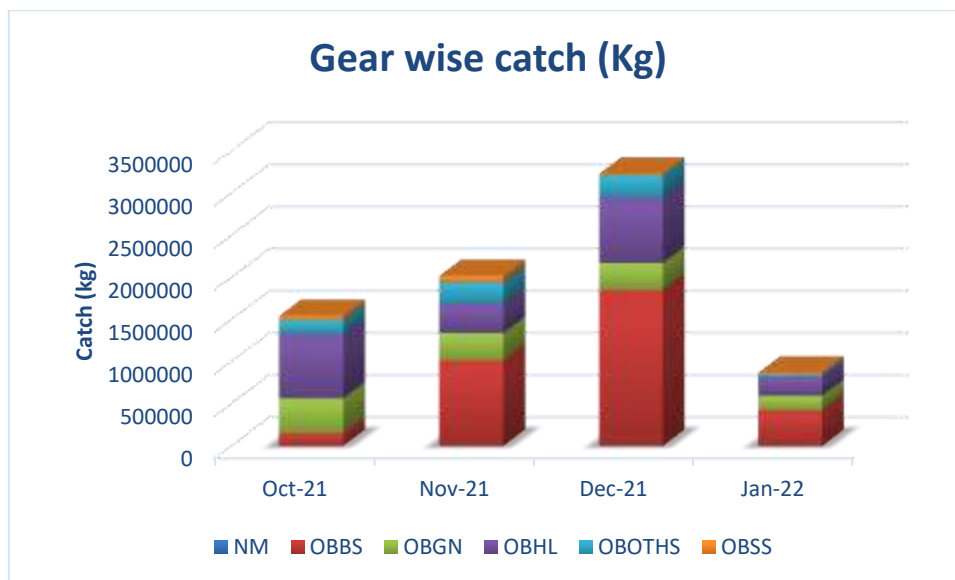


Fig.10.3.1.b Gear wise fish landings during post monsoon season

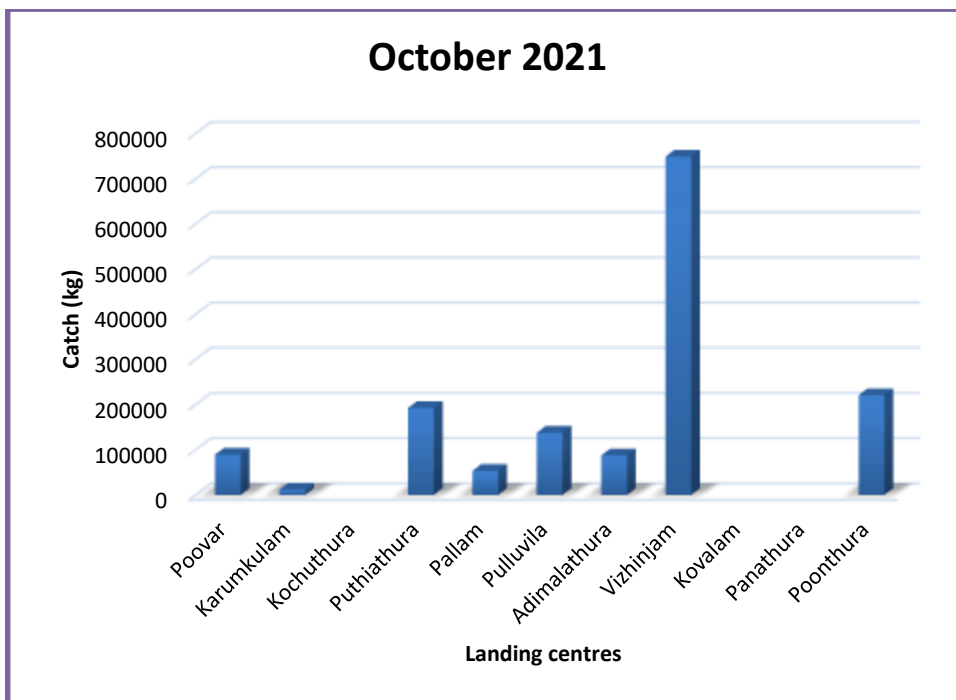


Fig.10.3.1.c Post monsoon landings (October 2021) at different landing centers

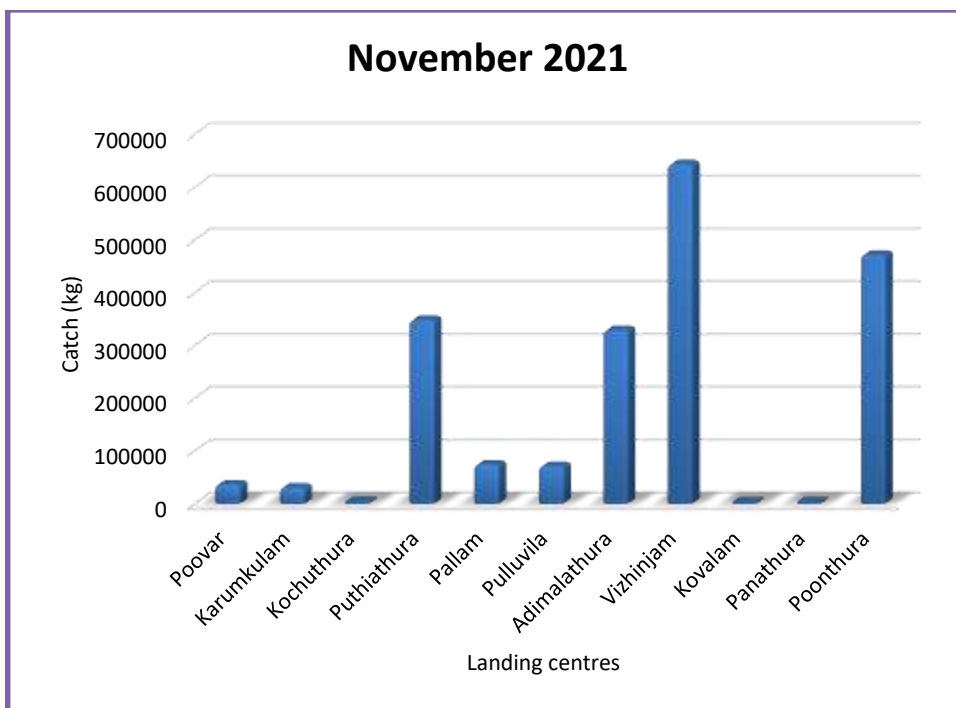


Fig.10.3.1.d. Post monsoon landings (November 2021) at different landing centers

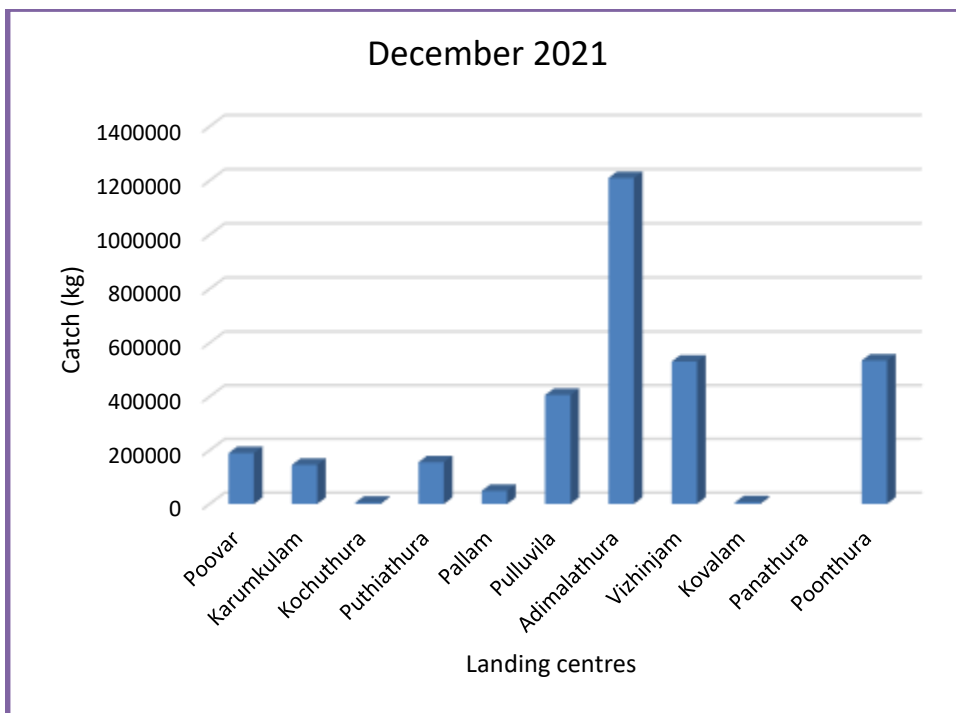


Fig.10.3.1.e Post monsoon landings (December 2021) at different landing centers

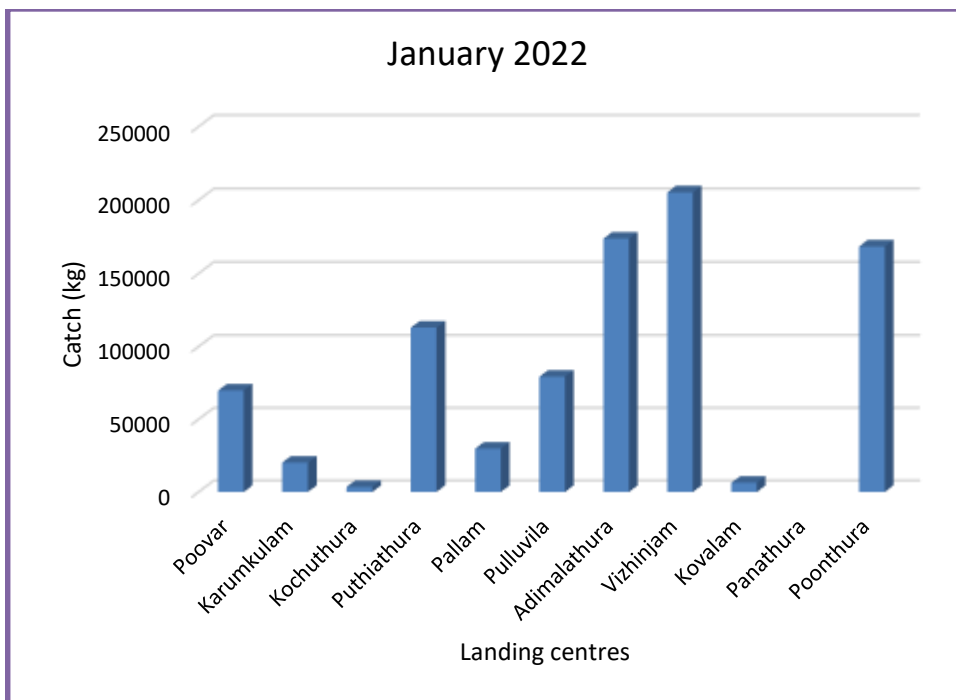
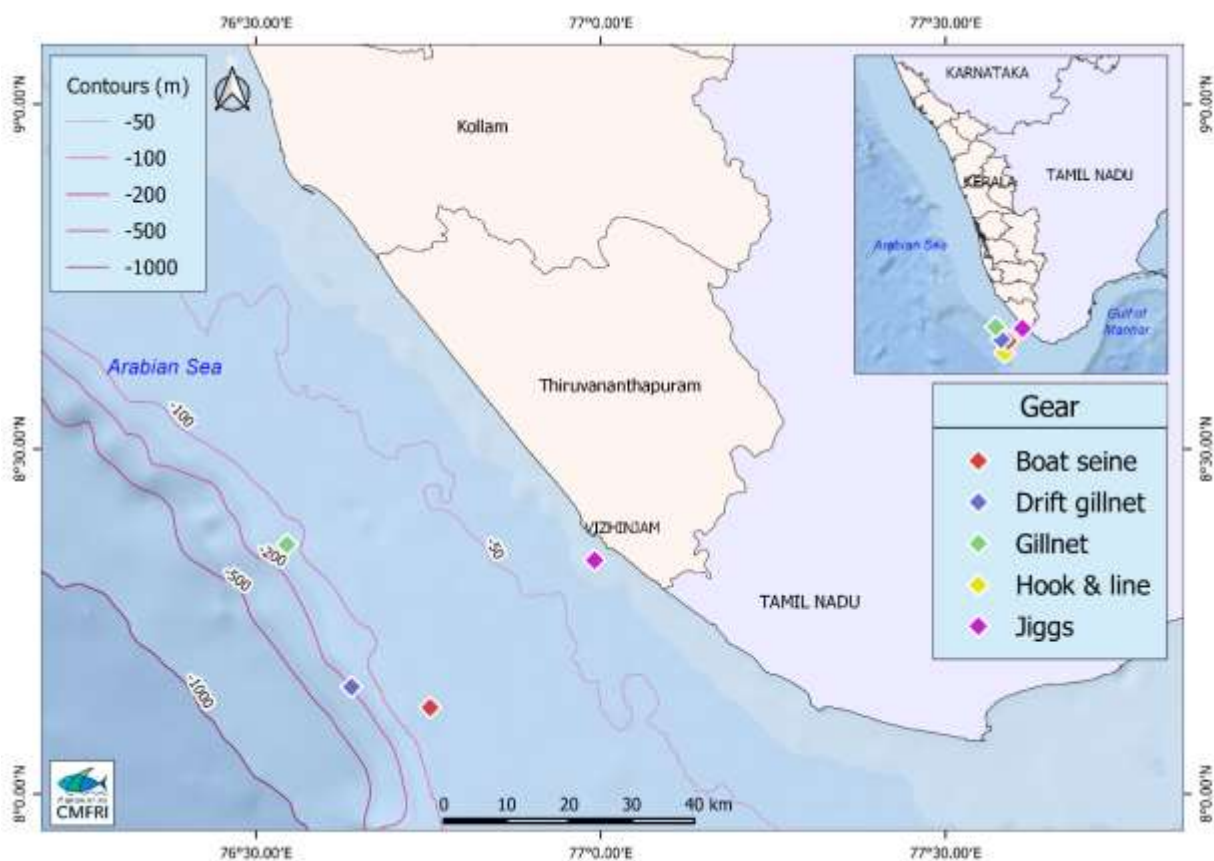


Fig.10.3.1.f Post monsoon landings (January 2022) at different landing centers

The fishing ground information of major gears during post-monsoon season is given in Fig. 10.3.1.g



10.3.1.g Fishing ground information of major gears operating during post monsoon season

The monthly landings of different species during the Post monsoon season are given in Table 10.3.1.a, 10.3.1.b, 10.3.1.c. & 10.3.1.d

Table. 10.3.1.a Fish species landed and its catch in October 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	2726
<i>Acanthocybium solandri</i>	1820
<i>Alepes djedaba</i>	47321
<i>Alepes kleinii</i> (<i>A. kalla</i>) (<i>A. para</i>)	1033
<i>Amblygaster sirm</i> (<i>Sardinella sirm</i>)	2006

<i>Anthias</i> spp.	1950
<i>Arius maculatus</i>	39
<i>Atule mate</i> (<i>Alepes mate</i>)	112965
<i>Auxis rochei</i>	42635
<i>Auxis thazard</i>	12475
<i>Carangoides malabaricus</i>	117
<i>Caranx heberi</i> (<i>C. sem</i>)	20514
<i>Caranx hippos</i>	1986
<i>Caranx ignobilis</i>	4030
<i>Caranx sexfasciatus</i>	231
<i>Caranx</i> spp.	78
<i>Cephalopholis sonnerati</i>	117
<i>Chanos chanos</i>	8
<i>Charybdis feriatus</i> (<i>C. cruciata</i>)	65
<i>Chirocentrus dorab</i>	390
<i>Chirocentrus nudus</i>	52
<i>Coryphaena hippurus</i>	22115
<i>Cynoglossus</i> spp.	708
<i>Dasyatis microps</i>	130
<i>Decapterus kurroides</i>	6033
<i>Decapterus russelli</i> (<i>D. dayi</i>)	62753
<i>Decapterus</i> spp.	8237
<i>Drepane</i> spp.	4
<i>Dussumieria acuta</i>	5603
<i>Elagatis bipinnulata</i>	2003
<i>Encrasicholina</i> spp.	8103
<i>Epinephelus bleekeri</i>	3023
<i>Epinephelus chlorostigma</i>	2373
<i>Epinephelus coioides</i>	1365
<i>Epinephelus flavocaeruleus</i>	488
<i>Epinephelus malabaricus</i>	293
<i>Erythrocles schlegelii</i>	65086
<i>Euthynnus affinis</i>	167333
<i>Fistularia petimba</i> (<i>F. villosa</i>)	960
<i>Gazza minuta</i>	83
<i>Hemiramphus</i> spp.	156

<i>Heteropriacanthus cruentatus</i> (<i>Priacanthus cruentatus</i>)	3510
<i>Hyporhamphus affinis</i> (<i>Hemirhamphus archipelagicus</i>)	329
<i>Hyporthodus octafasciatus</i>	33
<i>Istiompax indica</i> (<i>Makaira indica</i>)	8304
<i>Johnius</i> spp.	10
<i>Leiognathus brevirostris</i>	277
<i>Leiognathus</i> spp.	6475
<i>Lepturacanthus savala</i>	42416
<i>Lethrinus lentjan</i>	22
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	1560
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	156
<i>Megalaspis cordyla</i>	77018
<i>Mene maculate</i>	18799
<i>Mugil cephalus</i>	25
<i>Myripristis</i> spp.	1365
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	26689
<i>Nemipterus japonicas</i>	2889
<i>Nibea maculate</i>	1879
<i>Octopus</i> spp.	1398
<i>Odonus niger</i>	683
<i>Otolithes cuvieri</i>	218
<i>Otolithes ruber</i>	3465
<i>Otolithes</i> spp.	21
<i>Panulirus</i> spp.	16
<i>Parascolopsis aspinosa</i>	9588
<i>Parupeneus</i> spp.	195
<i>Pellona ditchela</i>	44
<i>Pempheris</i> spp.	405
<i>Perna indica</i>	31
<i>Photopectoralis bindus</i> (<i>Leiognathus bindus</i>)	618
<i>Portunus pelagicus</i>	557
<i>Portunus sanguinolentus</i>	5031
<i>Priacanthus hamrur</i>	14164
<i>Priacanthus</i> spp.	1240
<i>Pristipomoides filamentosus</i>	6028

<i>Pristipomoides typus</i>	30388
<i>Rachycentron canadum</i>	5944
<i>Rastrelliger kanagurta</i>	142714
<i>Rhinobatos obtusus</i>	325
<i>Sardinella fimbriata</i>	390
<i>Sardinella gibbosa</i>	44628
<i>Sardinella longiceps</i>	260
<i>Sardinella</i> spp.	31
<i>Sargocentron (Holocentrus)</i> spp.	1365
<i>Saurida tumbil</i>	1066
<i>Saurida undosquamis</i>	19456
<i>Scomberoides commersonianus</i>	7791
<i>Scomberomorus commerson</i>	16818
<i>Secutor insidiator</i>	47
<i>Selar crumenophthalmus</i>	115800
<i>Sepia pharaonis</i>	56030
<i>Seriolina nigrofasciata</i>	1138
<i>Sphyaena obtusata</i>	7150
<i>Sphyaena</i> spp.	96
<i>Stolephorus commersonii</i>	20201
<i>Stolephorus indicus</i>	6831
<i>Stolephorus</i> spp.	26644
<i>Stolephorus waitei</i>	4914
<i>Terapon jarbua</i>	3256
<i>Thryssa</i> spp.	297
<i>Trichiurus lepturus</i>	157484
<i>Tylosurus crocodilus (Strongylura crocodilus)</i>	2600
<i>Upeneus sulphureus</i>	3113
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	1950
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	7028
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	9185
<i>Uroteuthis(Photololigo)(Loligo) spp.</i>	2368
TOTAL	1542173

Table. 10.3.1.b Fish species landed and its catch in November 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	499
<i>Acanthurus spp.</i>	18
<i>Alepes djedaba</i>	723
<i>Alepes kleinii (A. kalla) (A. para)</i>	43
<i>Alepes spp.</i>	20
<i>Amblygaster sirm (Sardinella sirm)</i>	36849
<i>Atule mate(Alepes mate)</i>	24539
<i>Auxis rochei</i>	58635
<i>Auxis thazard</i>	2557
<i>Carangoides coeruleopinnatus</i>	33
<i>Carangoides malabaricus</i>	38
<i>Caranx heberi (C. sem)</i>	9778
<i>Caranx hippos</i>	26
<i>Caranx ignobilis</i>	30238
<i>Caranx spp.</i>	120
<i>Cephalopholis sonnerati</i>	310
<i>Cephalopholis urodeta</i>	9100
<i>Chanos chanos</i>	4
<i>Charybdis natator</i>	55
<i>Chirocentrus dorab</i>	375
<i>Cookeolus japonicus</i>	324
<i>Coryphaena hippurus</i>	13189
<i>Cynoglossus macrolepidotus (C. arel)</i>	347
<i>Decapterus kurroides</i>	5759
<i>Decapterus macrosoma</i>	4100
<i>Decapterus russelli(D. dayi)</i>	663475
<i>Elagatis bipinnulata</i>	1517
<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	11553
<i>Encrasicholina spp.</i>	433
<i>Epinephelus areolatus</i>	46
<i>Epinephelus coioides</i>	30
<i>Epinephelus diacanthus</i>	780
<i>Epinephelus epistictus</i>	2464
<i>Epinephelus longispinis</i>	618

