

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

INTERNATIONAL WORKSHOP ON REFERENCE POINTS AND HARVEST STRATEGY FOR INDIAN OIL SARDINE STOCKS OF MAHARASHTRA AND GOA

A one day International workshop on “Reference points and harvest strategy for the sardine stocks” was organized by Omega Fish meal and Oil Private Ltd, Ratnagiri on 19th May 2022 at Hotel Vyankatesh Executive Ratnagiri as part of its commitment to implementing the Fishery Action Plan for the Indian Oil Sardine Fishery Improvement Project.

A list of attendees (including those attending online) is provided at Appendix 1.

The agenda for the workshop is attached as Appendix 2.

The background to the FIP, under which the workshop was undertaken is attached as Appendix 3

Mr. Amol Patil, Director Omega Fishmeal And Oil Private Limited welcomed the participants and reviewed the current status of the FIP. He said, that this workshop was in sequence to the last workshop held on 3rd July 2019, on Stock Assessment of Indian oil sardine under the aegis of College of fisheries Ratnagiri. Based on the deliberations and outcome of that workshop, Omega Fishmeal And Oil Private Limited entered into a MoU with Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli, Maharashtra for undertaking a research project on Stock Assessment of Indian oil sardine & Indian mackerel in 2020. Dr. M. M. Shirdhankar, Professor & Principal, Diploma in Fisheries Engineering is the Chief investigator of the project. The two year project is near to completion & will be over by July 2022.

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

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FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

He further added that due to travel restrictions owing to the Covid 19 epidemic, two international experts, namely Mr. Duncan Leadbitter, FIP manager & Director Fish Matter, Australia and Dr. Tim Ward, Associate Professor, Fisheries Science, University of Tasmania, Australia were unable to visit India and they were forced to take part in the workshop online. Similarly, due to exigency of work Dr. Leela Edwin, Director I/c CIFT Kochi and Mr. Naresh Tambada , Deputy Director MPEDA Mumbai also could not make their way to Ratnagiri and opted to attend online.

Dr. M. M. Shirdhankar, Professor & Principal, Diploma in Fisheries Engineering, Ratnagiri College of Fisheries, chaired the workshop.



Mr. Amol Patil welcoming the participants

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FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022



Programme started with Lamp Lighting Ceremony

Mr. Duncan Leadbitter opened the session by presenting the topic" **Reference Points Requirements for Fisheries and the FIP" (Appendix 4)**. At the outset Mr. Duncan thanked the participants and welcomed the scientists from India and Australia to the workshop for involving in a meaningful discussion on the topic which is an important step in fisheries management. He provided a brief overview of the role of reference points in fisheries management and their relevance for the Fishery Improvement Project and the steps forward.

Reference points are part of the fisheries management process and an important part of any fisheries plan. The most common type of reference points are biological. The most common biological reference points relate to fishing mortality and fish abundance. Reference points can be social/economic also which will affect the fishermen community first then associated communities and finally the national wellbeing. Reference points must be qualitative and not quantitative.

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FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Marin Trust standards are based on the FAO Code of Conduct for Responsible Fisheries and many FAO Agreements rely on reference points for best practice fisheries management. It is the responsibility of Omega Fishmeal And Oil Private Limited and stakeholders to work together to meet the requirement of Marin Trust and this benefits both fishery from a sustainability perspective as well as assisting government and stakeholders to put in place good fisheries management.



Presentation by Mr. Duncan Leadbitter

Mr. Leadbitter advised Omega Fishmeal And Oil Private Limited to circulate the report of this workshop to interested parties, liaise with Govt. agencies about plans for fisheries management in Goa & Maharashtra and evaluate options for establishing management rules including reference points and associated indicators in order to have a suitable harvest strategy.

The next session “**Review of stock assessment project of Indian oil sardine and Indian mackerel along the coastal waters of Goa and Maharashtra**” (Appendix

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FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

5) was delivered by Dr. M. M. Shirdhankar, Chief Investigator of the project. This two year project will be completed in July 2022 his presentation covered the work so far completed. The objectives of the project are:

- To collect data on the fisheries for the two species, to study selected biological parameters and to study growth and mortality parameters for the stocks,
- To study the percentage of bycatch in purse seines, and
- To observe any interactions between fishing operations and protected species.



Presentation by Dr. M. M. Shirdhankar

The expected outcomes of the project will be:

- Length-weight relationship,
- Food and feeding habits,
- Gonado-somatic index,
- Seasonal maturity stages,

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- Ova diameter,
- Size at first maturity,
- Breeding season,
- Maximum Sustainable Yield (MSY), fMSY, and
- Percentage of bycatch.