<i>Epinephelus malabaricus</i>	69
<i>Epinephelus ongus</i>	585
<i>Epinephelus radiates</i>	64
<i>Epinephelus</i> spp.	436
<i>Epinephelus undulosus</i>	181
<i>Erythrocles schlegelii</i>	18593
<i>Euthynnus affinis</i>	95714
<i>Filimanus heptadactyla</i> (<i>Polynemus heptadactylus</i>)	333
<i>Fistularia petimba</i> (<i>F. villosa</i>)	2550
<i>Gerres filamentosus</i>	4630
<i>Gymnura poecilura</i>	61
<i>Himantura imbricata</i> (<i>Amphotistius imbricatus</i>)	8429
<i>Hyporthodus octafasciatus</i>	42
<i>Ilisha filigera</i>	832
<i>Istiompax indica</i> (<i>Makaira indica</i>)	2340
<i>Istiophorus platypterus</i>	5327
<i>Johnius</i> spp.	125
<i>Karalla dussumieri</i> (<i>Leiognathus dussumieri</i>)	6424
<i>Katsuwonus pelamis</i>	60
<i>Lactarius lactarius</i>	26
<i>Leiognathus equula</i> (<i>L. equulus</i>)	7
<i>Leiognathus</i> spp.	6699
<i>Lethrinus lentjan</i>	7150
<i>Lipocheilus carnolabrum</i>	286
<i>Lutjanus kasmira</i>	130
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	33
<i>Megalaspis cordyla</i>	79549
<i>Megalops cyprinoides</i>	52
<i>Mene maculate</i>	10248
<i>Monodactylus argenteus</i>	55
<i>Mugil cephalus</i>	130
<i>Narcine timlei</i>	72
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	55862
<i>Nemipterus japonicas</i>	720
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	646
<i>Nibea maculate</i>	569
<i>Octopus</i> spp.	504

<i>Odontanthias rhodopeplus</i>	70
<i>Odonus niger</i>	10
<i>Ostorhinchus fleurieu</i>	79
<i>Otolithes ruber</i>	17780
<i>Parapercis alboguttata</i>	18
<i>Parasclopsis eriomma</i>	377
<i>Pellona ditchela</i>	222
<i>Pempheris spp.</i>	15
<i>Perna indica</i>	11795
<i>Photopectoralis bindus (Leiognathus bindus)</i>	1397
<i>Plotosus lineatus (P. anguillaris)</i>	39
<i>Pomadasys guoraca</i>	29
<i>Pomadasys maculatus (P. maculatum)</i>	52
<i>Portunus pelagicus</i>	662
<i>Portunus sanguinolentus</i>	1055
<i>Priacanthus hamrur</i>	19605
<i>Priacanthus spp.</i>	577
<i>Pristigenys refulgens</i>	60
<i>Pristipomoides filamentosus</i>	18154
<i>Pristipomoides multidens</i>	30
<i>Pristipomoides spp.</i>	1000
<i>Pristipomoides typus</i>	5083
<i>Promethichthys Prometheus</i>	24
<i>Pseudotriacanthus strigilifer</i>	11
<i>Rachycentron canadum</i>	2788
<i>Rastrelliger kanagurta</i>	177837
<i>Rhinobatos annandalei</i>	180
<i>Sarda orientalis</i>	1669
<i>Sardinella fimbriata</i>	3000
<i>Sardinella gibbosa</i>	210330
<i>Saurida tumbil</i>	318
<i>Saurida undosquamis</i>	12917
<i>Scomberoides commersonianus</i>	21
<i>Scomberoides tol</i>	1667
<i>Scomberomorus commerson</i>	32515
<i>Secutor insidiator</i>	766
<i>Selar crumenophthalmus</i>	139182
<i>Sepia pharaonis</i>	26867
<i>Sepia spp.</i>	83

<i>Siganus canaliculatus</i> (<i>S. oramin</i>)	73
<i>Sillago sihama</i>	59
<i>Sphyraena obtusata</i>	28923
<i>Sphyraena putnamae</i>	21
<i>Sphyraena</i> spp.	564
<i>Stolephorus commersonii</i>	7180
<i>Stolephorus indicus</i>	1542
<i>Stolephorus</i> spp.	1375
<i>Stolephorus waitei</i>	2685
<i>Strongylura strongylura</i>	1900
<i>Sufflamen frenatum</i> (<i>S. capistratus</i>)	266
<i>Terapon jarbua</i>	1720
<i>Thryssa</i> spp.	500
<i>Thunnus albacares</i>	29610
<i>Thunnus obesus</i>	711
<i>Torpedo</i> spp.	2976
<i>Trachinocephalus myops</i>	131
<i>Trichiurus lepturus</i>	48965
<i>Upeneus sulphureus</i>	554
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>edulis</i> (<i>D. singhalensis</i>)	850
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>singhalensis</i> (<i>D. sibogae</i>)	751
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) <i>duvaucelii</i> (<i>L. duvaucelii</i>)	7521
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) spp.	1874
<i>Zebrias synapturoides</i>	22
TOTAL	2017185

Table. 10.3.1.c Fish species landed and its catch in December 2021 (Kg)

SPECIES	CATCH (Kg)
<i>Abalistes stellatus</i>	16
<i>Ablennes hians</i>	447
<i>Aethaloperca</i> spp.	304
<i>Alectis indica</i>	5235

<i>Alepes djedaba</i>	1903
<i>Alepes spp.</i>	135
<i>Amblygaster sirm (Sardinella sirm)</i>	152422
<i>Aphareus rutilans</i>	3375
<i>Arius arius</i>	34
<i>Arius maculatus</i>	1935
<i>Atule mate(Alepes mate)</i>	6629
<i>Auxis rochei</i>	167163
<i>Auxis thazard</i>	7214
<i>Brama orcini</i>	9
<i>Canthidermis maculata</i>	41
<i>Carangoides malabaricus</i>	310
<i>Carangoides spp.</i>	72
<i>Caranx heberi (C. sem)</i>	4390
<i>Caranx hippos</i>	103
<i>Caranx ignobilis</i>	9587
<i>Caranx spp.</i>	719
<i>Cephalopholis sonnerati</i>	5963
<i>Cephalopholis urodeta</i>	20346
<i>Charybdis natator</i>	58
<i>Chirocentrus dorab</i>	108
<i>Chirocentrus nudus</i>	529
<i>Coryphaena hippurus</i>	47218
<i>Cynoglossus macrolepidotus (C. arel)</i>	101
<i>Cypselurus poicilopterus</i>	14850
<i>Decapterus kurroides</i>	7
<i>Decapterus macarellus</i>	850522
<i>Decapterus macrosoma</i>	2908
<i>Decapterus russelli(D. dayi)</i>	30959
<i>Diagramma picta</i>	32
<i>Drepane punctata</i>	4
<i>Dussumieria acuta</i>	435
<i>Elagatis bipinnulata</i>	8234

<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	1935
<i>Encrasicholina spp.</i>	17820
<i>Epinephelus areolatus</i>	247
<i>Epinephelus bleekeri</i>	189
<i>Epinephelus coioides</i>	27
<i>Epinephelus diacanthus</i>	7659
<i>Epinephelus epistictus</i>	1099
<i>Epinephelus longispinis</i>	128
<i>Epinephelus malabaricus</i>	90
<i>Epinephelus merra</i>	270
<i>Epinephelus radiates</i>	387
<i>Epinephelus spp.</i>	223
<i>Epinephelus undulosus</i>	485
<i>Erythrocles schlegelii</i>	4146
<i>Euthynnus affinis</i>	84307
<i>Exocoetus spp.</i>	540
<i>Filimanus heptadactyla (Polynemus heptadactylus)</i>	22
<i>Fistularia petimba (F. villosa)</i>	323
<i>Gerres filamentosus</i>	240
<i>Gerres spp.</i>	4
<i>Gnathanodon speciosus</i>	594
<i>Gymnosarda unicolor</i>	378
<i>Gymnura poecilura</i>	1349
<i>Gymnura spp.</i>	868
<i>Hemiramphus far</i>	23671
<i>Heteropriacanthus cruentatus (Priacanthus cruentatus)</i>	608
<i>Himantura imbricata (Amphotistius imbricatus)</i>	300
<i>Hyporhamphus affinis (Hemirhamphus archipelagicus)</i>	350
<i>Ilisha filigera</i>	783
<i>Iniistius bimaculatus</i>	59
<i>Istiompax indica (Makaira indica)</i>	6392
<i>Istiophorus platypterus</i>	2729
<i>Johnius spp.</i>	387
<i>Kathala axillaris</i>	701

<i>Katsuwonus pelamis</i>	84939
<i>Lactarius lactarius</i>	1508
<i>Lagocephalus sceleratus</i>	32
<i>Leiognathus berbis</i>	3000
<i>Leiognathus brevirostris</i>	3
<i>Leiognathus spp.</i>	11658
<i>Lethrinus lentjan</i>	7985
<i>Lipocheilus carnolabrum</i>	441
<i>Lutjanus argentimaculatus</i>	135
<i>Lutjanus fulviflamma</i> (<i>L. fulviflammus</i>)	842
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	540
<i>Lutjanus johnii</i>	18
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	838
<i>Lutjanus quinquelineatus</i>	68
<i>Lutjanus rivulatus</i>	878
<i>Lutjanus spp.</i>	108
<i>Makaira nigricans</i>	945
<i>Megalaspis cordyla</i>	46048
<i>Megalops cyprinoides</i>	1433
<i>Mene maculate</i>	24617
<i>Monodactylus argenteus</i>	297
<i>Mugil cephalus</i>	75
<i>Naucrates doctor</i>	12
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	13216
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	55
<i>Nemipterus spp.</i>	7
<i>Neotrygon kuhlii</i> (<i>Dasyatis kuhlii</i>)	517
<i>Nibea maculate</i>	1217
<i>Odontanthias rhodopeplus</i>	95
<i>Odonus niger</i>	2104
<i>Ostorhinchus fleurieu</i>	34
<i>Otolithes cuvieri</i>	49

<i>Otolithes ruber</i>	1202
<i>Pampus argenteus</i>	338
<i>Panulirus homarus</i>	27
<i>Parascolopsis aspinosa</i>	56
<i>Parascolopsis eriomma</i>	385
<i>Parupeneus indicus</i>	20
<i>Pellona ditchela</i>	368
<i>Pempheris spp.</i>	25
<i>Perna indica</i>	3375
<i>Pinjalo pinjalo</i>	2532
<i>Plectorhinchus (Gaterin) spp.</i>	21
<i>Pomadasys argenteus</i>	120
<i>Pomadasys guoraca</i>	135
<i>Portunus sanguinolentus</i>	5315
<i>Priacanthus hamrur</i>	21093
<i>Pristipomoides filamentosus</i>	15629
<i>Pristipomoides typus</i>	5456
<i>Psenes cyanophrys (Ariomma cyanophrys)</i>	7
<i>Pseudotriacanthus strigilifer</i>	11
<i>Rachycentron canadum</i>	1884
<i>Rastrelliger kanagurta</i>	300056
<i>Rhinobatos obtusus</i>	362
<i>Sarda orientalis</i>	327
<i>Sardinella fimbriata</i>	70538
<i>Sardinella gibbosa</i>	231610
<i>Sargocentron (Holocentrus) rubrum (H. ruber)</i>	34
<i>Saurida spp.</i>	20
<i>Saurida tumbil</i>	284
<i>Saurida undosquamis</i>	835
<i>Scolopsis bimaculata</i>	45
<i>Scolopsis vosmeri</i>	50
<i>Scomberoides commersonianus</i>	4305
<i>Scomberoides tol</i>	1372
<i>Scomberomorus commerson</i>	101114
<i>Scomberomorus guttatus</i>	4636

<i>Secutor insidiator</i>	1308
<i>Selar crumenophthalmus</i>	556010
<i>Sepia pharaonis</i>	17337
Siganus spp.	24
<i>Sillago sihama</i>	33
<i>Sphyraena barracuda</i>	646
<i>Sphyraena forsteri</i>	2144
<i>Sphyraena jello</i>	285
<i>Sphyraena obtusata</i>	29471
<i>Sphyraena putnamae</i>	298
Sphyraena spp.	340
<i>Stolephorus commersonii</i>	15630
<i>Stolephorus indicus</i>	3937
Stolephorus spp.	3335
<i>Stolephorus waitei</i>	2325
<i>Sufflamen frenatum(S. capistratus)</i>	4033
<i>Synodus indicus</i>	207
<i>Terapon jarbua</i>	1480
<i>Terapon theraps (Eutherapon theraps)</i>	37
<i>Thenus unimaculatus(t. orientalis)</i>	583
Thryssa spp.	1072
<i>Thunnus albacares</i>	32401
<i>Thunnus obesus</i>	236
<i>Thunnus tonggol</i>	169
<i>Torpedo marmorata</i>	6727
<i>Trachinotus baillonii</i>	20
<i>Trichiurus lepturus</i>	41057
<i>Turbinella(Xancus) pyrum(X. pyrum)</i>	274
<i>Upeneus sulphureus</i>	11379
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	10
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	4615
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	9474
Uroteuthis(Photololigo)(Loligo) spp.	2396
Total	3230221

Table. 10.3.1.d. Fish species landed and its catch in January 2022 (Kg)

SPECIES	CATCH (Kg)
<i>Abalistes stellatus</i>	27
<i>Ablennes hians</i>	669
<i>Acanthocybium solandri</i>	2007
<i>Acanthurus spp.</i>	46
<i>Alepes djedaba</i>	2808
<i>Alepes kleinii (A. kalla) (A. para)</i>	20
<i>Alutera monoceros</i>	78
<i>Amblygaster sirm (Sardinella sirm)</i>	150798
<i>Arius maculatus</i>	194
<i>Arius spp.</i>	520
<i>Atule mate (Alepes mate)</i>	2323
<i>Auxis rochei</i>	79743
<i>Auxis thazard</i>	7991
<i>Canthidermis maculata</i>	620
<i>Carangoides coeruleopinnatus</i>	51
<i>Carangoides spp.</i>	600
<i>Caranx heberi (C. sem)</i>	746
<i>Caranx hippos</i>	66
<i>Caranx ignobilis</i>	1569
<i>Caranx sexfasciatus</i>	1233
<i>Caranx spp.</i>	325
<i>Cephalopholis sonnerati</i>	5546
<i>Charybdis natator</i>	20
<i>Chirocentrus dorab</i>	161
<i>Chirocentrus nudus</i>	130
<i>Cookeolus japonicus</i>	192
<i>Coryphaena hippurus</i>	2820
<i>Cynoglossus spp.</i>	124
<i>Dagetichthys commersonnii (Synaptura commersonnii)</i>	156
<i>Decapterus kurroides</i>	488
<i>Decapterus macrosoma</i>	15171
<i>Decapterus russelli (D. dayi)</i>	39222
<i>Drepane punctata</i>	27
<i>Dussumieria acuta</i>	255
<i>Elagatis bipinnulata</i>	2405

<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	1073
<i>Encrasicholina spp.</i>	11544
<i>Epinephelus areolatus</i>	1332
<i>Epinephelus bleekeri</i>	371
<i>Epinephelus chlorostigma</i>	2411
<i>Epinephelus coioides</i>	156
<i>Epinephelus diacanthus</i>	17
<i>Epinephelus epistictus</i>	569
<i>Epinephelus fasciatus</i>	853
<i>Epinephelus longispinis</i>	166
<i>Epinephelus malabaricus</i>	131
<i>Epinephelus spp.</i>	2174
<i>Epinephelus undulosus</i>	1276
<i>Erythrocles schlegelii</i>	7708
<i>Euthynnus affinis</i>	22064
<i>Exocoetus spp.</i>	2470
<i>Filimanus heptadactyla (Polynemus heptadactylus)</i>	21
<i>Fistularia petimba (F. villosa)</i>	965
<i>Gymnura poecilura</i>	20
<i>Gymnura spp.</i>	738
<i>Hemiramphus far</i>	351
<i>Himantura imbricata (Amphotistius imbricatus)</i>	117
<i>Hyporhamphus affinis (Hemirhamphus archipelagicus)</i>	169
<i>Iniistius bimaculatus</i>	23
<i>Istiompax indica (Makaira indica)</i>	1251
<i>Istiophorus platypterus</i>	6996
<i>Johnius spp.</i>	53
<i>Katsuwonus pelamis</i>	3094
<i>Lactarius lactarius</i>	108
<i>Leiognathus spp.</i>	7207
<i>Lepturacanthus savala</i>	447
<i>Lethrinus lentjan</i>	1104
<i>Lethrinus nebulosus (L. choerorhynchus, L. fraenatus)</i>	163
<i>Lipocheilus carnolabrum</i>	519
<i>Lutjanus argentimaculatus</i>	536
<i>Lutjanus fulviflamma (L. fulviflammus)</i>	109
<i>Lutjanus fulvus (L. vaigiensis)</i>	49
<i>Lutjanus johnii</i>	37
<i>Lutjanus lutjanus (L. lineolatus)</i>	4002
<i>Lutjanus quinquelineatus</i>	81

<i>Lutjanus rivulatus</i>	33
<i>Lutjanus</i> spp.	43
<i>Megalaspis cordyla</i>	14100
<i>Megalops cyprinoides</i>	313
<i>Mene maculata</i>	3157
<i>Mobula</i> spp.	98
<i>Monodactylus argenteus</i>	81
<i>Mugil cephalus</i>	72
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	6843
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	1017
<i>Nemipterus</i> spp.	18
<i>Nibea maculata</i>	42
<i>Odontanthias rhodopeplus</i>	616
<i>Odonus niger</i>	4186
<i>Otolithes ruber</i>	228
<i>Parapercis alboguttata</i>	7
<i>Parascolopsis eriomma</i>	401
<i>Parastromateus (Formio) niger</i> (<i>F. niger</i>)	27
<i>Parupeneus indicus</i>	247
<i>Pelates quadrilineatus</i>	19
<i>Pempheris</i> spp.	770
<i>Perna indica</i>	5850
<i>Pinjalo pinjalo</i>	818
<i>Platax teira</i>	155
<i>Plectorhinchus (Gaterin) spp.</i>	153
<i>Polydactylus plebeius</i> (<i>Polynemus plebeius</i>)	10
<i>Pomadasyus furcatus</i>	436
<i>Pomadasyus maculatus (P. maculatum)</i>	27
<i>Portunus sanguinolentus</i>	4010
<i>Priacanthus hamrur</i>	2573
<i>Priacanthus</i> spp.	81
<i>Pristigenys refulgens</i>	23
<i>Pristipomoides filamentosus</i>	18164
<i>Pristipomoides typus</i>	1422
<i>Rachycentron canadum</i>	1428
<i>Rastrelliger kanagurta</i>	99464
<i>Rhinobatos</i> spp.	191
<i>Rhinobatos variegatus</i>	233
<i>Sarda orientalis</i>	1288
<i>Sardinella fimbriata</i>	1582

<i>Sardinella gibbosa</i>	51129
<i>Sardinella</i> spp.	975
<i>Sargocentron (Holocentrus) rubrum (H. ruber)</i>	406
<i>Saurida tumbil</i>	211
<i>Saurida undosquamis</i>	1495
<i>Scatophagus argus</i>	16
<i>Scolopsis bimaculata</i>	302
<i>Scolopsis ciliata</i>	25
<i>Scolopsis</i> spp.	137
<i>Scolopsis vosmeri</i>	16
<i>Scomberoides commersonianus</i>	139
<i>Scomberoides tol</i>	1558
<i>Scomberomorus commerson</i>	4165
<i>Selar crumenophthalmus</i>	83456
<i>Selaroides leptolepis</i>	7145
<i>Sepia pharaonis</i>	6540
<i>Sepia</i> spp.	60
<i>Siganus canaliculatus(S. oramin)</i>	26
<i>Siganus javus</i>	59
<i>Sillago sihama</i>	54
<i>Sphyræna barracuda</i>	195
<i>Sphyræna forsteri</i>	258
<i>Sphyræna jello</i>	229
<i>Sphyræna obtusata</i>	1723
<i>Sphyræna putnamae</i>	1205
<i>Sphyræna</i> spp.	440
<i>Stolephorus commersonii</i>	537
<i>Stolephorus indicus</i>	13
<i>Stolephorus</i> spp.	1180
<i>Sufflamen frenatum(S. capistratus)</i>	1852
<i>Synodus</i> spp.	46
<i>Terapon jarbua</i>	314
<i>Terapon puta</i>	17
<i>Thunnus albacares</i>	1404
<i>Torpedo</i> spp.	878
<i>Trachinocephalus myops</i>	55
<i>Trachinotus baillonii</i>	33
<i>Trachinotus blochii</i>	750
<i>Trichiurus lepturus</i>	13629
<i>Upeneus sulphureus</i>	135

<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	355
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	27129
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	65482
<i>Uroteuthis(Photololigo)(Loligo) spp.</i>	19760
<i>Xiphias gladius</i>	1853
TOTAL	869238

10.3.2 EXPERIMENTAL FISHING IN POST- MONSOON SEASON

BOATSEINE SAMPLING

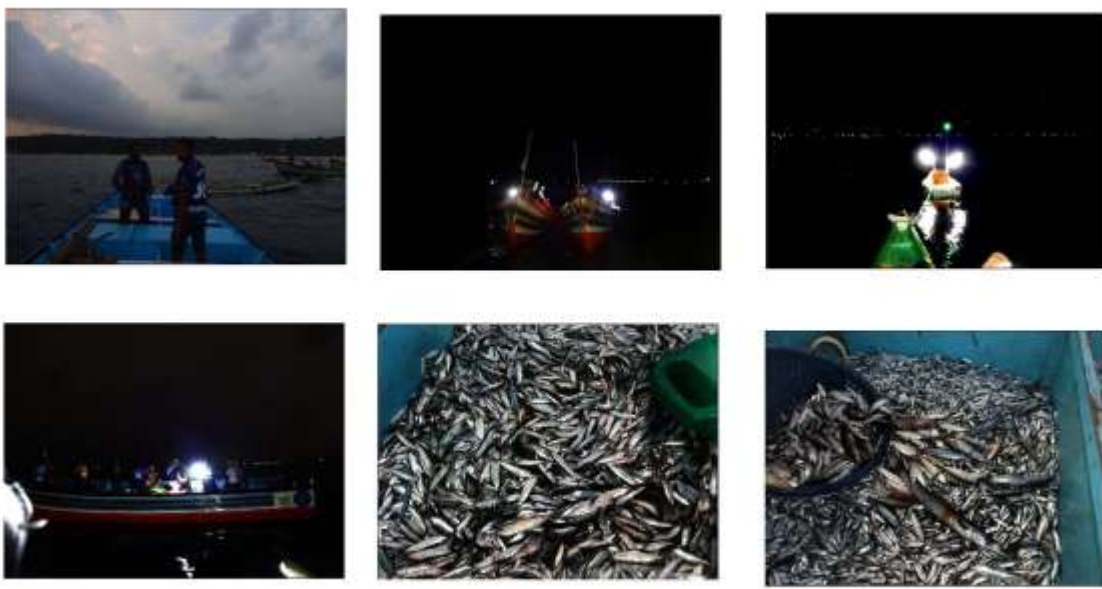


Plate 10.3.2.a Photograph showing the experimental fishing using Boat seine during Post-monsoon season