As of 31st March 2022, a total of 11733 specimens of mackerel have been collected for biological & length frequency study. In the case of Indian oil sardine, 1458 samples were examined for the same study.

Dr. Tm Ward, Associate Professor (Fisheries Science) University of Tasmania Australia presented the topic “**Reference points used in Australia’s small pelagic Fisheries; insights to inform the development of new fisheries**” (Appendix 6). Australia has a number of fisheries for small pelagics such as Australian sardine and Jack mackerel, which are located in the cooler waters of the southern states.

For sardines the spawning biomass is estimated by the Daily Egg Production Method (DEPM) which uses plankton surveys to conduct eggs counts and relates this to the average number of eggs spawned by each female. There are a number of separate stocks of Australian sardine which occur from the east to the west coasts. Management of these stocks has been successful in South Australia and for the Commonwealth fishery due to robust stock assessments and precautionary harvest strategies.

Stocks of some other species have not been well managed and fishing effort has been allowed to get out of control which has resulted in booms and busts in catches.

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PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Target reference point for SPF species can be safely set at 50% virgin biomass (B_{50}) and the limit reference point can be safely set 20% virgin biomass (B_{20}). Exploitation rates that achieve a median depletion of 0.5 or B_{50} , while maintaining less than a 10% chance of falling below the limit reference point of B_{20} vary by species and by stock ranging from about 10% for redbait up to 33% for Australian sardine.



Presentation by Dr. Tim Ward

The stocks are allocated to management areas, each with its own harvest strategy. The Objective for the Commonwealth Small Pelagics Fishery is: ecologically sustainable, profitable, maximises net economic returns to Australian community

- Target and limit references points of B_{50} and B_{20}
- Based on the Daily Egg Production Method (DEPM). Done every 5 years to remain at Tier 1.
- RBCs are based on estimates of spawning biomass obtained using the DEPM

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- Exploitation rates vary among species and reduce as estimates of SpB get older (conservative)
- TACs calculated by subtracting known sources of mortality from the RBCs
- Annual stock assessment reports at Tiers 1 and 2

A full copy of the presentation is attached.

The next topic was **“Pelagic fisheries of Goa & Maharashtra with special reference to Indian mackerel and Indian oil sardine”** (Appendix 7) by Dr. Prathibha Rohit, Principal Scientist & Scientist in-charge, Central Marine Fisheries Research Institute Regional Centre Mangalore.



Presentation by Dr. Prathibha Rohit

The Indian marine fisheries are dominated by pelagic fishes such as the clupeids, scombroids, carangids and the Bombay duck, and they have always played a pivotal

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PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

role in dictating the general trend of the marine capture fisheries of the country through the sheer size of the catches.

The pelagic fishes play a multi-faceted role in the food web of marine ecosystems, forming an important prey item of several larger fishes and as a predator of several other marine organisms. They thus play a significant role in maintaining the balance in marine ecosystems. They contribute to human food usages at several levels: directly, through actual consumption (fresh, frozen or processed) contributing significantly to the protein food basket and indirectly, by providing products used for animal feeds and fertilizers or by serving as bait. They form a considerable part of the marine domestic and export trade and supporting fishing industries (fishmeal, surimi and fish processing plants) and several ancillary industries.

It is mainly a single species of these major groups that forms the bulk of the catch and generally set the trend for the country's marine fish landing trends. Of these, the Indian oil sardine (*Sardinella longiceps*) and the Indian mackerel (*Rastrelliger kanagurta*) are the major contributors followed by Bombay duck (*Harpodon nehereus*) and the hairtail ribbonfish (*Trichiurus lepturus*).

Average marine fish production in Goa (2017- 2021)	:60,466 MT
Indian oil sardine (2017-2021)	:10,295 MT (17%)
Indian mackerel (2017-2021)	:14,456 MT (24%)
Average marine fish production in Maharashtra (2017- 2021)	:1,67,363 MT
Indian oil sardine (2017-2021)	:2,045 MT (1.2%)
Indian mackerel (2017-2021)	:22,070 MT(13.2%)

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Purse seines are the major gear used in Goa & Maharashtra for catching these two important species.

The topic “**Fisheries Management in India**”(Appendix 8) was delivered by Dr. Leela Edwin, Director (I/C), Central Institute of Fisheries Technology (CIFT), Kochi.



Presentation by Dr. Leela Edwin

Fisheries management in India, can be categorized into management of fisheries in the EEZ and in the territorial waters. According to the Constitution of India, the Central government has jurisdiction over the fisheries in the EEZ, while the State Governments have jurisdiction over fisheries in the territorial waters.

The following International Agreements India has signed:

- Agreement for the implementation of the provisions of the United Nations Convention on the Law of the Sea of 10 December,1982 relating to the Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stock.
- Agreement to promote compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1995).

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- International Plan of Action to prevent, deter and eliminate, illegal, unreported and unregulated fishing (2001).
- International Plan of Action for Management of Fishing Capacity, Conservation and Management of Sharks, reducing incidental catch of Sea Birds in long line fishing (1999).
- Indian Fisheries Act, 1897: The Indian Fisheries Act, 1897 is considered as the mother act of fisheries in India meant to regulate riverine fisheries and fisheries in inshore waters, to prohibit the use of poisons and dynamite in fishing, and to protect fish resources.
- Indian Wildlife (Protection) Act, 1972: It is under this act marine protected areas/ sanctuaries are declared. Marine protected areas (% of territorial waters) in India was 1.67% as of 2010. Its highest value over the past 20 years was 1.67% in 2010, while its lowest value was 1.55% in 1990.
- The Territorial Waters, Continental Shelf, Exclusive Economic Zone and Other Maritime Zones Act, 1976: This act recognizes the sovereign rights to conservation and management of living resources in the Indian EEZ, in addition to their exploration and exploitation. The EEZ is a sea zone prescribed by the UN Convention on the Law of the Sea over which a state has special rights over the exploitation and use of marine resources, including energy production from water and wind. The territorial sea extends to 200 nautical miles on the seas around India through enactment of territorial waters, Continental Shelf, EEZ and other maritime act, 1976.

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- The Indian Marine Fishing Regulation (IMFR) Act 1980: The Indian Marine Fishing Regulation (IMFR) Act 1980 was the first comprehensive national legislation designed to regulate marine and coastal fishing activities along the Indian coast. IMFRA (1980) was enacted to protect the interests of different sections of people using traditional fishing crafts, to conserve fish, to regulate fishing on a scientific basis and to maintain law and order in the sea.
- National Fishery Policy 2020: As per this Policy, the Central Govt. will encourage and empower traditional and small-scale fisher and fisher groups for undertaking resource specific deep sea fishing.

According to the Fisheries Policy, the untapped potential of high value resources like tuna, tuna-like species, myctophids and oceanic squids should be delivered in a sustainable manner with a precautionary approach in line with global standards regarding wild fish harvests.

In addition, deep-sea fisheries resources are to be exploited by an optimum fleet size of modern fishing vessels capable of undertaking extended voyages, infusion of modern technology and capacity building.

Mr. Chandresh Haldankar, Superintendent, Directorate of Fisheries Goa presented the topic “**Fisheries Regulation for Purse Seine Fishing in Goa**” (Appendix 9).

In Goa, 314 purse seiners and 58 trawler cum purse seiners are in operation.

Fishing Net License is granted to fishing nets having mesh size not less than 24 mm for catching fish and 20 mm for catching prawns. Purse-seine nets and trawl nets are

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

permitted to use beyond 5 km off coast in the Arabian Sea within territorial waters of Goa.

Conservation measures:

- 1 Monsoon Fishing Ban

As a conservation measure the Department is implementing a uniform fishing ban for the period of 61 days i.e. from 1st June to 31st July every year

- 2 Ban fishing in Specified area by bull or pair trawling
- 3 Ban use or Installation of fishing gear such as LED light, fish light attractors or any other light equipment with or without generator on mechanized fishing vessel or motorized fishing craft, for trawling, purse-seining or gill netting
- 4 Specified area: Up to 5km from the coast in the sea along the entire coastline is earmarked as “Specified Area” i.e. ban for mechanized fishing. Also mechanized fishing vessels are prohibited fishing from 7.00 pm to 5.00 am.



Presentation by Mr. Chandresh Haldankar

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- Restriction on Vessel Numbers & Sizes: Govt. will allow fishing vessels owners to construct or purchase new fishing vessel against replacement of old cancelled Vessel Registration Certificate (VRC) only. (Since year 2001)
- Fishing vessels (trawler/Purse-seiner) are registered up to the length of 23 meters and allowed to be fitted with engine of horse power up to 300BHP.
- Permission will be granted to construct only new 100 fishing canoes of length 26-38 feet fitted with OBM up to 10 HP per financial year.
- Government has implemented Minimum Legal Size (MLS) in Fisheries for 20 fish species including Indian oil sardine & Indian mackerel in Goa.

The topic “**Fisheries Regulation for Purse Seine Fishing in Maharashtra**” (**Appendix 10**) was presented by Mr. N. V. Bhadule, Assistant Commissioner of Fisheries Ratnagiri.