Table . 10.3.2.a Gear details of Boatseine

Gear	BOAT SEINE
Date	12 th October 2021
Craft	Outboard fibreglass
Horse Power	9.9+25 hp
Direction	West
Departure	5.15 p.m
Arrival	6.00 a.m
No: Hauls	4
Distance	19 NM
Depth	65 m

Table 10.3.2.b Species details Boat seine sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
<i>Sardinella gibbosa</i>	240	10-13
<i>Rastrelliger kanagurta</i>	15	20-24
<i>Amblygaster sirm</i>	120	12.5-15
<i>Uroteuthis duvaucelii</i>	3	30-32
<i>Sphyraena putnamae</i>	3	45-46.2
<i>Selar crumenophthalmus</i>	4	18-24.3

GILL NET SAMPLING



Plate 10.3.2.b Photograph showing the experimental fishing using Boat seine during Post-monsoon season

Table 10.3.2.c Gear details of Gillnet

Gear	Gillnet
Date	7 th November 2021
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	South west
Departure	4.30 am
Arrival	10.45 am
No: Hauls	1
Distance	5 NM
Depth	16 m

Table 10.3.2.d Species details Gillnet sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
<i>Decapterus russelli</i>	1	10-14.5
<i>Selar crumenophthalmus</i>	7	22-32.5
<i>Rastrelliger kanagurta</i>	18	16-27.9
<i>Fistularia petimba</i>	1	38.1-49.6
<i>Alepes djedaba</i>	2	15.2-20.1

SHORE SEINE SAMPLING**Plate 10.3.2.c Photograph showing the experimental fishing using Shore seine during Post-monsoon season**

Table 10.3.2.e Gear details of Shore seine

Gear	Shoreseine
Date	15 th October 2021
Craft	Outboard fiberglass
Horse Power	9.9+9.9 hp
Direction	West
Departure	6.05 am
Arrival	7.50 am
No: Hauls	1
Distance	2 NM
Depth	16 m

Table 10.3.2.f Species details of Shoreseine sampling

Species	Total Sample Weight (Kg)	Length Range (cm)
<i>Leiognathus</i> sp.	18	6-10
<i>Atule mate</i>	14	9-16
<i>Stolephorous</i> sp.	85	8.5-12
<i>Rastrelliger kanagurta</i>	5	23-26
<i>Megalapsis cordyla</i>	12	24-33
<i>Jelly fih</i>	52	-

10.4 PRE-MONSOON SEASON

Fish landings data collected for the Pre-monsoon season started in February 2022 and ended by May 2022. Landing centre-wise fish catch data (tonnes) during monsoon season is depicted in Fig. 10.4.1.

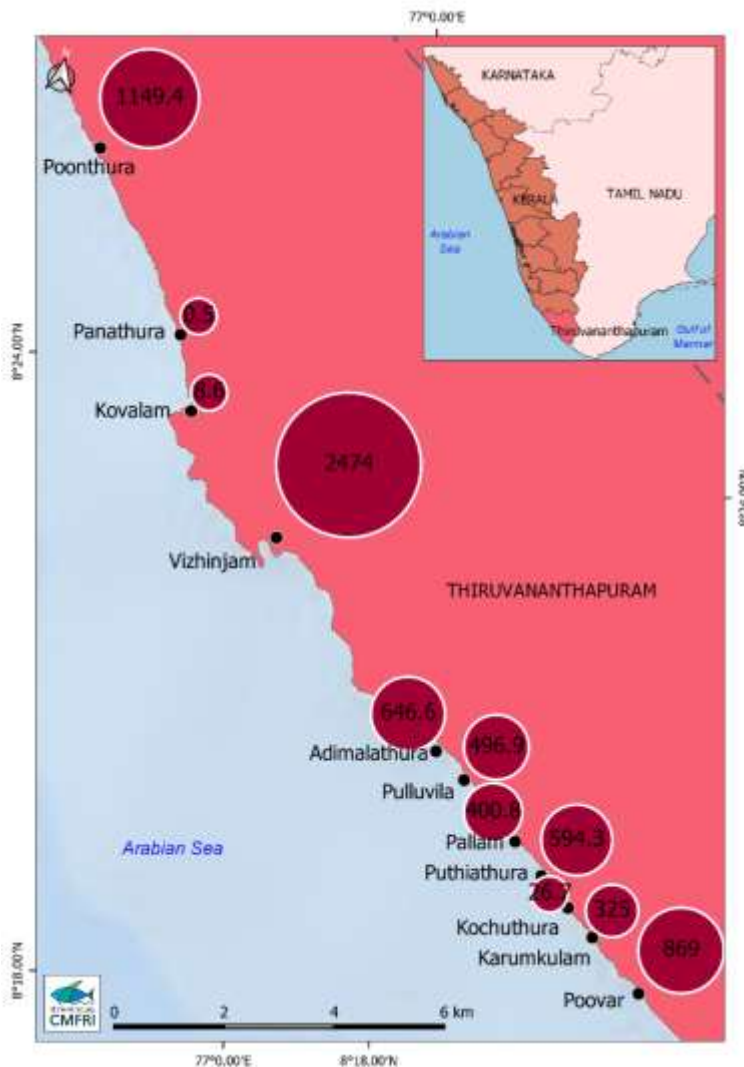


Fig.10.4.1. Landing centre wise fish landings (tonnes) during pre-monsoon season

10.4.1 Fish population & its landing

During the pre-monsoon season, the catch was reported from all the landing centres. Detailed landings on landing centre-wise for February, March, April and May 2022 were given in Fig.

10.4.1.c, Fig. 10.4.1.d, Fig. 10.4.1.e., and Fig. 10.4.1.f, respectively. Zonewise fish catch and gearwise landings during pre-monsoon season were given in Fig.10.4.1.a &10.4.1.b

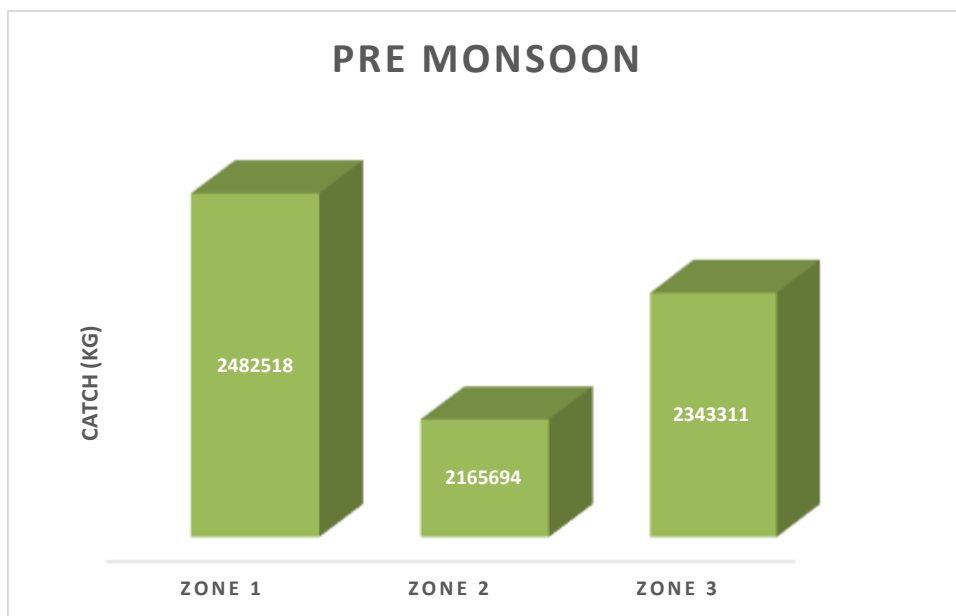


Fig.10.4.1.a Zone wise catch during pre-monsoon season

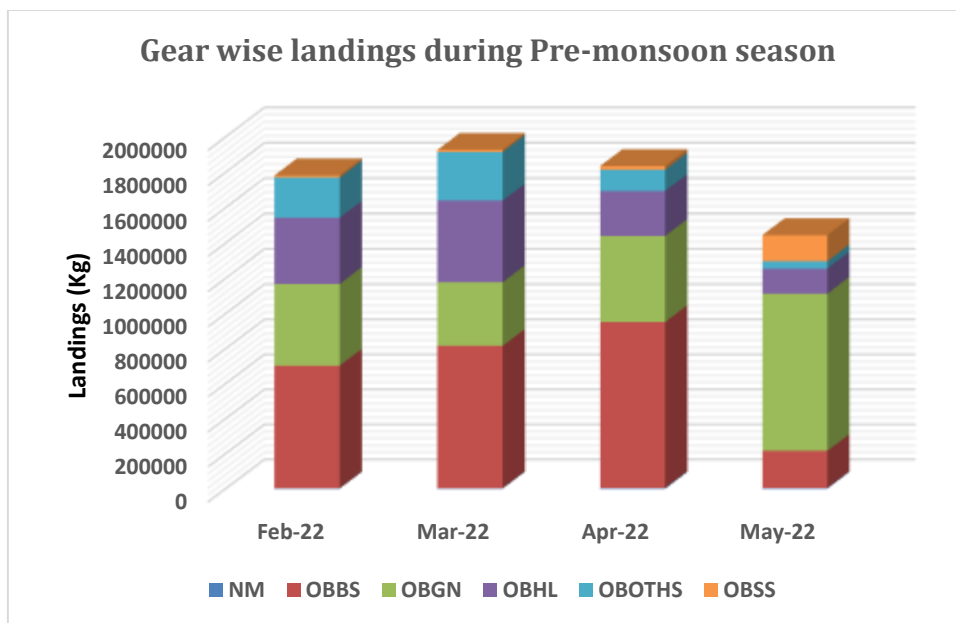


Fig.10.4.1.b Gear wise fish landings during pre-monsoon season

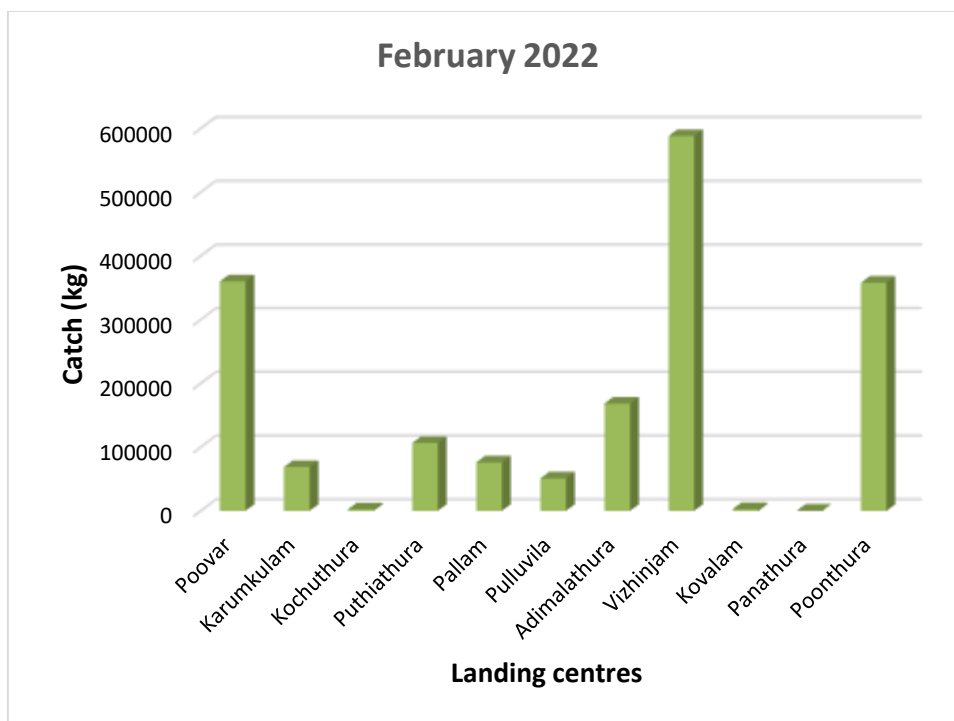


Fig.10.4.1.c Fish landings (kg) during February 2022 at different landing centers

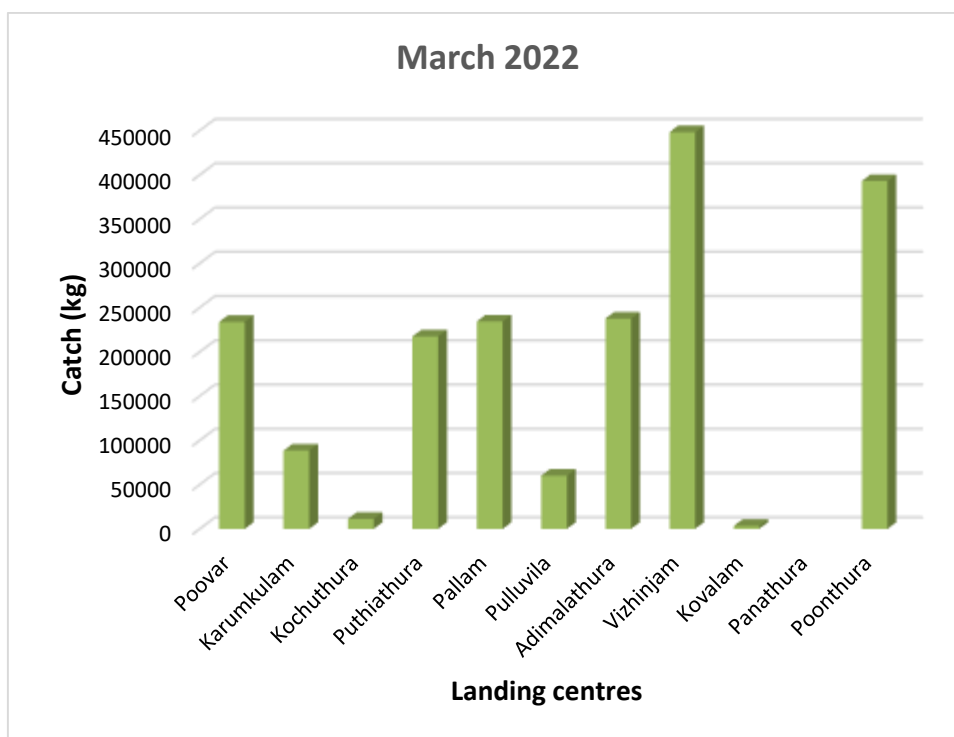


Fig.10.4.1.d. Fish landings (kg) during March 2022 at different landing centers

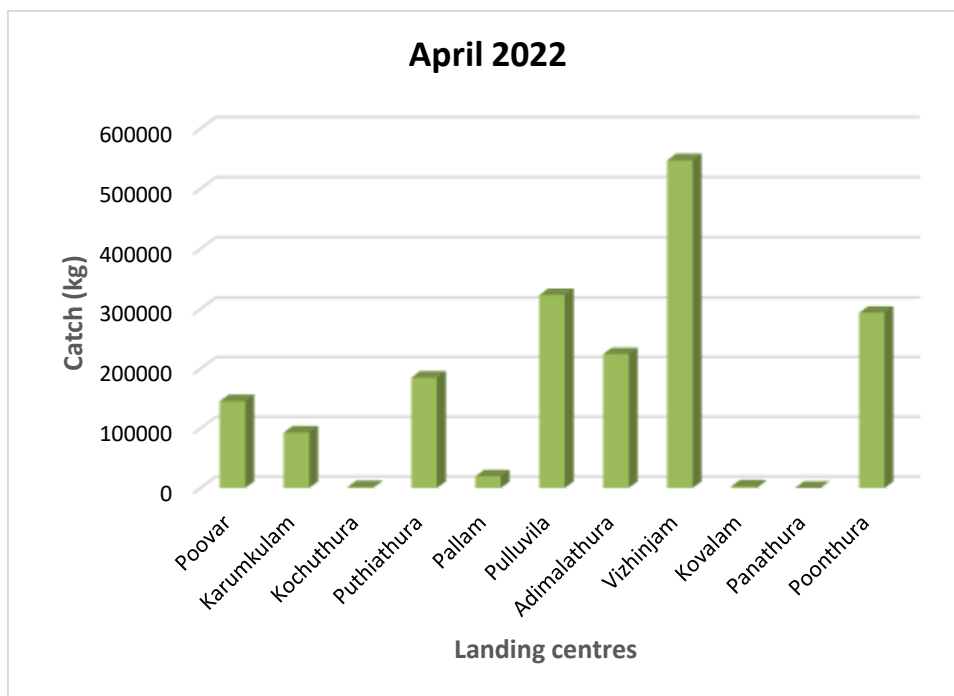


Fig.10.4.1.e Fish landings (kg) during April 2022 at different landing centers

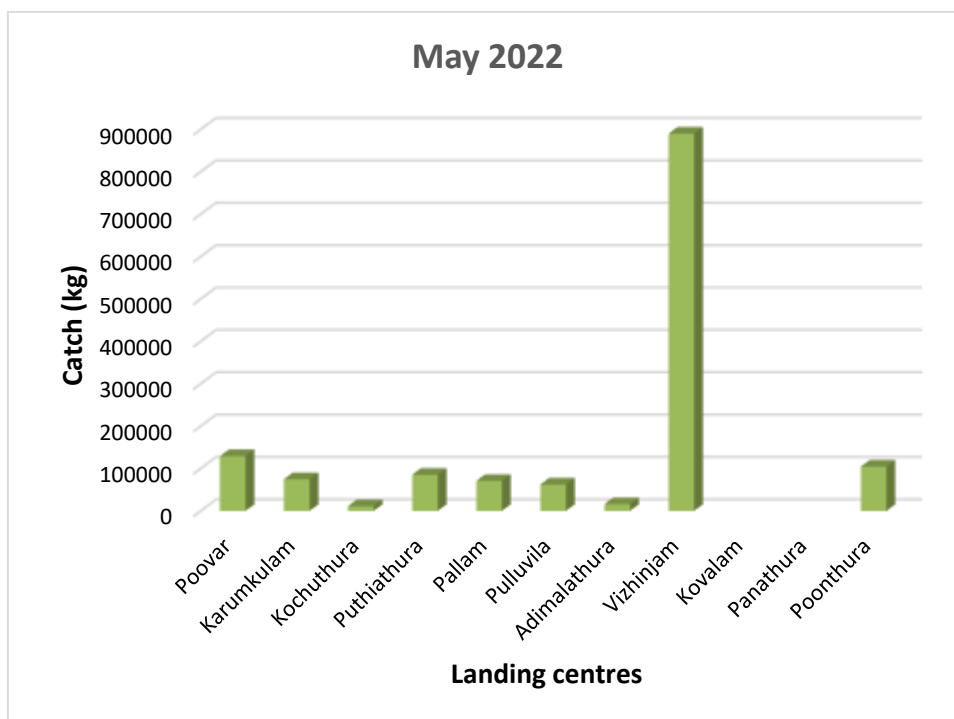


Fig.10.4.1.f Fish landings (kg) during May 2022 at different landing centers

The fishing ground information of major gears during Pre-monsoon is given in Fig.10.4.1.g

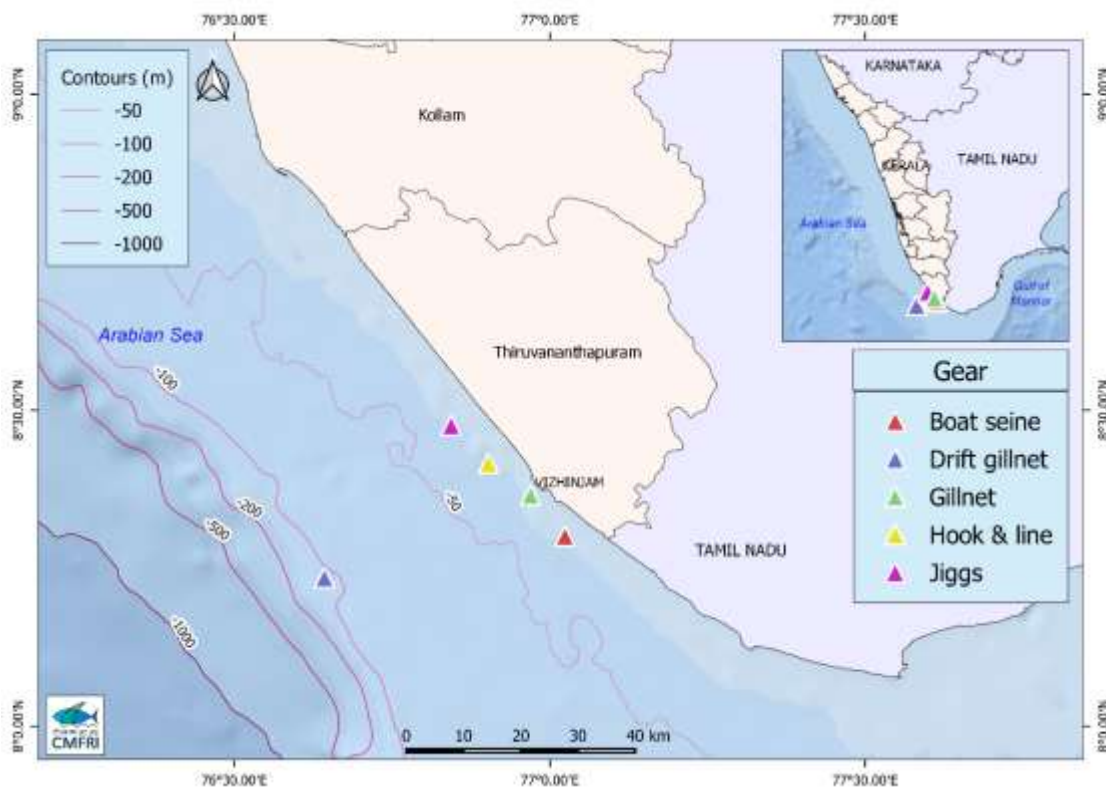


Fig.10.4.1.g Fishing ground information of major geragears during Pre-monsoon

The monthly landings of different species during the Pre - monsoon season are given in Table 10.4.1.a, 10.4.1.b, 10.4.1.c & 10.4.1.d.

Table. 10.4.1.a Fish species landed and its catch in February 2022 (Kg)

SPECIES	CATCH (kg)
<i>Ablennes hians</i>	279
<i>Acanthocybium solandri</i>	3484
<i>Aethaloperca spp.</i>	3880
<i>Alectis ciliaris</i>	40
<i>Alepes djedaba</i>	2333
<i>Alepes kleinii (A. kalla) (A. para)</i>	12
<i>Alutera monoceros</i>	1144
<i>Amblygaster sirm (Sardinella sirm)</i>	244582
<i>Atopus atropos</i>	11

<i>Atule mate</i> (<i>Alepes mate</i>)	4538
<i>Auxis rochei</i>	64568
<i>Auxis thazard</i>	65398
<i>Canthidermis maculata</i>	6840
<i>Carangoides hedlandensis</i>	408
<i>Carangoides malabaricus</i>	24
<i>Carangoides</i> spp.	306
<i>Caranx heberi</i> (<i>C. sem</i>)	4205
<i>Caranx hippos</i>	165
<i>Caranx ignobilis</i>	3869
<i>Caranx sexfasciatus</i>	258
<i>Cephalopholis sonnerati</i>	6679
<i>Cephalopholis urodeta</i>	10863
<i>Chanos chanos</i>	6
<i>Charybdis natator</i>	190
<i>Cheilopogon</i> spp.	5540
<i>Chirocentrus dorab</i>	80
<i>Chirocentrus nudus</i>	24
<i>Cookeolus japonicus</i>	322
<i>Coryphaena hippurus</i>	29254
<i>Cynoglossus macrolepidotus</i> (<i>C. arel</i>)	84
<i>Cynoglossus</i> spp.	548
<i>Dasyatis microps</i>	163
<i>Decapterus kurroides</i>	342
<i>Decapterus macarellus</i>	31
<i>Decapterus macrosoma</i>	29142
<i>Decapterus russelli</i> (<i>D. dayi</i>)	61314
<i>Elagatis bipinnulata</i>	1807
<i>Encrasicholina</i> spp.	384
<i>Epinephelus areolatus</i>	2361
<i>Epinephelus bleekeri</i>	1048
<i>Epinephelus chlorostigma</i>	3305
<i>Epinephelus diacanthus</i>	6663
<i>Epinephelus epistictus</i>	804
<i>Epinephelus longispinis</i>	671
<i>Epinephelus malabaricus</i>	1296
<i>Epinephelus radiates</i>	520
<i>Epinephelus</i> spp.	273
<i>Epinephelus undulosus</i>	80
<i>Erythrocles schlegelii</i>	14978

<i>Euthynnus affinis</i>	130614
<i>Exocoetus</i> spp.	3730
<i>Filimanus heptadactyla</i> (<i>Polynemus heptadactylus</i>)	474
<i>Fistularia petimba</i> (<i>F. villosa</i>)	1205
<i>Gazza minuta</i>	36
<i>Gephyroberyx darwinii</i>	40
<i>Gerres filamentosus</i>	2617
<i>Gymnosarda unicolor</i>	19
<i>Gymnura poecilura</i>	578
<i>Hemiramphus far</i>	33587
<i>Himantura imbricata</i> (<i>Amphotistius imbricatus</i>)	10284
<i>Hyporhamphus affinis</i> (<i>Hemirhamphus archipelagicus</i>)	216
<i>Hyporhamphus xanthopterus</i>	4
<i>Hyporthodus octafasciatus</i>	40
<i>Hyporthodus</i> spp.	1955
<i>Iniistius</i> spp.	109
<i>Istiompax indica</i> (<i>Makaira indica</i>)	28040
<i>Istiophorus platypterus</i>	24446
<i>Johnius</i> spp.	180
<i>Kajikia audax</i> (<i>Tetrapterus audax</i>)	7000
<i>Katsuwonus pelamis</i>	21197
<i>Leiognathus</i> spp.	5669
<i>Lepturacanthus savala</i>	261
<i>Lethrinus lentjan</i>	5256
<i>Lipocheilus carnolabrum</i>	442
<i>Lutjanus argentimaculatus</i>	560
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	241
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	2619
<i>Lutjanus quinquelineatus</i>	482
<i>Lutjanus</i> spp.	450
<i>Makaira nigricans</i>	2250
<i>Manta birostris</i>	360
<i>Megalaspis cordyla</i>	65229
<i>Mene maculate</i>	48708
<i>Mugil cephalus</i>	16
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	36716
<i>Nemipterus japonicas</i>	180
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	636
<i>Nibeas maculate</i>	152
<i>Octopus</i> spp.	127

<i>Odontanthias rhodopeplus</i>	1017
<i>Odonus niger</i>	15299
<i>Ostichthys acanthorhinus</i>	96
<i>Otolithes ruber</i>	4533
<i>Otolithes spp.</i>	414
<i>Oxyporhamphus micropterus</i>	240
<i>Oxyporhamphus spp.</i>	81
<i>Panulirus homarus</i>	47
<i>Parascolopsis eriomma</i>	192
<i>Parupeneus heptacanthus (P. cinnabarinus)</i>	22
<i>Parupeneus indicus</i>	22
<i>Pelates quadrilineatus</i>	65
<i>Pempheris spp.</i>	128
<i>Photopectoralis bindus (Leiognathus bindus)</i>	832
<i>Pinjalo pinjalo</i>	287
<i>Platax teira</i>	187
<i>Pomadasys furcatus</i>	192
<i>Pomadasys maculatus (P. maculatum)</i>	485
<i>Portunus pelagicus</i>	136
<i>Portunus sanguinolentus</i>	1011
<i>Priacanthus hamrur</i>	12364
<i>Pristipomoides filamentosus</i>	19678
<i>Pristipomoides typus</i>	13447
<i>Rachycentron canadum</i>	960
<i>Rastrelliger kanagurta</i>	230593
<i>Rhinobatos variegates</i>	98
<i>Sarda orientalis</i>	2922
<i>Sardinella fimbriata</i>	4404
<i>Sardinella gibbosa</i>	104694
<i>Sargocentron (Holocentrus) diadema (H. diadema)</i>	3
<i>Saurida tumbil</i>	468
<i>Saurida undosquamis</i>	9655
<i>Scolopsis bimaculata</i>	155
<i>Scolopsis vosmeri</i>	16
<i>Scomberoides commersonianus</i>	204
<i>Scomberoides tala</i>	84
<i>Scomberoides tol</i>	2078
<i>Scomberomorus commerson</i>	9996
<i>Scomberomorus guttatus</i>	5400
<i>Secutor insidiator</i>	2136

<i>Selar crumenophthalmus</i>	164750
<i>Selaroides leptolepis</i>	6089
<i>Sepia aculeate</i>	10
<i>Sepia pharaonis</i>	15574
<i>Sillago sihama</i>	137
<i>Sphyaena barracuda</i>	1305
<i>Sphyaena forsteri</i>	773
<i>Sphyaena jello</i>	652
<i>Sphyaena obtusata</i>	3209
<i>Sphyaena putnamae</i>	2287
<i>Sphyaena spp.</i>	16
<i>Stolephorus commersonnii</i>	648
<i>Stolephorus indicus</i>	137
<i>Stolephorus spp.</i>	678
<i>Stolephorus waitei</i>	1556
<i>Strongylura strongylura</i>	1092
<i>Sufflamen frenatum(S. capistratus)</i>	7215
<i>Terapon jarbua</i>	1201
<i>Terapon puta</i>	54
<i>Thenus unimaculatus(t. orientalis)</i>	163
<i>Thunnus albacares</i>	14505
<i>Torpedo spp.</i>	89
<i>Trachinocephalus myops</i>	376
<i>Trichiurus lepturus</i>	40738
<i>Turbinella(Xancus) pyrum(X. pyrum)</i>	233
<i>Upeneus sulphureus</i>	457
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	35086
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	3533
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	8596
<i>Uroteuthis(Photololigo)(Loligo) spp.</i>	24
<i>Xiphias gladius</i>	5280
TOTAL	1782945

Table. 10.4.1.b Fish species landed and its catch in March 2022 (Kg)

SPECIES	CATCH (Kg)
<i>Ablennes hians</i>	774
<i>Acanthocybium solandri</i>	622

<i>Aethaloperca spp.</i>	1782
<i>Acanthopagrus arabicus</i>	135
<i>Alectis ciliaris</i>	33
<i>Alectis indica</i>	49
<i>Alectis spp.</i>	20
<i>Alepes djedaba</i>	2828
<i>Alutera monoceros</i>	8165
<i>Amblygaster sirm (Sardinella sirm)</i>	2653
<i>Amphioctopus marginatus</i>	12
<i>Aphareus rutilans</i>	5265
<i>Arius arius</i>	1796
<i>Arius spp.</i>	772
<i>Atule mate(Alepes mate)</i>	5566
<i>Auxis rochei</i>	189419
<i>Auxis thazard</i>	50504
<i>Caesio and Pterocaesio spp.</i>	76
<i>Canthidermis maculata</i>	65
<i>Carangoides coeruleopinnatus</i>	1026
<i>Carangoides hedlandensis</i>	86
<i>Carangoides spp.</i>	459
<i>Caranx heberi (C. sem)</i>	1164
<i>Caranx ignobilis</i>	26443
<i>Caranx sexfasciatus</i>	556
<i>Carcharhinus leucas</i>	5636
<i>Cephalopholis argus</i>	38
<i>Cephalopholis miniata(C. miniatus)</i>	506
<i>Cephalopholis sonnerati</i>	3958
<i>Cephalopholis urodeta</i>	7934
<i>Chanos chanos</i>	5
<i>Charybdis feriatus (C. cruciata)</i>	45
<i>Charybdis natator</i>	8
<i>Coryphaena hippurus</i>	16582
<i>Cynoglossus macrolepidotus (C. arel)</i>	48
<i>Cynoglossus spp.</i>	248
<i>Dasyatis microps</i>	212
<i>Decapterus macarellus</i>	16770
<i>Decapterus macrosoma</i>	109672
<i>Decapterus russelli(D. dayi)</i>	142949
<i>Drepane punctata</i>	459
<i>Echinorhinus brucus</i>	2025

<i>Elagatis bipinnulata</i>	2131
<i>Eleutheronema tetradactylum</i>	27
<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	9143
<i>Epinephelus areolatus</i>	82
<i>Epinephelus bleekeri</i>	116
<i>Epinephelus chlorostigma</i>	2111
<i>Epinephelus diacanthus</i>	2170
<i>Epinephelus epistictus</i>	2588
<i>Epinephelus longispinis</i>	2421
<i>Epinephelus malabaricus</i>	1847
<i>Epinephelus ongus</i>	486
<i>Epinephelus spp.</i>	1936
<i>Epinephelus undulosus</i>	529
<i>Erythrocles schlegelii</i>	1547
<i>Euthynnus affinis</i>	240182
<i>Exocoetus volitans</i>	1181
<i>Fistularia petimba (F. villosa)</i>	2977
<i>Gerres filamentosus</i>	3124
<i>Gerres spp.</i>	72
<i>Gymnothorax fimbriatus</i>	10665
<i>Gymnura poecilura</i>	740
<i>Hemiramphus far</i>	2490
<i>Heteropriacanthus cruentatus (Priacanthus cruentatus)</i>	3060
<i>Hilsa kelee</i>	32
<i>Himantura imbricata (Amphotistius imbricatus)</i>	3570
<i>Himantura spp.</i>	203
<i>Hyporhamphus affinis (Hemirhamphus archipelagicus)</i>	310
<i>Hyporthodus octafasciatus</i>	394
<i>Iniistius bimaculatus</i>	49
<i>Istiompax indica (Makaira indica)</i>	2336
<i>Istiophorus platypterus</i>	6910
<i>Kajikia audax (Tetrapterus audax)</i>	1944
<i>Katsuwonus pelamis</i>	7801
<i>Leiognathus spp.</i>	4160
<i>Lepturacanthus savala</i>	2573
<i>Lethrinus lentjan</i>	12403
<i>Lethrinus nebulosus (L. choerorhynchus, L. fraenatus)</i>	76
<i>Lipocheilus carnolabrum</i>	392

<i>Lobotes surinamensis</i>	20
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	260
<i>Lutjanus indicus</i>	733
<i>Lutjanus johnii</i>	388
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	3009
<i>Lutjanus quinquelineatus</i>	305
<i>Lutjanus rivulatus</i>	432
<i>Lutjanus vitta</i>	21
<i>Maculabatis gerrardi</i> (<i>Himantura gerrardi</i>)	135
<i>Makaira nigricans</i>	324
<i>Manta birostris</i>	3094
<i>Megalaspis cordyla</i>	32138
<i>Megalops cyprinoides</i>	31
<i>Mene maculata</i>	53971
<i>Metapenaeus dobsoni</i>	360
<i>Monodactylus argenteus</i>	11
<i>Mugil cephalus</i>	103
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	18513
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	1754
<i>Octopus spp.</i>	81
<i>Odontanthias rhodopeplus</i>	226
<i>Odonus niger</i>	15923
<i>Ostichthys acanthorhinus</i>	101
<i>Otolithes ruber</i>	1260
<i>Pampus argenteus</i>	11
<i>Parapercis alboguttata</i>	15
<i>Parapercis spp.</i>	16
<i>Parascolopsis aspinosa</i>	810
<i>Parascolopsis eriomma</i>	50
<i>Parupeneus heptacanthus</i> (<i>P. cinnabarinus</i>)	7
<i>Pellona ditchela</i>	2030
<i>Pomadasys maculatus</i> (<i>P. maculatum</i>)	76
<i>Portunus pelagicus</i>	552
<i>Portunus sanguinolentus</i>	585
<i>Priacanthus hamrur</i>	9613
<i>Pristigenys refulgens</i>	10
<i>Pristipomoides filamentosus</i>	8186
<i>Pristipomoides multidentis</i>	1
<i>Pristipomoides typus</i>	22754
<i>Rachycentron canadum</i>	1679

<i>Rastrelliger kanagurta</i>	237498
<i>Remora remora</i>	63
<i>Rhinobatos obtusus</i>	258
<i>Rhinobatos spp.</i>	310
<i>Rhinobatos variegatus</i>	72
<i>Sarda orientalis</i>	849
<i>Sardinella fimbriata</i>	6484
<i>Sardinella gibbosa</i>	53767
<i>Sargocentron (Holocentrus) spp.</i>	810
<i>Saurida tumbil</i>	8
<i>Saurida undosquamis</i>	4069
<i>Scolopsis bimaculata</i>	349
<i>Scomberoides commersonnianus</i>	6492
<i>Scomberoides tala</i>	168
<i>Scomberoides tol</i>	1708
<i>Scomberomorus commerson</i>	3795
<i>Secutor insidiator</i>	759
<i>Selar crumenophthalmus</i>	181704
<i>Selaroides leptolepis</i>	91827
<i>Sepia pharaonis</i>	9691
<i>Sphyraena barracuda</i>	1613
<i>Sphyraena forsteri</i>	1063
<i>Sphyraena jello</i>	2814
<i>Sphyraena obtusata</i>	15098
<i>Sphyraena putnamae</i>	40
<i>Stolephorus commersonnii</i>	10915
<i>Stolephorus indicus</i>	22618
<i>Stolephorus spp.</i>	7493
<i>Stolephorus waitei</i>	20667
<i>Strongylura strongylura</i>	165
<i>Sufflamen frenatum (S. capistratus)</i>	3895
<i>Synodus indicus</i>	45
<i>Terapon jarbua</i>	897
<i>Thryssa mystax</i>	32
<i>Thunnus albacares</i>	3912
<i>Thunnus obesus</i>	284
<i>Trachinocephalus myops</i>	90
<i>Trachinotus blochii</i>	11
<i>Trichiurus lepturus</i>	9823
<i>Turbinella (Xancus) pyrum (X. pyrum)</i>	180

<i>Upeneus sulphureus</i>	245
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	64056
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	6592
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	21428
<i>Uroteuthis(Photololigo)(Loligo) spp.</i>	8122
<i>Xiphias gladius</i>	3186
TOTAL	1927696

Table. 10.4.1.c Fish species landed and its catch in April 2022 (Kg)

SPECIES	CATCH (kg)
<i>Ablennes hians</i>	1871
<i>Acanthocybium solandri</i>	2081
<i>Acanthopagrus arabicus</i>	271
<i>Alectis indica</i>	10
<i>Alectis spp.</i>	108
<i>Alepes djedaba</i>	6695
<i>Alepes kleinii (A. kalla) (A. para)</i>	62
<i>Alepes vari</i>	598
<i>Alutera monoceros</i>	83
<i>Amblygaster leiogaster(Sardinella leiogaster)</i>	1040
<i>Amblygaster sirm (Sardinella sirm)</i>	17907
<i>Atule mate(Alepes mate)</i>	6248
<i>Auxis rochei</i>	124038
<i>Auxis thazard</i>	97987
<i>Caesio and Pterocaesio spp.</i>	563
<i>Carangoides hedlandensis</i>	416
<i>Carangoides spp.</i>	319
<i>Caranx heberi (C. sem)</i>	19134
<i>Caranx ignobilis</i>	6383
<i>Caranx sexfasciatus</i>	481
<i>Caranx spp.</i>	130
<i>Cephalopholis sonnerati</i>	4204
<i>Cephalopholis urodeta</i>	1838
<i>Chanos chanos</i>	52

<i>Charybdis feriatus (C. cruciata)</i>	10
<i>Chirocentrus dorab</i>	2
<i>Cookeolus japonicus</i>	39
<i>Coryphaena hippurus</i>	10887
<i>Decapterus kurroides</i>	520
<i>Decapterus macarellus</i>	12133
<i>Decapterus macrosoma</i>	6333
<i>Decapterus russelli(D. dayi)</i>	147962
<i>Dipterygonotus balteatus (D. leucogrammicus)</i>	765
<i>Elagatis bipinnulata</i>	1092
<i>Encrasicholina punctifer (Stolephorus punctifer)</i>	32709
<i>Encrasicholina spp.</i>	8570
<i>Epinephelus areolatus</i>	410
<i>Epinephelus bleekeri</i>	676
<i>Epinephelus chlorostigma</i>	1049
<i>Epinephelus diacanthus</i>	1421
<i>Epinephelus epistictus</i>	2340
<i>Epinephelus longispinis</i>	39
<i>Epinephelus malabaricus</i>	1087
<i>Epinephelus ongus</i>	2158
<i>Epinephelus spp.</i>	145
<i>Erythrocles schlegelii</i>	3078
<i>Euthynnus affinis</i>	161092
<i>Exocoetus volitans</i>	1530
<i>Fistularia petimba (F. villosa)</i>	2239
<i>Gerres filamentosus</i>	2733
<i>Gerres spp.</i>	338
<i>Gnathanodon speciosus</i>	378
<i>Heteropriacanthus cruentatus (Priacanthus cruentatus)</i>	139
<i>Himantura imbricata(Amphotistius imbricatus)</i>	3531
<i>Hyporhamphus xanthopterus</i>	243
<i>Iniistius bimaculatus</i>	154
<i>Istiompax indica (Makaira indica)</i>	2427
<i>Istiophorus platypterus</i>	4534
<i>Istiophorus spp.</i>	2600
<i>Kajikia audax (Tetrapterus audax)</i>	1213
<i>Katsuwonus pelamis</i>	24917
<i>Lagocephalus inermis</i>	4
<i>Leiognathus spp.</i>	4310
<i>Lethrinus lentjan</i>	2305

<i>Lipocheilus carnolabrum</i>	992
Lobotes spp.	354
<i>Lobotes surinamensis</i>	198
<i>Lutjanus argentimaculatus</i>	1135
<i>Lutjanus fulvus</i> (<i>L. vaigiensis</i>)	31
<i>Lutjanus johnii</i>	1803
<i>Lutjanus lutjanus</i> (<i>L. lineolatus</i>)	2293
<i>Lutjanus quinquelineatus</i>	40
<i>Lutjanus rivulatus</i>	234
<i>Lutjanus russelli</i>	100
Lutjanus spp.	52
<i>Lutjanus vitta</i>	38
<i>Maculabatis gerrardi</i> (<i>Himantura gerrardi</i>)	35
<i>Makaira nigricans</i>	4862
<i>Manta birostris</i>	4102
<i>Megalaspis cordyla</i>	10330
<i>Megalops cyprinoides</i>	145
<i>Mene maculata</i>	80497
<i>Mugil cephalus</i>	330
<i>Nemipterus bipunctatus</i> (<i>N. delagoae</i>)	38392
<i>Nemipterus randalli</i> (<i>Nemipterus mesoprion</i>)	578
Nemipterus spp.	624
<i>Neotrygon kuhlii</i> (<i>Dasyatis kuhlii</i>)	9
<i>Nibea maculata</i>	26
<i>Odontanthias rhodopeplus</i>	3
<i>Odonus niger</i>	3898
<i>Otolithes ruber</i>	12696
<i>Parapercis alboguttata</i>	52
<i>Parascalopsis eriomma</i>	187
<i>Parupeneus heptacanthus</i> (<i>P. cinnabarinus</i>)	73
Pempheris spp.	450
<i>Photopectoralis bindus</i> (<i>Leiognathus bindus</i>)	400
<i>Portunus pelagicus</i>	37
<i>Portunus sanguinolentus</i>	17
<i>Priacanthus hamrur</i>	5178
<i>Pristipomoides filamentosus</i>	5886
<i>Pristipomoides typus</i>	1040
<i>Rachycentron canadum</i>	1426
<i>Rastrelliger kanagurta</i>	237301
<i>Sardinella fimbriata</i>	8328