Presentation by Mr. N. V. Bhadule

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Mr. Bhadule said that during 2010 there were 435 purses seiners were in operation along the Maharashtra coast (Marine Fisheries Census, 2010) and their overall length (OAL) ranges from 14-18 m. The number of FRP mini purse seines (9-13 m OAL) are increasing, especially in southern Maharashtra. Important technology adoption by purse seine fishing in recent years was the hydraulic power block for hauling the purse seine and Automatic Identification System (AIS) useful for navigation and tracking fishing boats.

Fisheries Regulation: The committee appointed by Government of Maharashtra to study the status of Purse seine fishing and its impact on the traditional fishing and ecology along the Maharashtra coast submitted its report in May 2012. Based on these recommendations Government of Maharashtra issued an order dated 5th February 2016 to regulate purse seine fishing in Maharashtra to resolve conflicts among the traditional small scale fishers and purse seine fishers.

The committee has demarcated four different zones for purse seine fishing in Maharashtra while reserving the rights of traditional fishers also. These zones are:

- Zone (I)- Zai to Murud: Area from shore to 12 nautical miles (Nm) shall be reserved for traditional fishing. The purse seine, ring seine including mini purse seine fishing shall be prohibited in this Zone.
- Zone (II) Murud to Burundi: Area up to 10 m (5 fathom) depth from shore shall be reserved for traditional fishing. The Purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 10 m (5 fathom) depth.

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- Zone (III) Burundi to Jaigad: Area up to 20 m (10 fathom) depth from shore shall be reserved for the traditional fishing. The purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 20 m (10 fathom) depth.
- Zone IV Jaigad to Banda: Area up to 25m (12.5 fathom) depth from shore shall be reserved for traditional fishing. The purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 25-meter (12.5 fathom) depth.

The number of existing and operational purse seine, ring seine and mini-purse seine fishing licenses shall be brought down gradually to 262 and finally to 182.

Also the Government will not issue new licenses for purse seine/ring seine (including mini-purse seine). Purse seines, ring seines and mini-purse seines are permitted to operate during the period September to December only and that too within the specified zone. To conserve the fish stock the use of hydraulic winch (boom) is also prohibited for purse seine/ring seine (including mini-purse seine) fishing operations.

In addition, gear specifications are issued for purse seine/ ring seine (including mini-purse seine) that can be operated by any mechanized fishing vessel in the territorial waters of the state.

As per the Maharashtra Marine Fishing Regulation Act (MMFRA) 1981 and 2021 the state can enforce and regulate fishing in the territorial waters (12 Nm) and whoever contravenes an order under this Act relating to the regulation of purse seine or ring seine (including mini purse seine) or Trawl net including violation of mesh size shall be liable for- 1. Penalty of one lakh rupee for the first contravention; 2.

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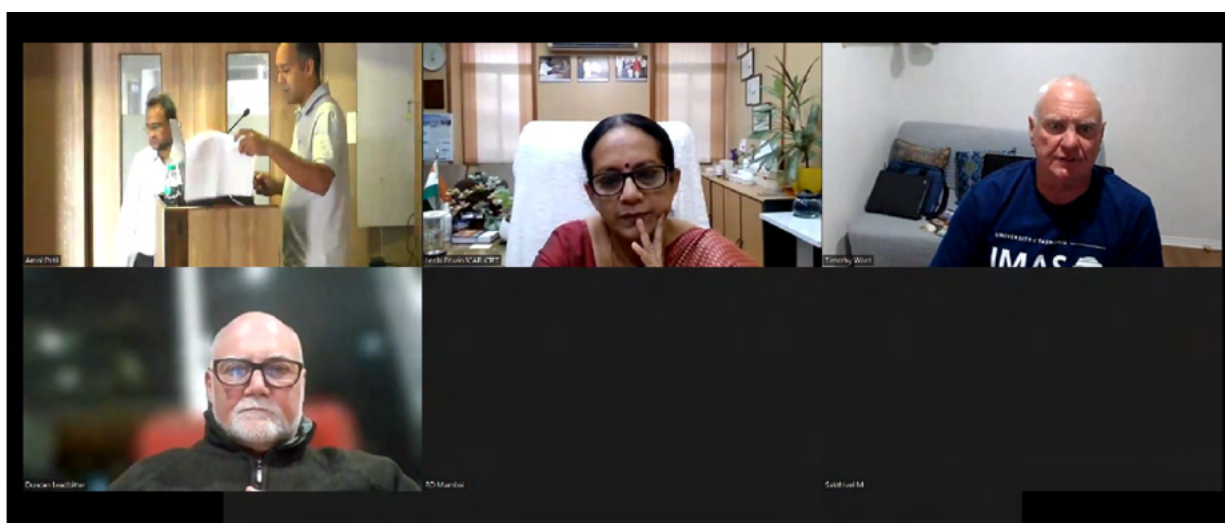
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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Penalty of two lakh rupee for the second contravention; and 3. Penalty of five lakh rupee for the third or subsequent contraventions.