<i>Sardinella gibbosa</i>	369970
<i>Sardinella</i> spp.	3784
<i>Sargocentron (Holocentrus) rubrum (H. ruber)</i>	259
<i>Saurida tumbil</i>	379
<i>Saurida undosquamis</i>	3287
<i>Scoliodon laticaudus</i>	255
<i>Scolopsis bimaculata</i>	94
<i>Scolopsis vosmeri</i>	13
<i>Scomberoides commersonianus</i>	7310
<i>Scomberoides tala</i>	26
<i>Scomberoides tol</i>	26
<i>Scomberomorus commerson</i>	6504
<i>Selar crumenophthalmus</i>	79837
<i>Selaroides leptolepis</i>	25879
<i>Sepia pharaonis</i>	3622
<i>Seriolina nigrofasciata</i>	67
<i>Siganus canaliculatus(S. oramin)</i>	67
<i>Sphyraena barracuda</i>	952
<i>Sphyraena forsteri</i>	2579
<i>Sphyraena jello</i>	1330
<i>Sphyraena obtusata</i>	8658
<i>Sphyraena putnamae</i>	879
<i>Stolephorus commersonnii</i>	11132
<i>Stolephorus indicus</i>	57735
<i>Stolephorus</i> spp.	8645
<i>Stolephorus waitei</i>	12860
<i>Strongylura strongylura</i>	607
<i>Sufflamen frenatum(S. capistratus)</i>	3630
<i>Thryssa</i> spp.	78
<i>Thunnus albacares</i>	4014
<i>Trachinocephalus myops</i>	599
<i>Trachinotus blochii</i>	52
<i>Trichiurus lepturus</i>	2274
<i>Upeneus sulphureus</i>	139
<i>Uroteuthis(Photololigo)(Doryteuthis) edulis(D. singhalensis)</i>	29062
<i>Uroteuthis(Photololigo)(Doryteuthis) singhalensis(D. sibogae)</i>	4898
<i>Uroteuthis(Photololigo)(Loligo) duvaucelii(L. duvaucelli)</i>	4521
<i>Uroteuthis(Photololigo)(Loligo) spp.</i>	8376
<i>Xiphias gladius</i>	6665

TOTAL	1835867
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Table. 10.4.1.d Fish species landed and its catch in May 2022 (Kg)

SPECIES	CATCH (kg)
<i>Ablennes hians</i>	2637
<i>Acanthocybium solandri</i>	752
<i>Alectis ciliaris</i>	662
<i>Alepes djedaba</i>	8898
<i>Alepes kleinii</i> (<i>A. kalla</i>) (<i>A. para</i>)	333
<i>Alepes melanoptera</i> (<i>A. melanopterus</i>)	654
<i>Alepes</i> spp.	26
<i>Alutera monoceros</i>	18
<i>Amblygaster sirm</i> (<i>Sardinella sirm</i>)	541
<i>Atule mate</i> (<i>Alepes mate</i>)	6034
<i>Auxis rochei</i>	255170
<i>Auxis thazard</i>	152560
<i>Caranx heberi</i> (<i>C. sem</i>)	21574
<i>Caranx ignobilis</i>	1006
<i>Cephalopholis formosa</i>	21
<i>Cephalopholis sonnerati</i>	2353
<i>Cephalopholis urodeta</i>	2113
<i>Chanos chanos</i>	17
<i>Charybdis feriatus</i> (<i>C. cruciata</i>)	62
<i>Coryphaena hippurus</i>	8866
<i>Dagetichthys commersonnii</i> (<i>Synaptura commersonnii</i>)	152
<i>Decapterus russelli</i> (<i>D. dayi</i>)	3019
<i>Diagramma picta</i>	36
<i>Dipterygonotus balteatus</i> (<i>D. leucogrammicus</i>)	155
<i>Dussumieria acuta</i>	10
<i>Elagatis bipinnulata</i>	911
<i>Encrasicholina punctifer</i> (<i>Stolephorus punctifer</i>)	23021
<i>Encrasicholina</i> spp.	8766
<i>Epinephelus areolatus</i>	659
<i>Epinephelus bleekeri</i>	87
<i>Epinephelus chlorostigma</i>	62
<i>Epinephelus diacanthus</i>	1057

<i>Epinephelus longispinis</i>	156
<i>Epinephelus malabaricus</i>	42
<i>Epinephelus spp.</i>	436
<i>Erythrocles schlegelii</i>	4171
<i>Euthynnus affinis</i>	136449
<i>Fistularia petimba (F. villosa)</i>	1857
<i>Gazza minuta</i>	2
<i>Gerres filamentosus</i>	149
<i>Himantura spp.</i>	1033
<i>Iniistius bimaculatus</i>	222
<i>Istiophorus platypterus</i>	2042
<i>Jellyfish</i>	117
<i>Johnius spp.</i>	1418
<i>Kathala axillaris</i>	4862
<i>Katsuwonus pelamis</i>	1517
<i>Lactarius lactarius</i>	8121
<i>Leiognathus brevisrostris</i>	63
<i>Leiognathus spp.</i>	7255
<i>Lethrinus lentjan</i>	3467
<i>Lethrinus nebulosus(L. choerorhynchus, L. fraenatus)</i>	104
<i>Lipocheilus carnolabrum</i>	7
<i>Lutjanus argentimaculatus</i>	338
<i>Lutjanus bohar</i>	124
<i>Lutjanus indicus</i>	52
<i>Lutjanus johnii</i>	10
<i>Lutjanus lutjanus(L. lineolatus)</i>	8800
<i>Lutjanus rivulatus</i>	21
<i>Manta birostris</i>	16420
<i>Megalaspis cordyla</i>	16804
<i>Megalops cyprinoides</i>	121
<i>Mene maculata</i>	92321
<i>Monodactylus argenteus</i>	44
<i>Mugil cephalus</i>	69
<i>Nemipterus bipunctatus(N. delagoae)</i>	58670
<i>Nemipterus japonicus</i>	28
<i>Nemipterus randalli(Nemipterus mesoprion)</i>	1108
<i>Nemipterus spp.</i>	87
<i>Nibea maculata</i>	2750
<i>Odonus niger</i>	4576
<i>Opisthopterus tardoore</i>	258

<i>Otolithes cuvieri</i>	20
<i>Otolithes ruber</i>	7345
<i>Otolithes spp.</i>	29
<i>Pampus argenteus</i>	13
<i>Parapercis alboguttata</i>	34
<i>Pellona ditchela</i>	20
<i>Pempheris spp.</i>	134
<i>Penaeus indicus</i>	3589
<i>Penaeus monodon</i>	390
<i>Pinjalo pinjalo</i>	468
<i>Plotosus lineatus (P. anguillaris)</i>	14
<i>Pomadasys maculatus (P. maculatum)</i>	607
<i>Portunus sanguinolentus</i>	13
<i>Priacanthus hamrur</i>	834
<i>Pristipomoides filamentosus</i>	163
<i>Rachycentron canadum</i>	8625
<i>Rastrelliger kanagurta</i>	171254
<i>Sarda orientalis</i>	4661
<i>Sardinella fimbriata</i>	2486
<i>Sardinella gibbosa</i>	93341
<i>Sardinella longiceps</i>	49677
<i>Sardinella spp.</i>	277
<i>Saurida tumbil</i>	366
<i>Saurida undosquamis</i>	9517
<i>Scoliodon laticaudus</i>	878
<i>Scolopsis bimaculata</i>	390
<i>Scolopsis vosmeri</i>	52
<i>Scomberoides commersonianus</i>	346
<i>Scomberoides lysan</i>	72
<i>Scomberoides tol</i>	887
<i>Scomberomorus commerson</i>	5344
<i>Secutor insidiator</i>	1546
<i>Selar crumenophthalmus</i>	28652
<i>Selaroides leptolepis</i>	878
<i>Sepia pharaonis</i>	7002
<i>Sphyraena forsteri</i>	2281
<i>Sphyraena jello</i>	620
<i>Sphyraena obtusata</i>	9781
<i>Sphyraena putnamae</i>	248
<i>Sphyraena spp.</i>	176

<i>Stolephorus commersonii</i>	21999
<i>Stolephorus indicus</i>	4793
<i>Stolephorus</i> spp.	9955
<i>Stolephorus waitei</i>	92275
<i>Sufflamen frenatum</i> (<i>S. capistratus</i>)	1665
<i>Synodus indicus</i>	104
<i>Terapon jarbua</i>	1719
<i>Thryssa mystax</i>	23
<i>Thryssa</i> spp.	872
<i>Thunnus albacares</i>	737
<i>Torpedo</i> spp.	10
<i>Trachinocephalus myops</i>	669
<i>Trichiurus lepturus</i>	982
<i>Tylosurus crocodilus</i> (<i>Strongylura crocodilus</i>)	1788
<i>Upeneus sulphureus</i>	8295
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>edulis</i> (<i>D. singhalensis</i>)	549
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Doryteuthis</i>) <i>singhalensis</i> (<i>D. sibogae</i>)	1953
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) <i>duvaucelii</i> (<i>L. duvaucelli</i>)	3269
<i>Uroteuthis</i> (<i>Photololigo</i>)(<i>Loligo</i>) spp.	55
<i>Xiphias gladius</i>	1950
TOTAL	1445015

10.4.2 EXPERIMENTAL FISHING IN PRE-MONSOON SEASON

JIGGS SAMPLING

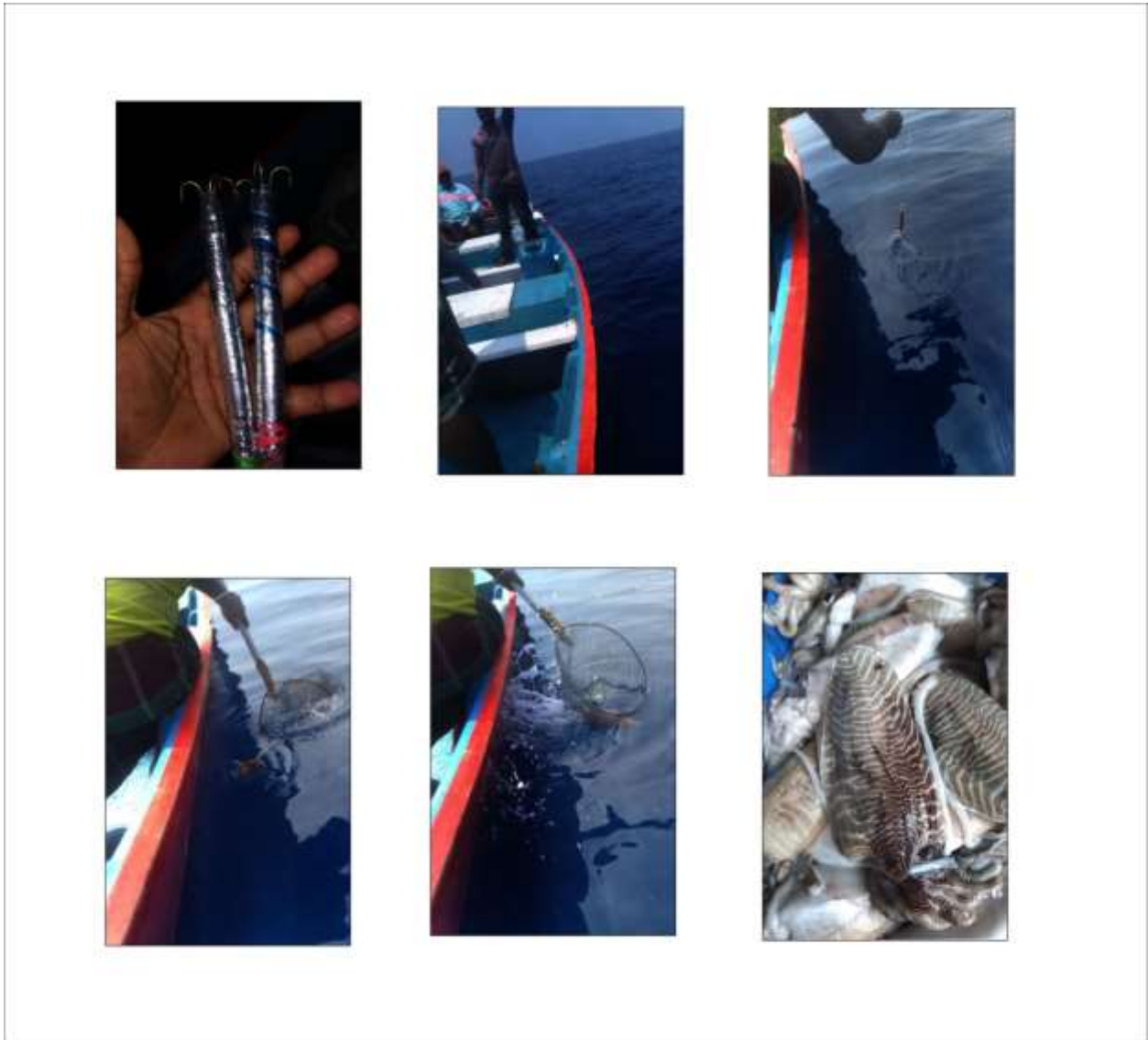


Plate 10.4.2.a Photograph showing the experimental fishing using Jiggs during Pre-monsoon season

Table 10.4.2.a Gear details of Jiggs

Gear	Jiggs
Date	10 th March 2022
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	West
Departure	4.35 am
Arrival	2.50 pm
No: Hauls	50
Distance	11 NM
Depth	33 m

Table 10.4.2.b Species details of jiggs samplig

Species	Total Sample Weight (kg)	Length Range (Cm)
<i>Sepia pharonis</i>	23	25-65

HOOK & LINESAMPLING

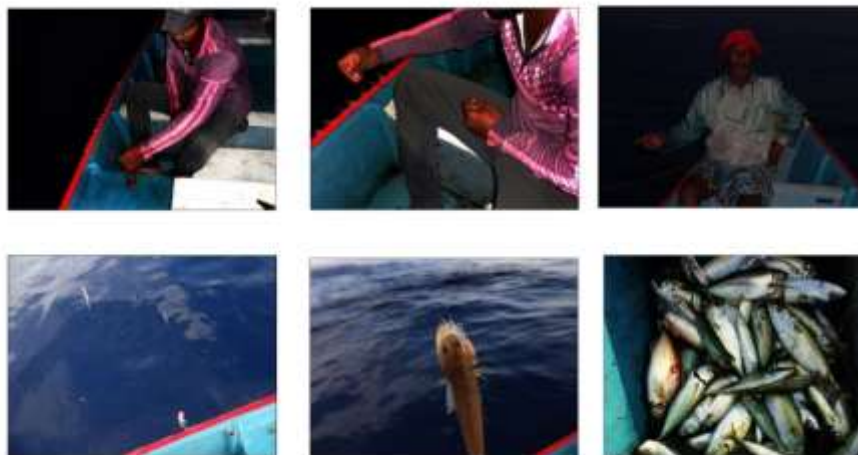


Plate 10.4.2.b Photograph showing the experimental fishing using Hook &Line during Pre-monsoon season

Table 10.4.2.c Gear details of Hook & Line

Gear	Hook & Line
Date	5 th February 2022
Craft	Outboard fiberglass
Horse Power	9.9 hp
Direction	Northwest
Departure	4.15 am
Arrival	2.00pm
No: Hauls	40
Distance	10 NM
Depth	45 m

Table 10.4.2.d Species details of Hook&Line sampling

Species	Total Sample Weight (kg)	Length Range (Cm)
<i>Saurida undosquimis</i>	5	19-27
<i>Rastrelliger kanagurta</i>	7	20-27
<i>Selar crumenophthalmus</i>	12	19-26
<i>Fistularia petimba</i>	3	45-58
<i>Atule mate</i>	2	14-18

DRIFT GILLNET SAMPLING

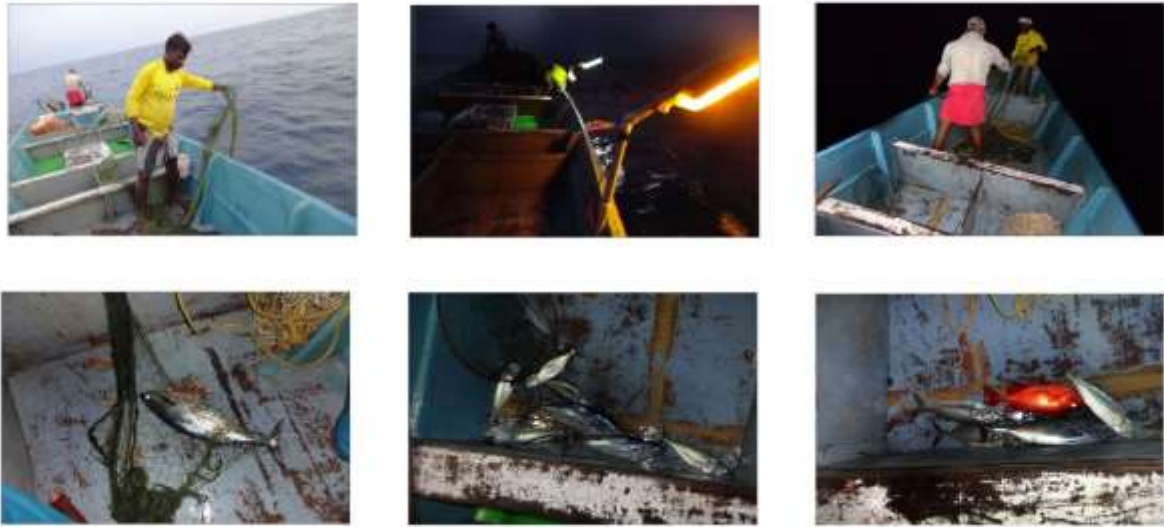


Plate 10.4.2.c. Photograph showing the experimental fishing using Driftgillnet during Pre-monsoon season

Table 10.4.2.e. Gear details of Driftgillnet

Gear	Drift gillnet
Date	11 th January 2022
Craft	Outboard fiberglass
Horse Power	9.9+25 hp
Direction	North west
Departure	3.00 pm
Arrival	4.25 am
No: Hauls	1
Distance	33 NM
Depth	69 m

Table 10.4.2.f Species details of Driftgillnet sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
<i>Auxis thazard</i>	6	26-45
<i>Euthynnus affinis</i>	18	29-47
<i>Scomberomorus tol</i>	2	25-28
<i>Rastrelliger kanagurta</i>	15	19-27.2
<i>Priacanthus hamrur</i>	2	25.3 – 27.9

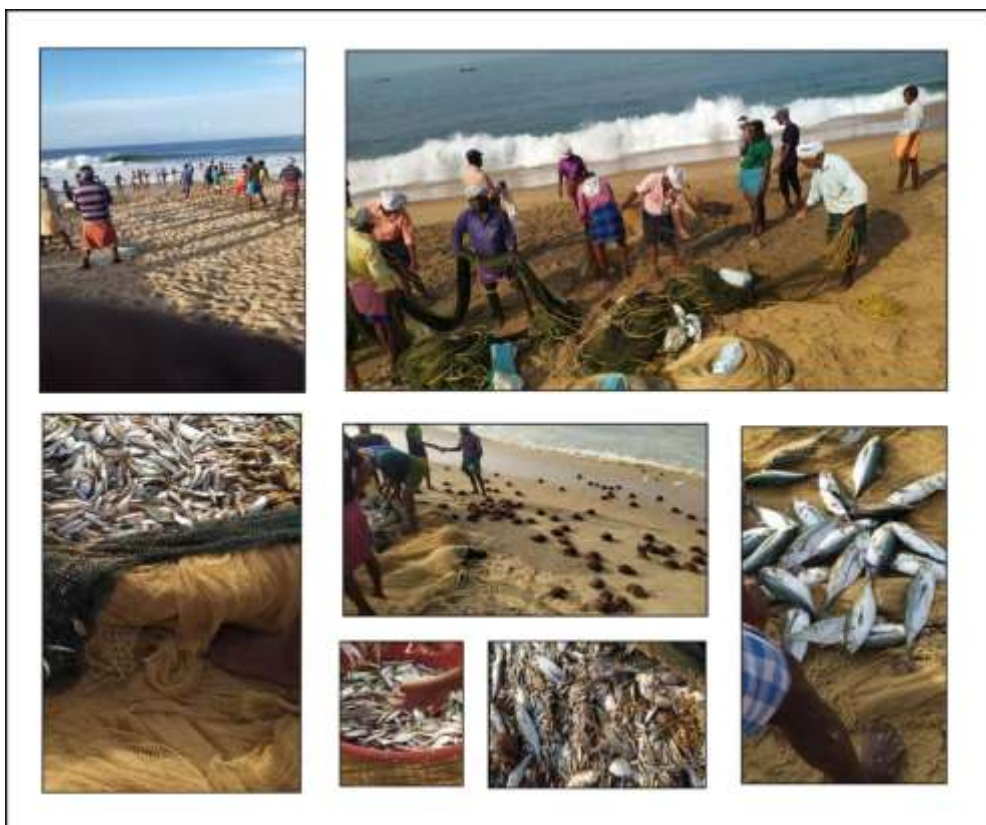
SHORE SEINE SAMPLING**Plate 10.4.2.d Photograph showing the experimental fishing using Shoreseine during Pre-monsoon season**

Table 10.4.2.g Gear details of Shoreseine

Gear	Shoreseine
Date	03 February 2022
Craft	Outboard fiberglass
Horse Power	9.9+9.9 hp
Direction	West
Departure	6.15 am
Arrival	8.00 am
No: Hauls	1
Distance	1.5 NM
Depth	12 m

Table 10.4.2.h Species details of shoreseine sampling

Species	Total Sample Weight (Kg)	Length Range (Cm)
<i>Sardinella gibbosa</i>	110	7.5-14
<i>Stolephorous</i> sp.	7	9-12
<i>Rastrelliger Kanagurta</i>	2	23-25.5

10.5 FISHING METHODS

Trivandrum coast is one of the major traditional fishing zones of Kerala where, Vizhinjam Landing Centre (8° 22' 30" N, 76° 59' 15" E), is one of the important fish landing centres in Thiruvananthapuram and fish landings occur all over the year by employing crafts and gears according to the seasonal requirements and availability of fishes. Fishing is carried out by traditional crafts and gears, fitted with outboard engines, vessels fitted with inboard engines and other modern gears are not able to operate along the coast due to the patchy rocks and steep sloping continental shelf of this region. During the last decade, there was a complete transition from wooden crafts to fibre boats which made crafts lighter and enabled an increase in the speeds of the fishing vessels. Most of the traditional crafts along the coast ranged from 25 to 40 feet overall length (OAL). Two outboard engines with 9.9 HP each are used for propulsion. Drift gillnet forms the major gear in fishing operations along the coast, followed by mechanized hooks and line and boat seines. The details of some of the artisanal gears collected during the data collection programme are given below;

Boat seine (Thattu madi)

This gear is made up of four net pieces, known as ara vala, kuralu madi, thelinga madi, and ka vala made of nylon and has three parts, (i) a short wide-mouthed conical bag called the madi or net proper made of nylon, (ii) a platform known as thattu attached to the lower part of the gear (iii) two long wings attached to the margin of the thattu on either side known as era vala. Each wing or era vala measures 150 m in length with 40 meshes breadth, each measuring 1.5 m from one knot to the nearest knot. The distal extremity of the wings on either side is also attached with two nylon ropes known as Kamba. Two catamarans or fibreglass coated plywood boats are employed for operating this gear. The gear is loaded in one catamaran/boat and venture into the sea along with the other catamaran/boats. When a fish shoal is sighted, the net is shot and one of the warps is handed over to the crew in the other catamaran/ boat. The two boats move apart and encircle the shoal in the direction opposite to the movement of the shoal. Later on, two boats come close, hauls the net simultaneously and unload the fishes from the bag portion of the net into one boat. The fishermen continue fishing operations if catches are satisfactory. The fishing season is June to October. The fishes caught in this gear are carangids, ribbonfishes, catfishes, clupeids, sciaenids, pomfrets, *Sphyraena* spp., *Sillago sihama*, balistids,

Priacanthus spp.etc. Along the Vizhinjam coast the main gear used for squid during monsoon season (July-November) is boat seine. The motorized FRP boats fitted with outboard engines of fishers from Anjuthengu to Kollamkodu concentrate on fishing at Vizhinjam. Boat seines operated 3 to 10 km from the shore within 20 to 35 m depth. Boat seines are also operated from two catamarans of 5 m size comprising six fishermen who row the same with oars. This type of fishing is carried out from Vizhinjam to Poonthura or Vizhinjam to Pulluvila, up to 18 fathoms and about 3 km from shore. Squids, anchovies, sardines, prawns, carangids, tuna, sciaenids, *Nemipterus* spp., *Lactarius lactarius*, pomfrets and mullets are caught in this gear.



Plate 10.5.1. Boat seine catch and its operation



Plate.10.5.2. Boat seine fishing using lights and its catch

Gillnets

Gillnets are the most common gear operated along the Thiruvananthapuram coast from time immemorial. Different modifications can be made possible in the gillnetting on resource availability. The various modified gillnets are;

Monofilament gill net (Roll vala, Kangoose vala): The size of the gear is 100 to 120 m in length with 15 m breadth having 62 mm mesh size. Head rope is of 3 mm thickness with small floats attached at every 3.5 m length and for every float a stone sinker of 150 g is attached. In addition to the small floats at every tenth float 5litre, empty oil can or large spherical-shaped float is also attached. (Fig Fig 10.5.1.). A total of 30 spherical floats are used in each gill net. From May to September, when the sea becomes turbid fishers adjust the float line to 3 m, and during October to April and during the full moon phase, 15 m float lines are used and again during the new moon phase the float lines are reduced to 7 to 8 m length. This gear is mainly

employed for catching tunas and mackerel. The float line is attached with 150 numbers of 3-inch floats arranged at intervals of 2 m and small stone sinkers corresponding to each float tied to the foot rope of the gear. The end of the net has a floating line of 45 m on which 2 five-litre empty cans functions as floats and the foot rope bears a four kg stone sinker. The gear is preferred due to its light weight and low visibility during daytime.



Fig 10.5.1 Ayala vala



Fig.10.5.2 Netholi vala



Fig.10.5.3 Chala vala



Fig.10. 5.4 Chala vala catch

Idakettuvala

Idakettuvala is a modification of gillnet, usually with a length of 1000-1500 m and breadth of 3.25 m. The mesh size of the net is 45 mm. Head rope is of 3 mm thickness with small floats attached at every 3.5 m length. A total of 300-350 floats are used in the net, with every float, a stone sinker of 150 g is attached. Stone as well as lead sinkers are used in the net. Lead sinkers are tied at every 40-45 cm interval and they are tied with the foot rope. Two empty cans are attached with the main line at both ends to identify the gear in the sea and taking up of the gear. The gear is operating in the morning hours. Outboard plywood or Outboard fiberglass crafts are used for fishing. Catches include *Nemipterus* spp., Croackers, crabs and many juvenile fishes.



Fig.10.5.5. Idakettuvala

Fig.10.5.6. Detangling of Idakettuvala

Drift gill net (Valiya vala, Ozhukku vala):

These gears operated throughout the year have a 9 m breadth with 100 mm mesh size. On the 4 mm thickness float line, 120 mm-sized floats are attached at an interval of 2.5 m. After every 15 small floats, one five-litre empty oil can is used as floats and one kg stone sinkers tied at both ends of the gear. Thirty-two-foot boats for single-day fishing operation within 5 to 25 NM and 40-footer fishing boats with fish hold for multiday fishing of 5 to 7 days are seen. These boats usually operate beyond 50 to 60 NM with a manpower of four fishermen. For multi-day fishing, 15 to 30 blocks of ice are generally required to preserve the catches. From November to March, fishing is conducted up to 50 to 60 NM and during June to September, fishing is confined to 5 to 25 NM. The area of fishing operation is from Kanyakumari to Varkala, with operations that start at 2 pm and the boats reach the fishing ground by 5 to 6 pm. After shooting the gear, it is hauled in after 5 hours and large tunas, seer fish, sharks etc. are caught.



Fig.10. 5.7 Drift gillnet

Bottom set gill net (Thathuvala):

This gear has 3 m breadth and is made up of 62 mm mesh size monofilaments. Float line is made of 3 mm thickness rope and every three-meters a small float is attached. Two-foot ropes of 1.5 mm thickness are used for attaching small lead sinkers (20 g) at 40 cm interval and the second rope is used for attaching the net. This gear is operated up to 3 nautical miles from the shore and usually operates within 1 to 1.5 nautical miles from the shore. Three to eight fishermen will be involved in fishing from a boat. In this gear, the disentangling of the fish caught is highly time-consuming and labor-intensive. Catches include flatfishes, crabs, prawns, croakers, skates, rays and chanks. This gear is operated from 5 to 9 am.



Plate. 10.5.3. Bottom set gillnet

Trammel Net (Disco Vala/Konchu vala):

This gear is made up of three layered netting approximately 300 m in length. The mesh size of the inner net is 48 to 50 mm and the outer two layers of netting are 100 to 120 mm. Head and foot ropes are of 2 mm thickness. The breadth of the gear is 2 fathoms. The float line measures 30 fathoms. At both ends of the gear, three numbers of 5-litre empty oil cans were tied as floats. Besides, sinkers weighing 3 kg were also attached at the end of the foot rope. At every 40 cm of the foot rope, a lead sinker of 50 g size, and every three meters of a head rope, a small float was also attached. The gear is characterized by two head ropes and two two-foot ropes, that is, head ropes for attaching the three layers of netting and also for attaching 100 floats and the foot rope for attaching sinkers respectively. A single trammel net unit requires 3.6 kg (3 pieces of 1.2 kg) netting. Trammel nets were operated from 6 am to 7 pm. Usually, 4 to 7 fishermen go for this fishing in a single boat and gear is hauled every 30 minutes.



Fig .10.5.8 Trammel net used to catch shrimp

Hook and line fishing

Hand line (Aachil) is characterized by the main line of nylon monofilament twines ranging from 15 to 20 m with many branch lines tied at intervals of 1.5 m on the mainline and hooks at their distal end (Plate 10.5.4). At the end of the main line, 0.5 kg iron sinker is attached. The 15 m longlines are used during the night, and the 7 m longline during the daytime. The monofilament twines are categorized as numbers 40, 60, 80 etc. based on their thickness; with the smaller the number, the thicker the twine. For day fishing, number 80 main lines with number 60 branch line are used, while for night fishing, number 30 is used for both main and branch lines. Similarly, different types of hooks categorized into numbers are used. Hooks used for day fishing range from number 8 to 13, while hook number 15 is used for night fishing. The hand lines are operated from 28-foot fiberglass coated plywood boats (FPB) fitted with 9.9 HP outboard (usually two) engines. Three to four fishermen go fishing, and each of them operates a hand line. Fuel consumption was estimated at about 7 litres per hour with

consumption of about 10 litres of kerosene. Apart from FRP boats, catamarans are also employed for the hand-line operations.



Plate 10.5.4. Hand lines

Hand lines with jigs for squid and cuttlefish are made up of monofilament twines number 80 (mainline) with 28 fathoms length with in 1 m of number 60 branch attached. Six to ten branch lines with jigs (Plate.10.5.5) are tied at an interval of 1 to 1.5 m along the main line. Motorized fibre reinforced plastic (FRP) boats fitted with outboard engines with manpower of 6 to 7 are employed in jigging operations. A jig-like device made of a long thin steel rod attached with four hooks is used for capturing cuttlefishes and the crab is tied to the middle of the rod as bait. Spindle-shaped lead weight covered using glittery ribbon with attached hooks was also used. Once the cuttlefish get entangled in the hook, the lines are lifted to collect the catch. Hand jigging is employed both day and night. Occasionally a few catamarans are also employed for squid fishing which is again carried out during day and night. The peak season for the operation of handlines is during October -November period. Several units of FADs (Fish Aggregating devices) are placed within 15 to 30 m depths by the local fishermen which are located using GPS at regular intervals. The fishing is conducted in areas ranging from 5 to 15 km from the shore, mainly concentrated along Poovar to Varkala coastline. Fishing for cuttlefish using FADs is carried out only during the daytime.



Plate.10.5.5. Squid jigs and its catch

Long line fishing

Traditional long line (Chooru Mattu/ Ayiram choonda) is mainly used for catching tunas. November to March is the peak longline fishing season along this coast which is operated for tunas, cobia, groupers and snappers. Mainline of number 80 monofilament nylon twine five nautical miles in length with 3 m branch line of twine numbers 60 to 70 attached with hooks are employed (Plate 10.5.6). The distance between each hook is 10 m and at the end of every 50th hook, a float (5-litre empty oil) is tied using 1.5 mm thick rope of 75 m length and a sinker (300 g) tied with 15 cm rope. 20 floats are used for every 1000 hooks. The hook number 9 is used for tuna, 8 for cobia and 6 and 7 for groupers. The area of operation is from 15 to 25 nautical miles (NM) from shore having depths of 48 to 72 fathoms. These crafts usually venture into the sea by 2 am to reach the fishing ground by 5 am, and shooting the lines takes one hour. The hauling of the gear starts after 6.00 am. Sardines stored in ice boxes are used as baits. Reef long line (Paruamatu): This long line is used mainly for catching *Pristipomoides* spp., rock cod, carangids, skates, cobia etc. The main line is made up of the number 120 monofilament twine

of 4 NM length with 1.5 m branch lines made up of number 80 monofilaments attached with hook number 9. The distance/length between each hook is 5 m and for every 100 hooks, a floating line is tied using 1.5 mm thickness rope of 125 m length and two 5 litre empty oil cans are tied to the float line for floatation besides a sinker (300 g) tied with 15 cm rope. The total number of floats used is about 20 for a long line with 300 hooks (Fig.6). The depth of operation is 55, 65, 75 and 110 fathoms at a distance of 30-110 NM from shore.

Shark long line (Shravu mattu):

In this long line billfishes, sailfish, sharks, yellowfin tuna and rays are caught using either variety of live coastal tunas or mackerel as bait. The main line is made up of Number 140 monofilament nylon twine with 25 to 90 m branch lines made up of number 110 monofilaments attached with 1 foot long thin silver wire-rope made of 20 strands connected using a swivel, to which hook Number 2 or 3 is attached at their distal end. The distance/length between each hook is measured at 50 m with a total of 100 hooks.



Plate 10.5.6. Longliners used to catch Tuna, shark, Seerfishes and big carangids (a)



Plate 10.5.7. Longliners used to catch Tuna, shark, Seerfishes and big carangids (b)

Shore seines (Karamadi)

The Shore-seines are operated from the sea shore and are locally known as Kara madi, indicating fishing operation from the shore. A shore-seine has three parts, the warps or kamba, the wings or kayaru and madi the funnel-shaped bag net. Ara vala forms the bottom portion of the gear, constituting the bag, which measures 20 m in length with a mesh size of 6 mm. The cod end of the gear is 5 m in breadth. Mel madi or Neriya vala part of gear is attached to the anterior margin of the ara vala, which is 15 m in length with 20 mm mesh size on Ara valaside, and 30 mm mesh size towards the mouth of the gear. The wings or Kayaru is made of nylon, ranged from 600 m to 900 m and are attached along the lateral margins of the mel madi with mesh size increasing from the proximal to the distal extremity. The warp or Kamba is made of split nylon fibre rope, measuring 200m to 250 m length and is attached to the wings. Mode of operation: This gear is operated by canoes or fiberglass boats of 28 to 36 feet. The gear is loaded into the vessel and before leaving the shore one of the warps is handed over to a group of fishermen on shore. The vessel then makes a semi-circular course while shooting the net and as soon as the vessel reaches the shore, the remaining warp is handed over to the second group of fishermen. The two groups comprising 20 to 40 numbers of fishermen on the shore haul the net simultaneously. Meanwhile three or four fishermen jump into the area along the sea enclosed by the warps and beats/splash the waves to scare the fishes, forcing them to enter in the gear. As the hauling progresses, the groups of fishermen on the shore come closer and gear is dragged ashore. The fishing season is from October to May. Shore seine operations are mostly conducted after sighting a shoal in the near shore waters. The catch usually comprises inshore pelagic fishes and shrimps such as anchovies, silver bellies, carangids, sardines, mullets, mackerel, *Saurida* sp., squids, *Acetes* spp. etc.



Plate.10.5.8. Shore seine operation and its catch

10.6 SEASONAL VARIATIONS IN FISH CATCH AND FISHING OPERATIONS

Fisheries are one of the significant communities owing to its ecological, recreational, economic and aesthetic roles. The productivity of water determines the health of the water body in terms of the abundance and health of fishes occupying all the trophic levels. Fishes are relatively sensitive to most habitat disturbances, fishes may try to avoid stressful ecosystems, so the availability of fishes varies from season to season. Data collected during the present study was tabulated to analyze the seasonal difference in fish catch and population and also the different fishing operations that existed in the area. We tried to collect the geo coordinates to understand the different fishing locations during different seasons. The overall picture of the fishing operations during different seasons are given in Figure.10.6.1

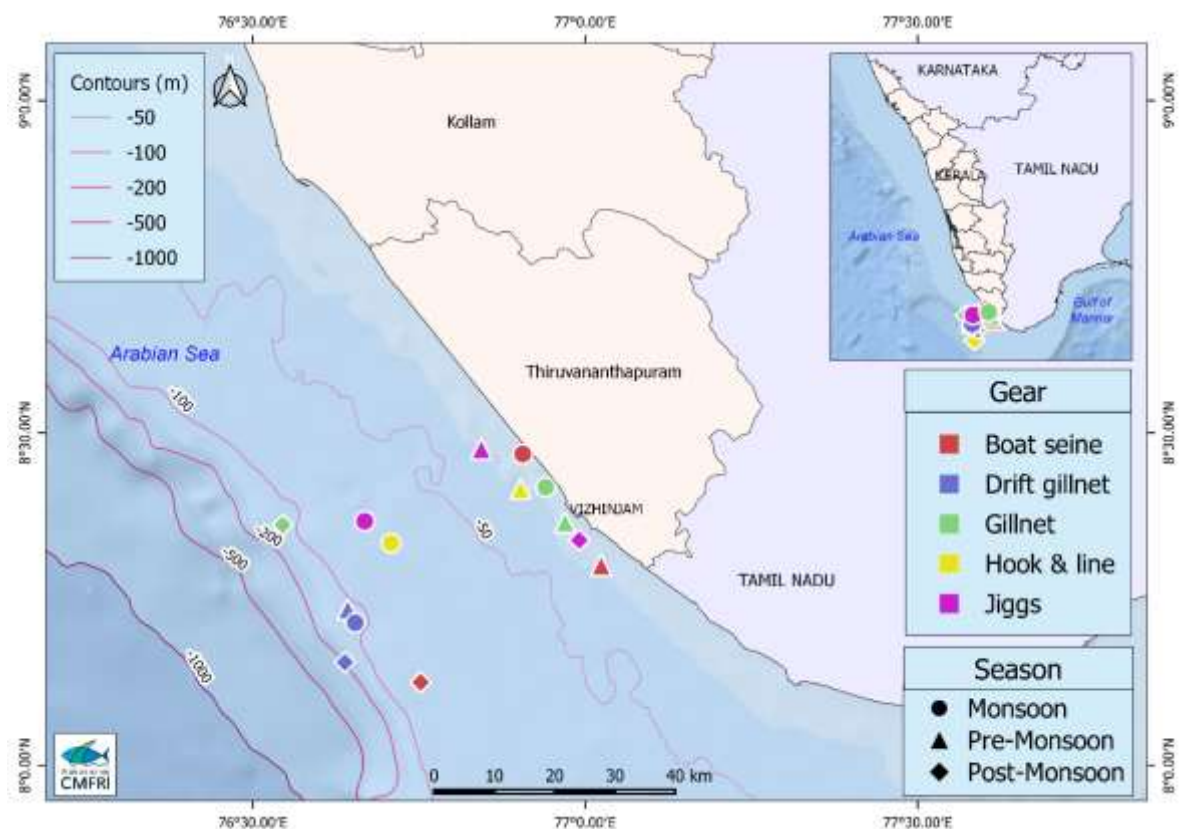


Fig.10.6.1 Fishing locations by different gears during different seasons

The fish catch, the number of fishing units (efforts), Catch Per Unit Effort, and average CPUE during different seasons, zone wise is given in Fig.10.6.2, Fig.10.6.3 and Fig.10.6.4