After the presentations, open discussion was there to clear the doubts and clarify certain points.



Open discussion by all participants

Vote of thanks was delivered by K J Antony, FIP local consultant.



Mr. K. J. Antony giving vote of thanks

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PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022



Group photo of participants

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

APPENDIX 1

LIST OF PARTICIPANTS

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

Sr. No.	Name of The Participant	Organisation Name
1.	Dr. Leela Edwin	CIFT
2.	Dr. Prathiba Rohit	CMFRI
3.	Dr. M.M. Shirdhankar	Diploma in Fisheries Engineering
4.	Mr. N.V. Bhadule	Dept. of Fisheries, Maharashtra
5.	Mr. Naresh V. Tambada	MPEDA, Maharashtra
6.	Mr. Chandresh Haldankar	Directorate of Fisheries, Goa
7.	Mr. Duncan Leadbitter	Fish Matter, Australia
9.	Mr. Tim Ward	Associate Professor , University Of Tasmania, Australia
10.	Mr. Amol Patil	Omega Fishmeal And Oil Private Limited
11.	Mr. Manoj Kushe	Omega Fishmeal And Oil Private Limited
12.	Ms. Jeeranuch Akkhomi	CPF (India) Pvt Ltd.
13.	Mrs. Latha Srinivasan	CPF (India) Pvt Ltd.
14.	Mr. Piti Pukdee	CPF (India) Pvt Ltd.
15.	Mr. Sakthivel M	CPF (India) Pvt Ltd.
16.	Mr. David Sawant	CMFRI, Ratnagiri
17.	Mr. S. P. Hotekar	CMFRI, Ratnagiri
18.	Mr. P. L. Mahadwala	Dept. of Fisheries, Maharashtra
19.	Mrs. Utkarsha Keer	Dept. of Fisheries, Maharashtra
20.	Dr. R. A. Pawar	College of Fisheries
21.	Dr. Rakesh Jadhav	Diploma in Fisheries Engineering

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

22.	Mr. Tousif Kazi	Diploma in Fisheries Engineering
23.	Er. Nilesh Mirajkar	Diploma in Fisheries Engineering
24.	Mr. Sushil Kamble	Diploma in Fisheries Engineering
25.	Mr. Hrishikesh Bhatkar	Diploma in Fisheries Engineering
26.	Mr. Ketan Chavan	Diploma in Fisheries Engineering
27.	Mr. Rohit Burte	Diploma in Fisheries Engineering
28.	Mr. K. J. Antony	Omega Fishmeal And Oil Private Limited
29.	Mr. Sandesh Surve	Ratnadurga Machchimar Sahakari Sanstha
30.	Mr. Datta V. Natekar	Ratnadurga Machchimar Sahakari Sanstha
31.	Mr. Kamlesh Parab	Omega Fishmeal And Oil Private Limited
32.	Mr. Ashish Salvi	Omega Fishmeal And Oil Private Limited
33.	Mr. Abhijeet Padalkar	Omega Fishmeal And Oil Private Limited
34.	Mr. Abhishek Shivgan	Omega Fishmeal And Oil Private Limited
35.	Mr. Piyush Bane	Omega Fishmeal And Oil Private Limited

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PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

APPENDIX 2

AGENDA

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

✦ PROGRAMME ✦

- 09.00 To 09.15 : Registration
- 09.15 To 09.30 : Welcome And FIP Status Review
Director, Omega Fishmeal And Oil Private Limited
- 09.30 To 10.00 : Reference Points Requirements For Fisheries And The FIP
Mr. Duncan Leadbitter, FIP Manager And Director, Fish Matter, Australia
- 10.00 To 10.45 : Review Of Stock Assessment Project Of Indian Mackerel And Indian Oil Sardine
Dr. M. M. Shirdhankar, Professor & Principal, Diploma In Fisheries Engineering, Ratnagiri
- 10.45 To 11.15 : Reference Points In Sardine Fisheries Management In Australia
Mr. Tim Ward, Associate Professor (Fisheries Science), University Of Tasmania, Australia.
- 11.15 To 11.30 : Pelagic Fisheries Of Goa And Maharashtra With Special Reference To Indian Mackerel And Indian Oil Sardine
Dr.Prathibha Rohit, Principal Scientist & Sic, CMFRI, Regional Centre, Manglore, Karnataka

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

- 11.30 To 11.45 : Fisheries Management In India
Dr.Leela Edwin, Director I/C, Central
Institute Of Fisheries Technology (CIFT),
Kochi
- 11.45 To 12.00 : Fisheries Regulation For Purse Seine Fishing
In Goa
Mr. Chandresh Haldankar, Superintendent
Fisheries, Directorate Of Fisheries,
Government Of Goa, Panjim, India
- 12.00 To 12.15 : Fisheries Regulation For Purse Seine Fishing
In Maharashtra
Mr. N. V. Bhadule , Asst. Commissioner,
Department Of Fisheries, Ratnagiri
,Government Of Maharashtra
- 12.15 To 12.45 : Open Discussion
All Participants
- 12.45 To 13.15 : Next Steps In FIP
Mr. Duncan Leadbitter, FIP Manager And
Director, Fish Matter, Australia
- 13.15 To 13.30 : Vote Of Thanks
Director, Omega Fishmeal And Oil Private
Limited

* End Of The Programme *

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

APPENDIX 3

BACKGROUND TO WORKSHOP

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT MAY 2022

During 2017 Omega Fishmeal And Oil Private Limited started the FIP for getting certification of their plant producing fishmeal & oil by the Marin Trust U K for the raw material sourced from the waters of Goa & Maharashtra. To achieve the goal, Omega Fishmeal And Oil Private Limited has entered into a MoU with related private parties and Govt. agencies and prepared a Fishery Action Plan duly approved by the Marin Trust which is under implementation. The action plan contains a series of actions designed to ensure that the supply fishery meets requirements in accordance with the FAO Code of Conduct for Responsible Fisheries (CCRF). Good fisheries management is essential for the wellbeing of both fish and people. Good fisheries management is a joint activity between the Government and stakeholders for ensuring the sustainability of the resources and will help to take corrective actions when there is a deviation from the responsible fisheries.

Sustainability of fisheries has assumed importance worldwide for farmed and wild products and consumers are preferring seafood from well managed fisheries. The use of fishmeal in the aquaculture sector establish a link between farmed and wild production and the growing mandate for responsible fisheries demands that fishmeal should be sourced from sustainable resources.

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PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT JUNE 2022

APPENDIX 4

“ REFERENCE POINTS REQUIREMENTS FOR FISHERIES AND THE FIP ”

Reference points in fisheries management

Options and relevance for the Indian Oil Sardine Fishery Improvement Project – Maharashtra and Goa, India



Duncan Leadbitter
Fish Matter Pty Ltd
19 May 2022

Presentation overview

Why this workshop

Role of reference points in fisheries
management

Reference points and the Fishery
Improvement Project

Where too from here

Why this workshop (1)

Globally there is increasing scrutiny of the environmental and social impacts of seafood production – both farmed and wild

Private sector standards have been developed to drive improvements in aquaculture and capture fisheries production

The use of fishmeal in the diets of some farmed species creates a connection between farmed and wild production. Responsible feed requires assurance that fisheries which supply fishmeal are responsibly managed

In 2017 Omega Fishmeal began the process of working towards certification to the Marine Trust standard for its factory supplying fishmeal and oil

A Fishery Improvement Project for the source fisheries in Goa and Maharashtra was developed as management improvements are required

Why this workshop (2)

Omega has registered a Fishery Improvement Project (FIP) with Marin Trust and has worked closely with partner organisations to prepared and implement a Fishery Action Plan.

This Action Plan contains a series of actions designed to ensure that the supply fishery meets requirements in accordance with the FAO Code of Conduct for Responsible Fisheries

Reference points and fisheries management

Fisheries management is important for fish and people. Poor fisheries management can lead to overfishing and negative consequences for those who rely on fish for food or business, including those that sell seafood products (including fishmeal and fish feed)