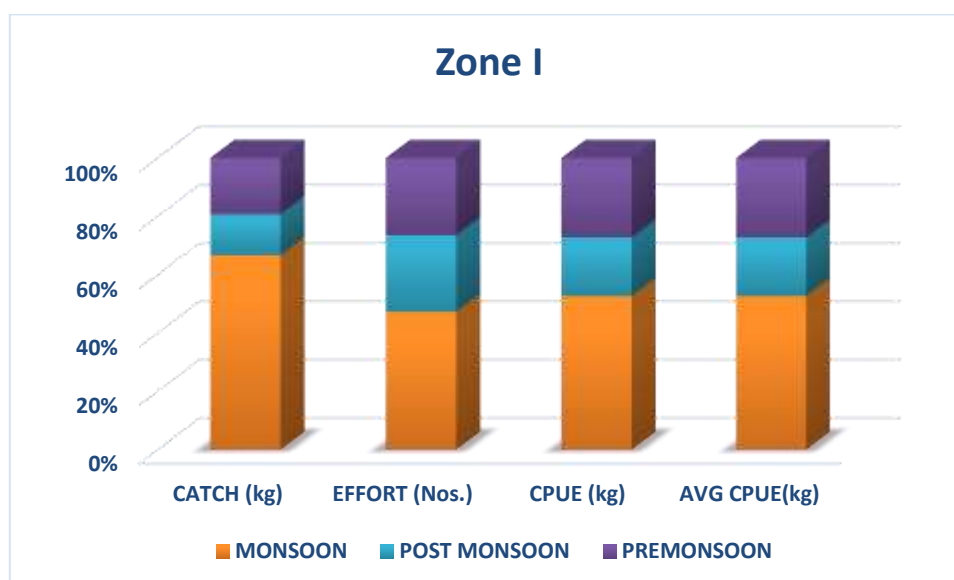


Fig.10.6.2 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone I

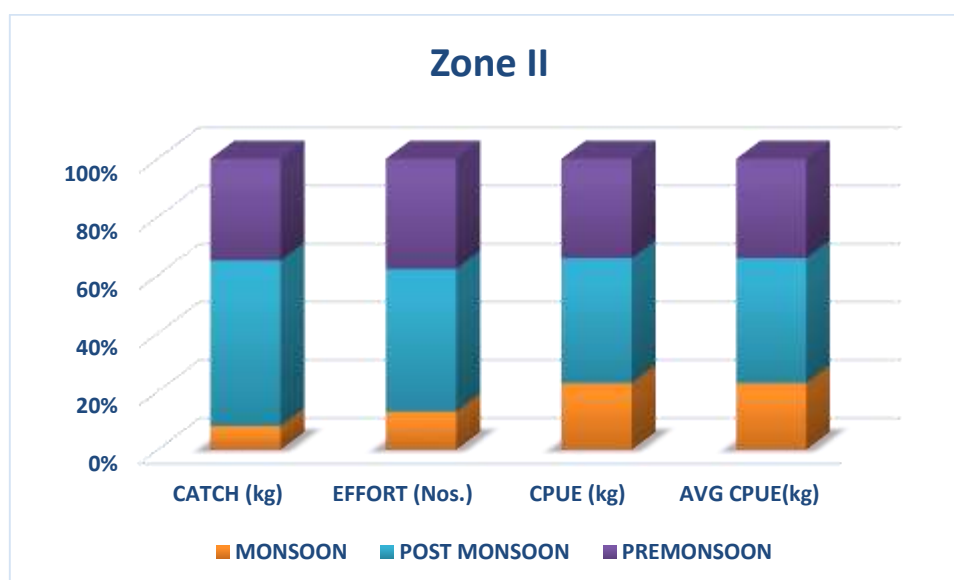


Fig.10.6.3 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone II

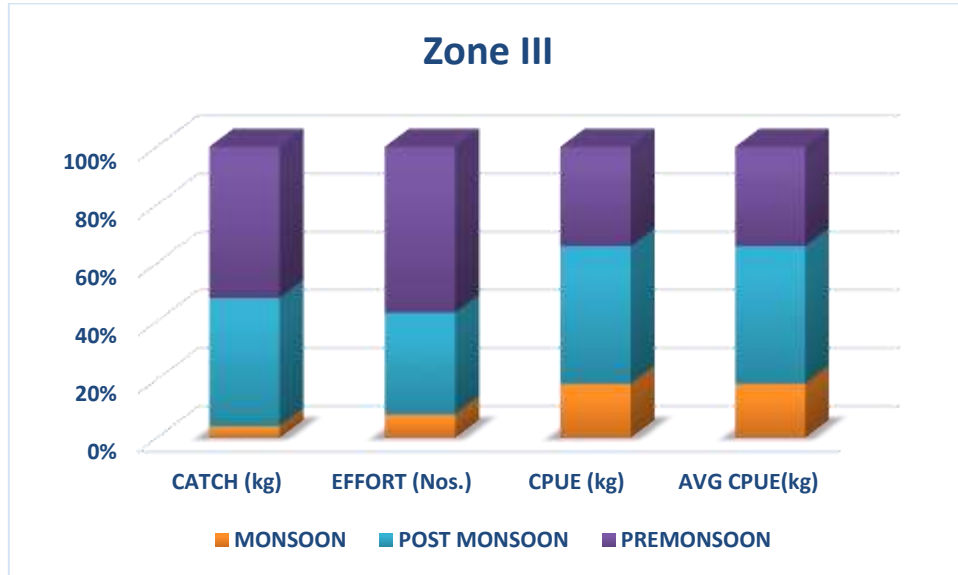


Fig.10.6.4 Graph shows the Fish catch, No. of efforts, CPUE and Average CPUE during monsoon season from Zone III

The total fish catch and average fish catch reported during June 2021- May 2022 during different seasons from different zones are represented in Fig.10.6.5 and Fig.10.6.6

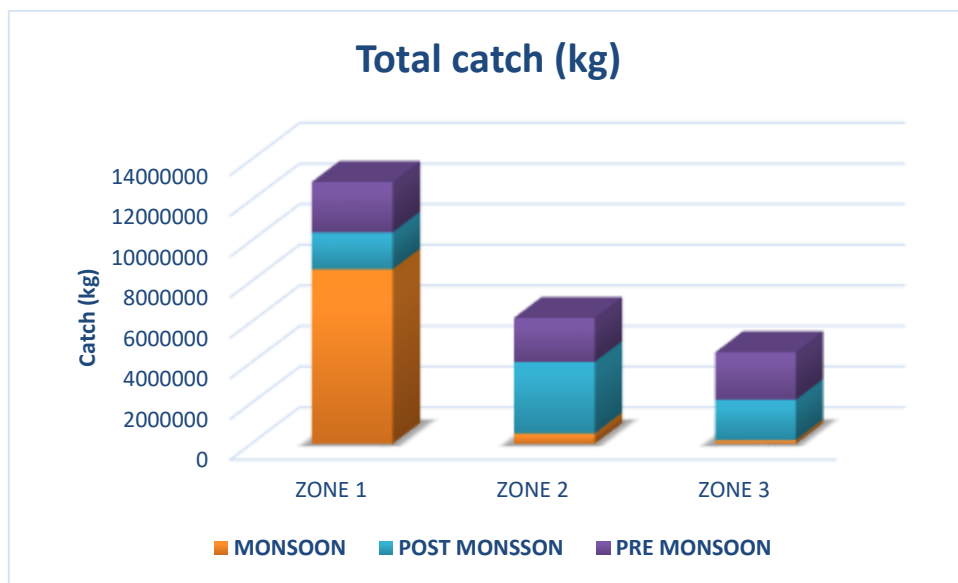


Fig.10.6.5 Total fish catch, season wise-zone wise

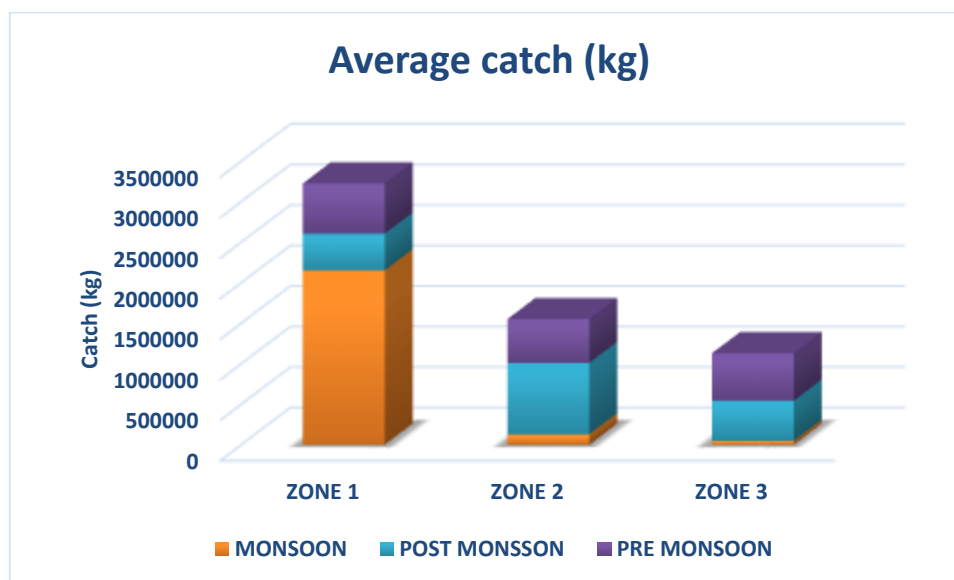


Fig.10.6.6 Average fish catch, season wise-zone wise

10.7 COMPARISON OF PRESENT FISH CATCH DATA WITH THE BASELINE INFORMATION COLLECTED DURING 2011-12

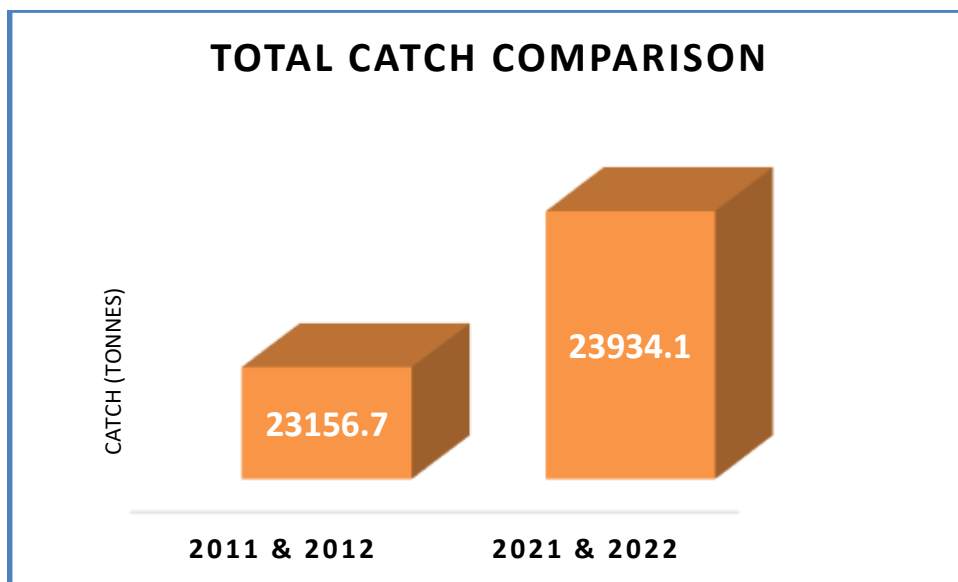
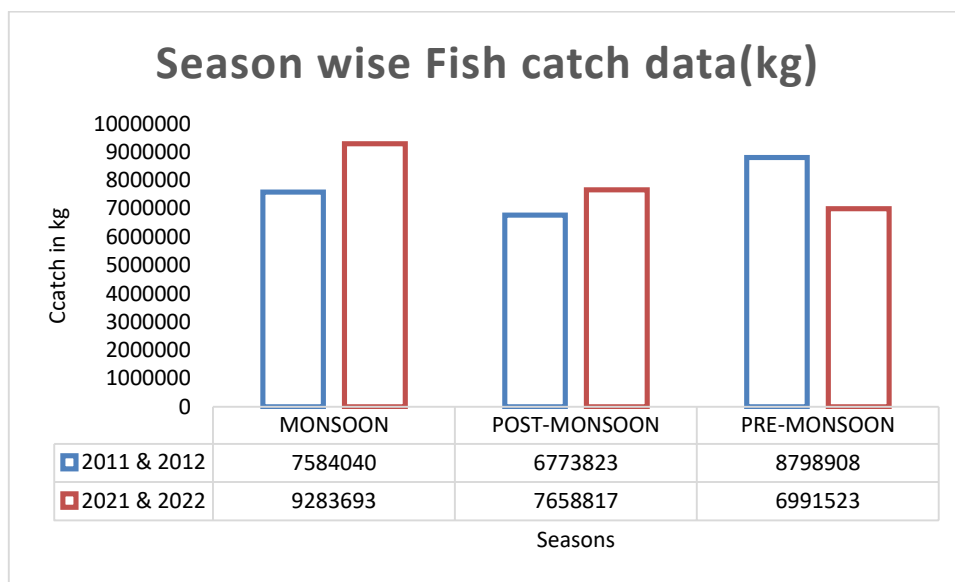


Fig.10.7.1. Fish catch data 2011-12 & 2021-22



10.7.2. Season wise Fish catch data (kg)

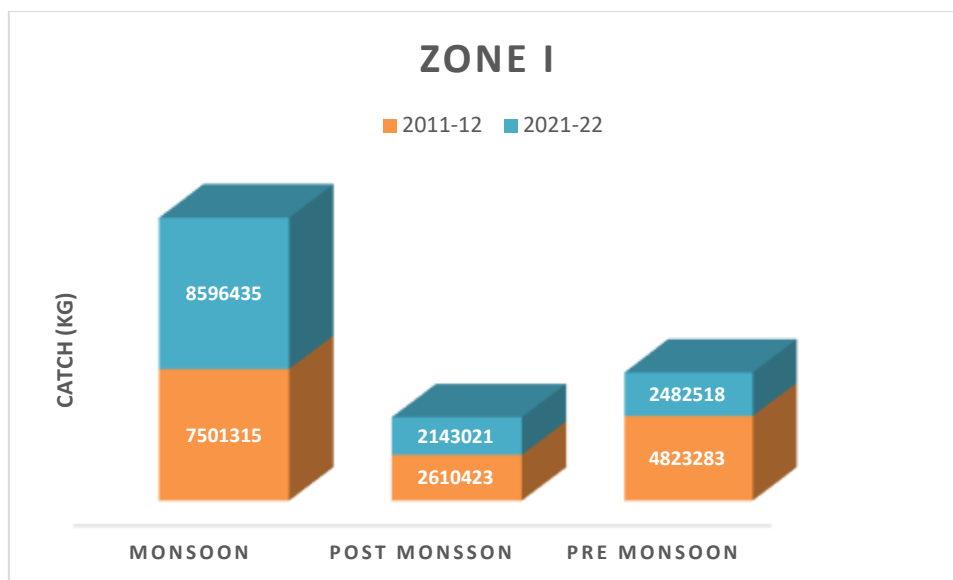


Fig.10.7.3. Season wise fish catch data in Zone I during 2011-12 & 2021-22

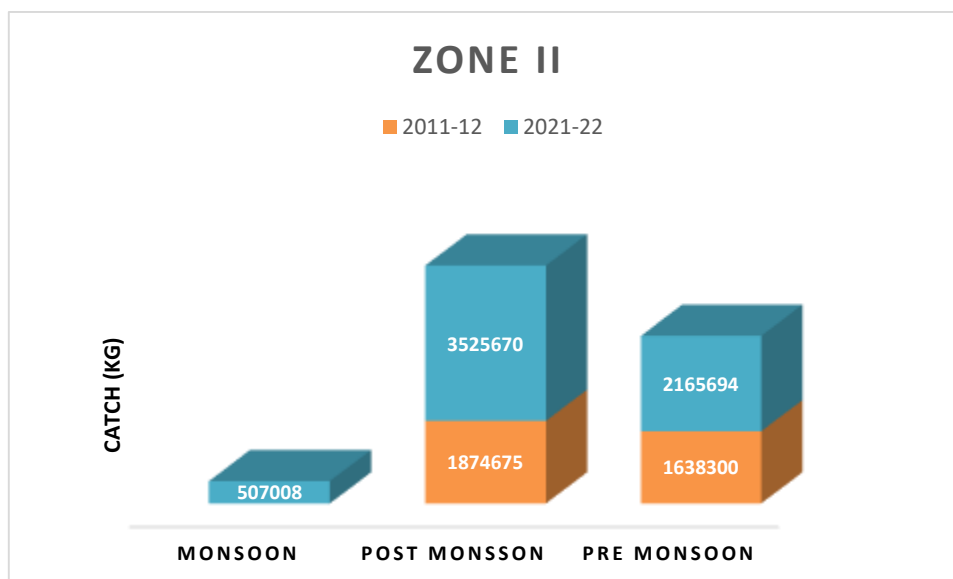


Fig.10.7.4 Season wise fish catch data in Zone II during 2011-12 & 2021-22

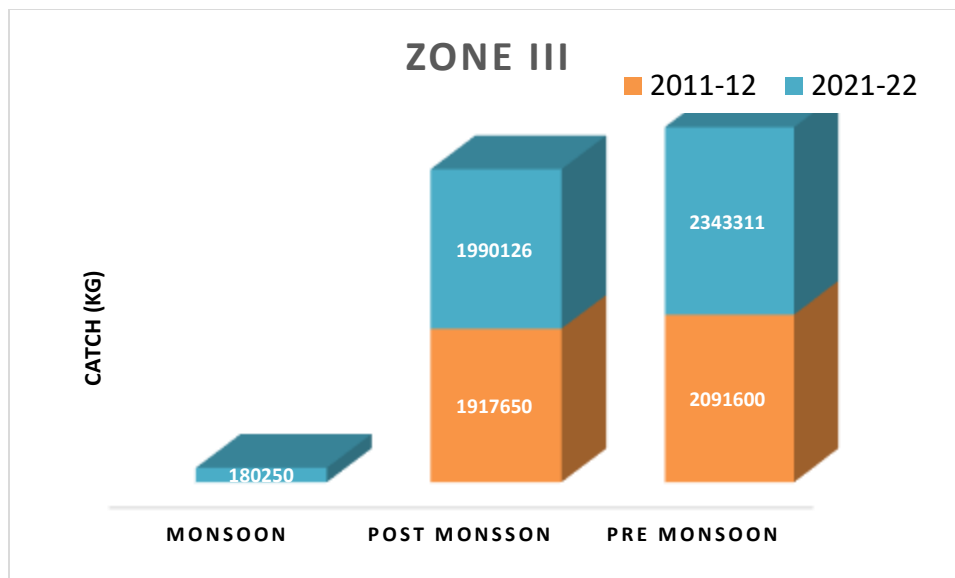


Fig.10.7.5. Season wise fish catch data in Zone III during 2011-12 & 2021-22

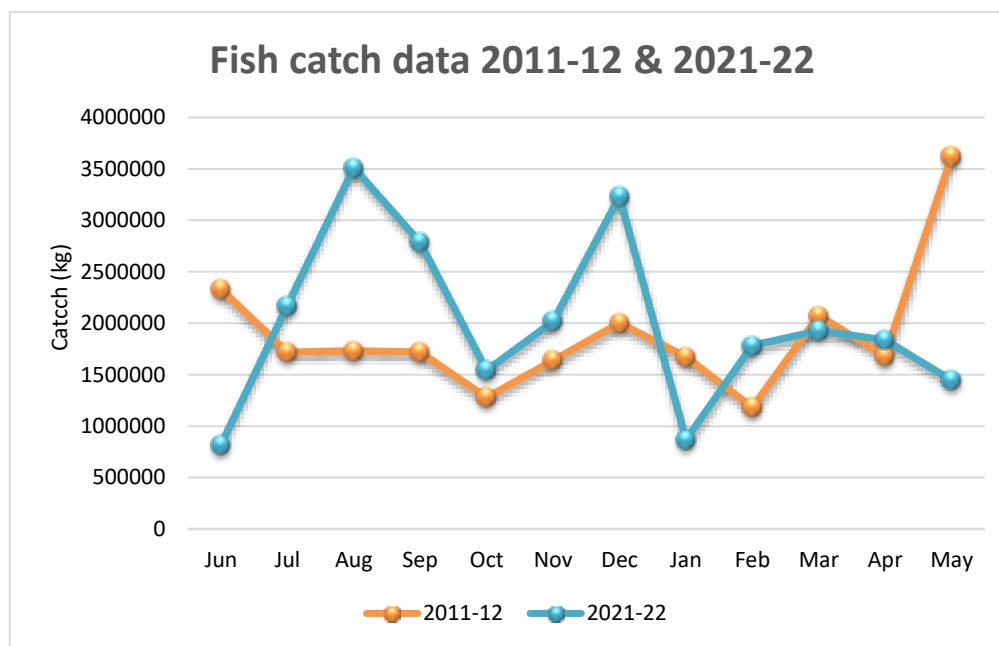


Fig.10.7.6. Comparison of month wise Fish catch data 2011-12 & 2021-22

2011-2012

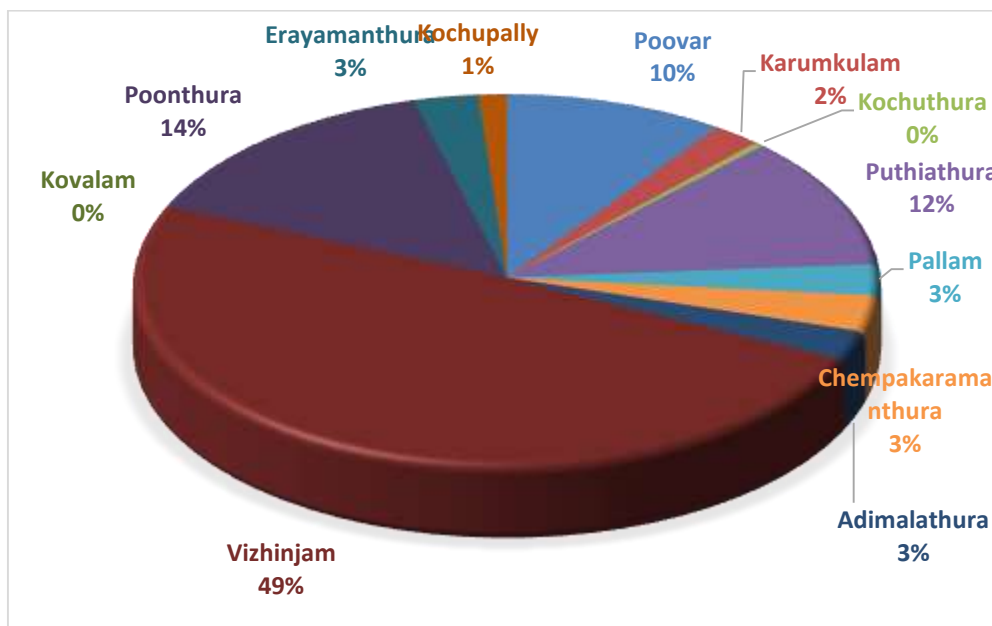


Fig.10.7.7. Landing centre wise fish catch during 2011-12

2021-2022

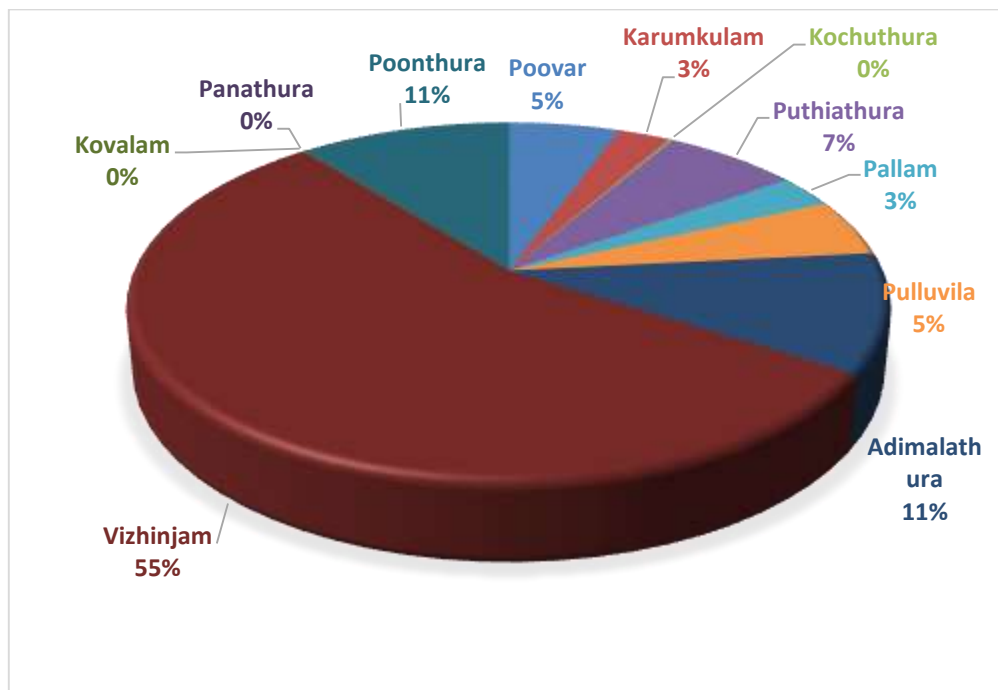


Fig.10.7.8. Landing centre wise fish catch during 2021-22

11. SUMMARY

The marine fisheries resources of India are spread along the country's vast coastline of 8118 km, 2.02 million square km Exclusive Economic Zone (EEZ) and 0.53 million sq.km continental shelf area. The total fish production in the country rose from 0.752 million metric tons in 1950-51 to 13.42 mmt (provisional) during FY 2018-19. Of this, the marine fisheries contributed 3.71 mmt and the inland fisheries contributed 9.71mmt. During FY 2018-19, 71% of marine fisheries potential has been harnessed and the inland fisheries potential harnessed during the same period stands at 58%. The marine fisheries sector is dominated by the socio-economically backward artisanal and small-scale fishers whose lives are closely intertwined with the oceans and seas. However, 75% of the total marine fish production comes from the mechanized sector, 23% from the motorized sector and only 2 % from the artisanal sector. As per the Handbook of fishery statistics, 2020, marine production was estimated at 3.72 mmt. The marine fish landings of India during the last five years (2015-2020) showed fluctuations in its landings mainly owing to the loss of fishing days during the pandemic period, of which, the highest landing of 3.83 mmt was recorded during 2017 while the lowest during 2020 with 2.73 mmt. Gujarat held the first position in fish landings during the last couple of years, followed by Tamil Nadu. Kerala occupies the third position in marine fish landings, while during 2020, Karnataka took the lead and occupied the third position and Kerala was drawn down to the fourth position. The marine fish landings of Kerala from 2015-2021 indicated a fluctuating trend showing a peak landing of 6.42 lakh tonnes during 2018 and the lowest in 2020 with 3.6 lakh tonnes. The fluctuations were mainly due to the decline in the landings of Indian oil sardine (*Sardinella longiceps*) along the Kerala coast.