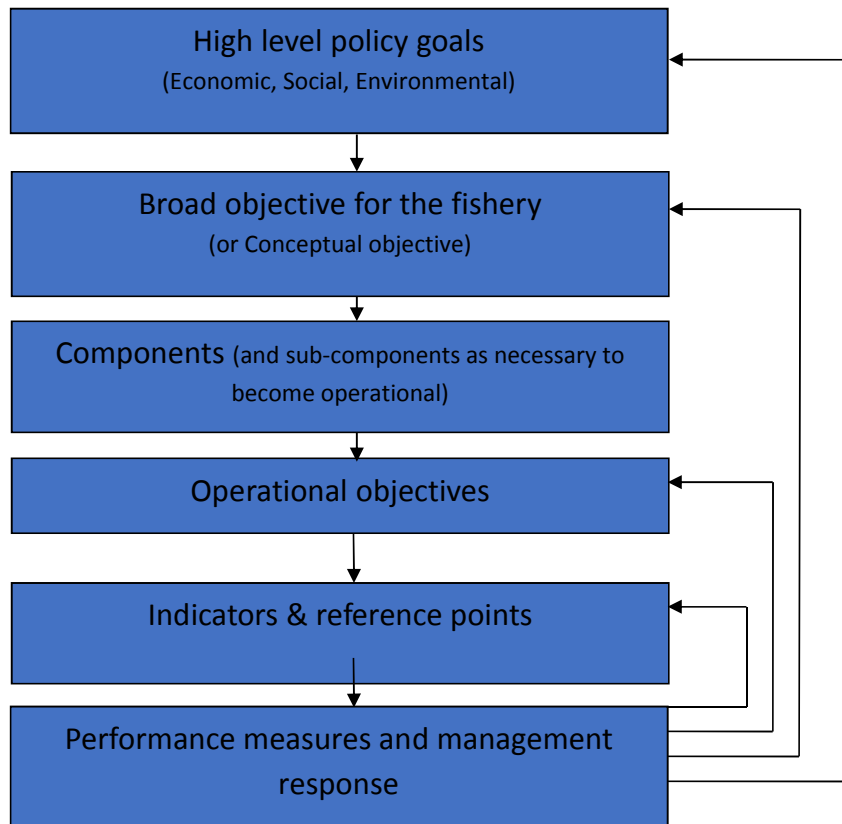
Good fisheries management is a joint activity between government and stakeholders, who need to jointly agree on what they want from a fishery, how to check if the things are going according to plan, when to take action if things are not and what to do to fix the problems

Reference points are part of the fisheries management process and an important part of any fisheries management plan

Overall framework linking objectives, indicators, reference points, performance measures and management actions

- From the FAO Ecosystem Approach to Fishery Management

In fishery law



Today's topic

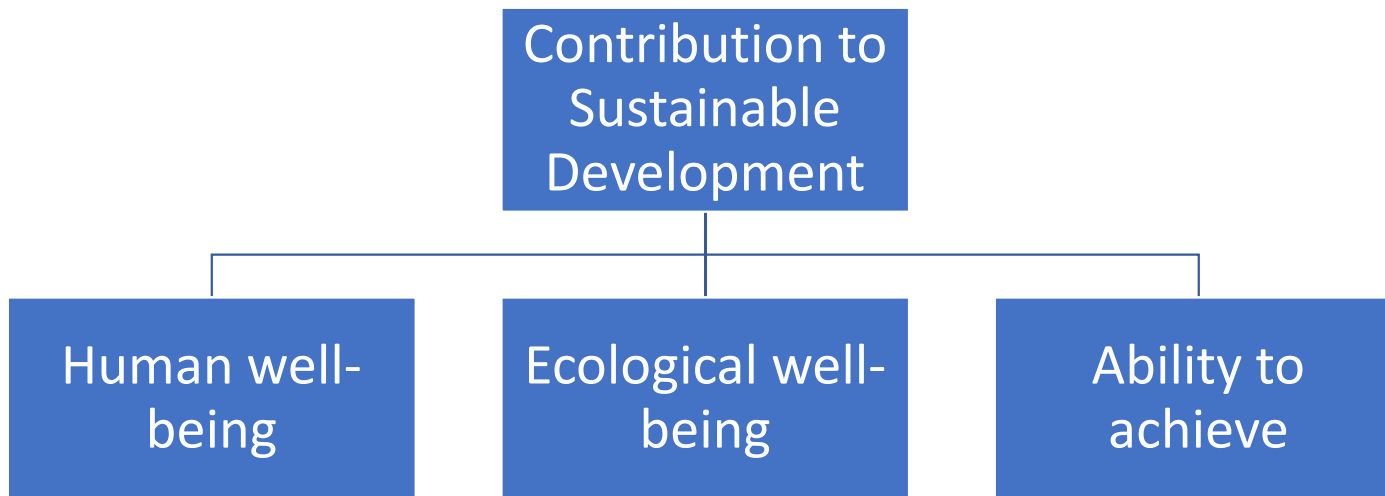
- This linkage is necessary to keep focus on 'the reasons for the journey' - the objectives
 - to avoid investment of time and effort on activities that are not well aligned with achieving the objectives
 - to provide a transparent explanation for the work plan and investment in it
-
- It is usual to have to re-visit this framework as more detailed and operational consideration are worked through
 - So have a very clear view about the conceptual objectives

'Unpacking'

High level objective	Broad statement of intent
Component	A major issue of relevance
Operational objective	Objective with direct and practical interpretation
Indicator	Something measured to track an operational objective
Reference point	Target and limit 'benchmarks' for indicators
Performance measure	Relationship between indicator and benchmark

- Establish the hierarchy between high level and operational objectives
- High level objectives need operational objectives
- Operational objectives need indicators and reference points
- Indicators and reference points give performance measures