Vizhinjam, one of the most productive coasts of Kerala, contributes significantly to the fish landings. The breakwater facility at Vizhinjam harbour is an added advantage for berthing and launching the crafts, even during the monsoon months. Hence during the peak monsoon months, many fishermen from Anchengo to Colachel migrate to Vizhinjam along with their craft and gear for fishing. The marine fish landings of Vizhinjam (K1 zone of the Thiruvananthapuram district) during 2015-2021 depicted a landing pattern with significant ups and downs. During 2015, there recorded a landing of 24791 tonnes, reduced to 20408 tonnes during 2016, then raised to ever peak of 35711.8 tonnes in 2018 and coming down to the lowest landing of 24391 tonnes, replenished to 33849 tonnes in 2020 and again down to 25291 tonnes

in 2021. Vizhinjam, the landings are mainly contributed by the pelagic fishes like Tuna, Scads, Mackerels, ribbon fishes, sardines, anchovies etc. These resources are showing high fluctuations in their landings and that resulted in the dynamic fish landings at Vizhinjam.

The distribution of gears along the Vizhinjam coast (K1 zone) from 2016-2021 indicated the decline in the number of boat seine followed by the fluctuating status of Outboard gillnets, increasing trend in the No. of Outboard Hook and line and the gradual reduction in the Non-motorized units. During the study period, which included the post-monsoon, pre-monsoon, and monsoon periods, the fishery was observed from 13 fish landing centres, including Vizhinjam, Poovar, Karumkulam, Kochuthura, Puthiyathura, Pallom, Erayamanthura, Chempakaramanthura, Kochupalli, Adimalathura, Kovalam, Panathura and Poonthura. During the reporting period (June 2021-May 2022) an estimated 23934.033 tonnes of fish were landed from the three zones of Vizhinjam port. Monthwise- landing centre wise catch data depicted that, the maximum landings were recorded during August followed by December and the least catch was recorded during June 2021. Monsoon season (39%) contributed more to the fish landings, followed by post monsoon (32%) and pre monsoon season (29%). Landing centres located in the zone I (direct foot print zone) contribute more to the landings, followed by zone II (potential impact zone) and zone III (control zone). Outboard Gillnet (OBGN), Outboard Hook and Line (OBHL) and Outboard Boat seine (OBBS) were the major gears operated during the study period. The percentage contribution of OBBS was maximum to the total landings during all the months except October and May. The CPUE analyzed for different gears depicted that, it was high for OBBS during all the months except May.

MONSOON SEASON

During monsoon season, the highest landing was reported in August (3417030 Kg) followed by September, June and July. The dominant species that landed in June 2021 was *Mene maculata* with a catch of 115943 kg. In July, August and September *Decapterus russelii* were reported as the dominant species. The zone-wise catch during monsoon season showed that zone 1, Direct Footprint Zone solely contributed to the majority of catch (>80%) and the least contributed by Zone 3, Control Zone. Experimental sampling was done mainly in Boatseine and the catch was mainly constituted by *Decapterus russelii* and other 10 species. The catch during experimental sampling by Disco net was mainly composed of *Penaeus indicus* followed by *Penaeus monodon* and *Upeneus sulphureus*. During monsoon months the highest number of species landed in July with 154 species. The number of species that landed in June, August and September were 116, 130 and 115, respectively. The analysis of gear-wise

landings during monsoon depicted that Boat seine contributed more to the landing all the months.

POST MONSOON SEASON

During the postmonsoon season, Zone 2- the potential impact zone reported maximum landing and Zone 1- Direct footprint Zone reported the least catch. Analysis of landing centre-wise catch data shows that Vizhinjam landing centre had reported the highest catch during all the post monsoon months except December. In December, Adimalathura landing centre was reported with the highest catch. The dominant species that landed during October was *Euthynnus affinis* with a species diversity of 108. In November *Decapterus russelli* species constituted a major catch and the species diversity of the month was 134. *Decapterus macarellus* was the major catch in December and *Amblygaster sirm* in January. Species diversity in December was 171 and in January was 160. During post-monsoon season the experimental sampling was done by Boat seine, Gill net and Shore seine. A total of 6 species were reported from Boat seine collection, 5 from Gill net and Shore seine collection. The analysis of gear-wise landings during post-monsoon depicted that except October, boat seine contributed more to the landing in all the months. In October outboard Hook and Line contributed more.

PRE-MONSOON SEASON

The -wise catch during pre-monsoon season showed that zone 1, Direct Footprint Zone contributed to the majority of the catch. The Zone-2, the Potential impact zone, contributed the least. The Vizhinjam landing centre had reported the highest catch during all the pre-monsoon months. The landings were dominated by *Amblygaster sirm* in February, *Euthynnus affinis* in March, *Sardinella gibbosa* in April and *Auxis rochei* in May. The species diversity was 160 in February, 166 in March, 143 in April and 132 in May. The major fishing gear contributed to the fishery was Boat seine in February, March and April months and Gillnetter in May. The experimental sampling during pre-monsoon was done by using drift gill net, jiggs, shore seine and hook and line. A total of 5 species were collected from drift gill net and hook and line, three species from shore seine and one species using jigs.

SEASONAL VARIATIONS

Fish catch data collected during the reporting period were analyzed seasonally to determine the variations. Monsoon season (39%) contributes more to the fishery, followed by Post monsoon (32%) and Pre-monsoon (29%). The maximum catch was recorded from Zone I (High impact zone) followed by Zone II (Moderate impact zone) and Zone III (Low Impact

zone). Zone-wise catch analysis depicted that, in Zone I, Catch was reported maximum during monsoon season followed by Pre-monsoon and post-monsoon season. The distribution and number of fishing units in Zone I was maximum during monsoon season and recorded a similar distributional pattern during post and pre-monsoon. The CPUE was maximum recorded during monsoon, followed by Pre-monsoon and post-monsoon season.

In Zone II, the catch was recorded maximum during post- monsoon season, followed by pre- monsoon season, and the least during monsoon season. The maximum fishing units operated during post-monsoon season followed by pre-monsoon and monsoon seasons. The CPUE was reported maximum during Post monsoon followed by Pre-monsoon and monsoon season.

In Zone III, the maximum catch was recorded in the Pre-monsoon season, followed by Post monsoon and the least during the monsoon season. Pre-monsoon season with a maximum number of fishing operations, followed by Post monsoon and monsoon season. But the CPUE was recorded as high post-monsoon, followed by pre-monsoon and monsoon season.

COMPARISON WITH THE BASELINE DATA

Fish catch data collected during the present investigation were compared with the baseline collected during 2011-12 to elucidate the impact of port construction on the fishery activities along the potential impact zones of the project. The total fish catch estimated from June 2021 to May 2022 was 23934 tonnes, which is 3.5 % higher than the baseline catch estimated during 2011-12 (23156 tonnes). There is no significant variation in fish catch as we compared the present study with the baseline information.

We compared the season-wise catch data of the present study with the baseline data to analyze the seasonal variations during these years. During the monsoon season, a total catch of 9283 tonnes of fish was reported in 2021, while during 2011, 7584 tonnes of fish were recorded and had shown an increase in fish catch of 18% during 2021. A total of 7658 tonnes of fish were recorded during 2021, Post monsoon season, while in 2011 recorded, a catch of 6773 tonnes and an increase of 11.5% was noted during 2021. In the pre-monsoon season, the situation varied and a reduction of 20% of catch happened during 2021 as we compared the data with the baseline information (2021- 6991 tonnes landed, 2011- 8798 tonnes landed)

In Zone I, the catch was reported maximum during monsoon season, followed by Pre-monsoon and post-monsoon season during 2021-22, as well as 2011-12. During monsoon season, the highest catch was recorded during 2021-22; in post-monsoon and premonsoon, the maximum catch was recorded during 2011-12. In zone II, Post monsoon catches were more during 2011-12 and 2021-22, followed by pre-monsoon. There was absolutely nil catch in 2011-12 during monsoon season. During the post-monsoon and pre-monsoon high catches were recorded during 2021-22. In zone III, Pre-monsoon catches were more during both the study periods and there was no catch during the monsoon season in 2011-12. During post and - monsoon, the maximum catch was recorded during 2021-22.

Monthwise detailed comparison is given below;

June 2011 & June 2021

The total landings during 2011 and 2021 were 2332225 kg and 819149 kg, respectively. If we compare the landings between June 2011 and June 2021, there is a reduction in fish landings during 2021 and recorded a percentage decline of about 64%. The species composition also varies, with less valued fishes recorded during June 2021. The number of fishing days in June 2021 was comparatively less due to heavy rain and rough sea conditions. Fishers now agree with the government's weather warning signals after the Okhi cyclone incident in 2017. The loss of actual fishing days was one factor that led to less catch in June 2021.

July 2011 & July 2021

The total landing in 2011 was 1719325 kg and in 2021 was 2167941 kg. The comparison of fish landings (July 2011 and July 2021) depicted a 20% increase during July 2021. The species composition of various crafts and gear will be comparable, but the quantity varies.

August 2011 & August 2021

The total landings reported during 2011 were 1730440 kg and in 2021 were 3510864 kg and showed a 50.71% increase in the landings during July 2021.

September 2011 & September 2021

In September 2011, the total landing was reported as 1802050 kg, and in 2021, the fish catch was 2785739 kg. Landings during September 2021 showed a 35% increase in the catch.

October 2011 & October 2021

The total landings in 2011 and 2021 were 1277882 kg and 1542173 kg, respectively, showing a 17% increase in landings during 2021. From October onwards, almost all landing centres around the port started functioning.

November 2011 & November 2021

The total landings reported in November 2011 and November 2021 were 1639138 kg and 2017185 kg, respectively and registered an increase of 19% in 2021.

December 2011 & December 2021

The total landings reported in December 2011 and December 2021 were 2082357 kg and 3230221 kg. There is an increase of 55.12% in the fish catch during 2021 December.

January 2011 & January 2022

The total landings reported in January 2011 and January 2022 were 1673396 kg and 869238 kg. The 48.055% decrease in fish catch was recorded in January 2022.

February 2011 & February 2022

The total landings reported in February 2011 and February 2022 were 1181491 kg and 1782945 kg respectively and recorded a 50.90% increase in the fish catch during February 2022.

March 2011 & March 2022

The total landings reported in March 2011 and March 2022 were 2072042 kg and 1927696 kg respectively and recorded a 6.966 % decrease in fish catch.

April 2011 & April 2022

The total landings reported in April 2011 and April 2022 were 1679875 kg and 1835867 kg, respectively, and reported a 9.28593% increase in the fish catch during April 2022.

May 2011 & May 2022

The total landings reported in May 2011 and May 2022 were 3619775 kg and 1445015 kg respectively and a reduction of 60.08% reduction in the fish catch was reported in May 2022. The loss of fishing days during extreme environmental conditions and the monthly fluctuations in the landing of pelagic resources may be the reason for the decline.

The month-wise fish species dominance was also compared and it is given below;

June 21- The dominant species in June 2011 was *Decapterus russelii* with a total catch of 395000 kg, but in June 2021, it was *Mene maculata* with a catch of 115943 kg. The lowest catch reported in June 2011 was for *Panulirus homarus* with 225 kg, and in 2021 it was *Diodon hystrix* with 2 kg.

July 21- The dominant species in July 2011 was *Aluterus monoceros* with a total catch of 292500 kg, but in 2021 was *Decapterus russelii* with a catch of 504208 kg. Species with the lowest catch reported in 2011 and 2021 were *Panulirus homarus*(lobster) with 250 kg and *Cephalopholis miniata* with 14 kg, respectively.

August 21- The dominant species in 2011 was *Rastrelliger kanagurta* with a catch of 259375 kg ,as in 2021 *Decapterus russelli* with 1464713 kg. *Sargocentron (Holocentrus) rubrum* with 7 kg is the least during 2021 and *Panulirus homrarus* during 2011.

September 21- *Rastrelliger kanagurta* reported the highest catch in 2011 with 228175 kg and *Decapterus russelli* with 870969 kg reported highest during 2021. *Megalaspis cordyla* with 100 kg was the least species reported in 2011, whereas *Aesopia cornuta* with 1 kg in 2021.

October 21- *Euthynnus affinis* showed the highest catch in October 2011 and 2021 with 169325 kg and 167333 kg respectively. *Loligo duvauceli* with 75 kg and *Drepane* spp. showed the least landing during 2011 and 2011 respectively.

November 21- *Rastrelliger kanagurta* shows the highest catch with 222625 kg and *Decapterus macrosoma* with 100 kg was the least during 2011. *Decapterus russelli* with a catch of 663475 kg and *Chanos chanos* with 4 kg in 2021 was the highest and lowest catch, respectively.

December 21- *Decapterus macarellus* showed the highest catch with 850522 kg in 2021 and *Auxis rochei* in 2011 with landings of 225000 kg. *Caranx* spp. has been reported as the least catch in 2011(250 kg) and *Leiognathus brevirostris* was the least caught fish with landings of 3 kg in 2021.

January 22- *Rastrelliger kanagartha* formed the highest catch in 2012 with 318875kg and *Amblygaster sirm* with 150798 kg catch was highest in 2022. *Panulirus.homarus* (296kg) and *Parapercis alboguttata* (7 kg) recorded the least catch in 2012 and 2022 respectively.

February 22- *Amblygaster sirm* was reported as the highest catch in 2022 with a catch 244582 kg and *Sargocentron (Holocentrus) diadema* (3 kg) was reported least. *Rastrelliger kanagartha* led highest in 2012 with a catch 278650 kg and *Panulirus homarus* showed the least catch with 16 kg.

March 22- *Rastrelliger kanagartha* (355500 kg) and *Euthynnus affinis* (240182 kg) have been reported as the highest catch during 2011 and 2022, respectively. *Panulirus homarus* with catch 42 kg and *Pristipomoides multidens* with 1 kg recorded least in 2011 and 2022 respectively.

April 22- Highest catch reported in 2012 and 2022 was *Rastrelliger kanagartha* (399550 kg) and *Sardinella gibbosa* (369970 kg), respectively and *Priacanthus hamrur* (100 kg) and *Chirocentrus dorab* (2kg) was the lowest catch in 2012 and 2022 respectively.

May 22- *Auxis rochei* (255170 kg) recorded the highest catch and *Gazza minuta* (2 kg) was the least catch in 2022 while *Rastrelliger kanagartha* (382250 kg) reported the highest catch and *Sufflamen frenatum* (875kg) been the lowest catch in 2012.

Comparison of fish catch data landing centre-wise during 2011-12 and 2021-22

The fish catch data were estimated landing centre-wise and compared to elucidate the fluctuations in landing and it is given below; During 2011-12, Vizhinjam (49%) contribute more to the landings followed by Poonthura (14%), Puthiyathura (12%), Poovar (10%), Pallam (3%), Erayammanthura((3%), Adimalathura (3%), Chempakaramanthura (3%), Karumkulam (2%), Kochupally (1%), Kovalam (<1%) and Kochuthura (<1%). While in 2021-22, Vizhinjam (55%) contributed more to the landings, followed by Adimalathura (11%), Poonthura (11%),

Puthiyathura (7%), Pulluvila (5%), Poovar (5%), Karumkulam (3%), Pallam (3%), Panathura (<1%), Kovalam (<1%), and Kochuthura (<1%).

The fish landings of different landing centres located in the study zones mainly comprised of pelagic fishes (Tuna, sardines, mackerel, scads, ribbonfishes etc) followed by demersal fishes and cephalopods. Annual and biannual fluctuations in landings of specific pelagic fishes have been observed from the Vizhinjam coast (earlier fishery and biological studies) resulting in the huge landings of a particular pelagic fish during one year and witnessing a few landings report of the same species in the coming year and an abundance of a new species. Since the majority (>60%) of the landings comprised of pelagic fishes, fluctuations in the species wise landings (pelagic fishes) are common to Vizhinjam coast. Due to this, the fish landings reported from Vizhinjam and its nearby landing centres were in a mere stagnant phase for years, where couldn't notice a great rise or fall in the annual landings. Monsoon fishery was affected at Vizhinjam for the last few years due to the less number of migrant fishers from the northern side of Thiruvananthapuram coast, this was mainly associated with the construction of the fishing harbour at Perumathura and the availability of suitable berthing facilities at Perumathura harbour during monsoon season. The failure of Southwest monsoon in certain years was also attributed to the fluctuations in the availability of pelagic resources and their recruitment. COVID-pandemic affected the actual fishing days during the last two years and contributed to the fluctuations in the landings. But during 2022, things were in line, and a good quantum of fish was landed during monsoon season with the ever-highest landings (last five years) of Ribbon fishes, Indian oil sardines and Scads. The present study witnessed the insignificant impacts of the port during its construction phase on the fish landings along the potential impact zones.

12. Conclusion and Recommendations

Fish landings survey along the potential impact zone of the Adani Vizhinjam Port Private Limited (AVPPL) from June 2021 to May 2022 recorded **23934.033** tonnes of fish catch which registered an increase of 3.35 % compared to the total landings reported in 2011. A total of 337 fish species were recorded from the present investigation of the species composition of fishes. The fish population was estimated from 13 landing centres such as Poovar, Karumkulam, Kochuthura, Puthiyathura, Pallom, Erayammanthura, Chempakaramanthura, Kochupally, Adimalathura, Vizhinjam, Kovalam, Panathura and Poonthura. Among these landing centres, Erayammanthura, Chempakaramanthura, and Kochupally showed very little catch, and the catch was brought together at Pulluvila and considered Pulluvila instead of the above three in final catch estimates. The experimental fishing conducted along the commercial fishing grounds helped to identify the present fishing ground and species composition of various gears. Seasonal and zonal variations of fish catch analysis depicted the highest catch from the direct footprint zone, implying the insignificant impacts of the development phase of Vizhinjam on the availability of fish resources. During the landing centre survey, fishers opined on the change in the fishing ground and the extended duration of fishing. The impact assessment during the port's operational phase will reveal the fish landing's unique status and availability. Hence, studies need to be conducted during the operational phase to examine its effect on the marine habitat, flora, and fauna.

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INDEX

Shorthand	Description
Zone 1	Foot Print Zone
Zone 2	Potential impact Zone
Zone 3	Control Zone
GDP	Gross domestic product
CPUE	Catch Per Unit Effort
FY	Financial Year
EEZ	Exclusive Economic Zone
HP	Horse power
Spp.	Species
GPS	Global Positioning System
OAL	Length Overall
FPB	Fiberglass Coated Plywood Boats
FADS	Fishing Aggravating Devices
FRP boats	Fiber Reinforced Plastic Boats
OBBS	Outboard Boatseine
OBGN	Outboard Gillnet
OBHL	Outboard Hook & Line
OBOTHS	Outboard Others Gears
NM	Non Motorized Units
t	Tonnes
g	Gram
nm	Nautical Mile
km	Kilometer
m	Meter
mm	Millimeter
etc	Et Cetera