The scope of the framework and considerations



- Usually in the broad context of Sustainable Development
- This includes high level objectives of
 - ecological sustainability
 - economic and social sustainability
 - plus the institutional arrangements to achieve these sustainability goals
- So as indicators etc for a given application can span and include these three areas

Common components for the elements of Sustainable Development

Ecological Well-being

- Status of species or species groups
- Threatened, Endangered or Protected (TEP) species
- Food-webs and trophic interactions
- Habitats
- Community structure

Human Well-being

Fishing community

- Income; MEY, profit
- employment
- Compliance costs
- Health and safety

Associated communities

- Distributed income
- Resource dependency
- Social capital

National well-being

- Income, MEY, profit
- Food security
- National development

Ability to Achieve - governance

Legal framework

- Regulation
- allocation
- Conflict management

Management

- Decision making
- Compliance
- Resilience

Policy capacity

- Management, science, training

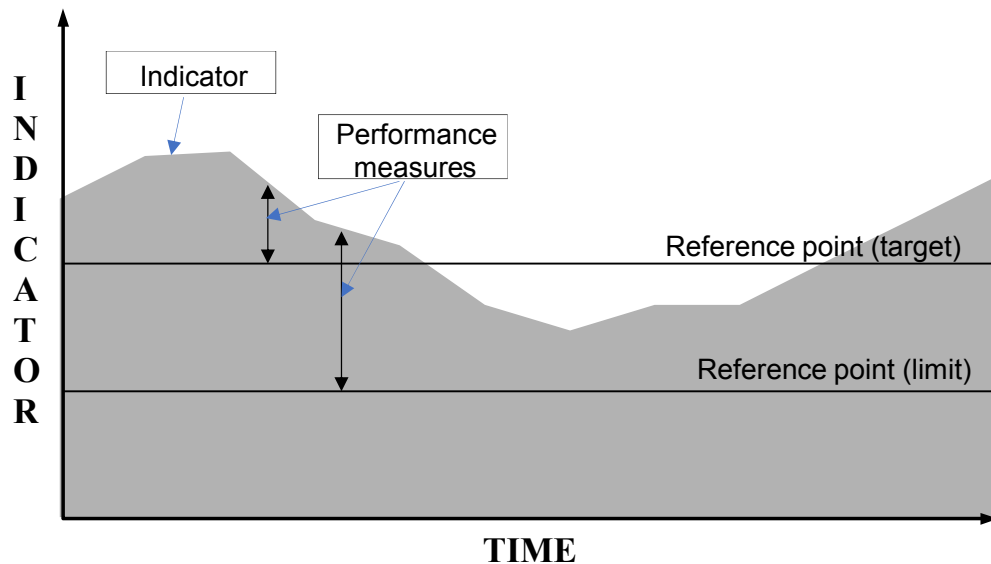
Social engagement

- Economic development
- community benefit
- Conflict management

Industry development

- Co-management, benefit sharing, compliance
- Sustainability
- Conflict management

To be clear – what are indicators, reference points and performance measures?



- Indicators are what you measure
 - Reference points are benchmarks for the indicators that can relate to desired outcomes, undesired outcomes or triggers for specific management action
 - Performance measures relate to how close an indicator is to a reference point – how close to a desired/undesired outcome
- Beware of indicators without reference points, performance measures without indicators, and no direct linkage to objectives
- usually means the overall framework is lost
- Quantitative indicators and reference points are commonly emphasised but there are many kinds and approaches that can be used:
- Numerical and non-numerical categories of situation, including risk categories
 - Bounds of acceptability
 - Directions of change

Just like a household budget

Target

Enough money to pay bills and save for a rainy day

Indicator

Monthly bank balance

Trigger

Balance is 75% or 50% or 25% of what is expected

Actions

Review possible reason
Cut back on spending
Increase income

Types of reference points

The most common types of reference points are biological

The most common biological reference points relate to fishing mortality and fish abundance

An example is stock status – how many fish are in the water compared to what is desirable

Target

Fish stock is at an agreed level

Indicator

Fish stock level based on stock assessment

Trigger

Stock is at the agreed level

Actions

No action required, all good

Trigger

Stock is at 75% of agreed level

Actions

Meeting to discuss what the reasons may be (normal, market etc)

Trigger

Stock is at 50% of agreed level

Actions

Meeting to trigger more detailed information gathering and review

Trigger

Stock is at 25% of agreed level

Actions

Implement catch cuts to rebuild stock

Reference points can be social/economic

Human Well-being

Fishing community

- Income; MEY, profit
- employment
- Compliance costs
- Health and safety

Human Well-being

Associated communities

- Distributed income
- Resource dependency
- Social capital

Human Well-being

National well-being

- Income, MEY, profit
- Food security
- National development

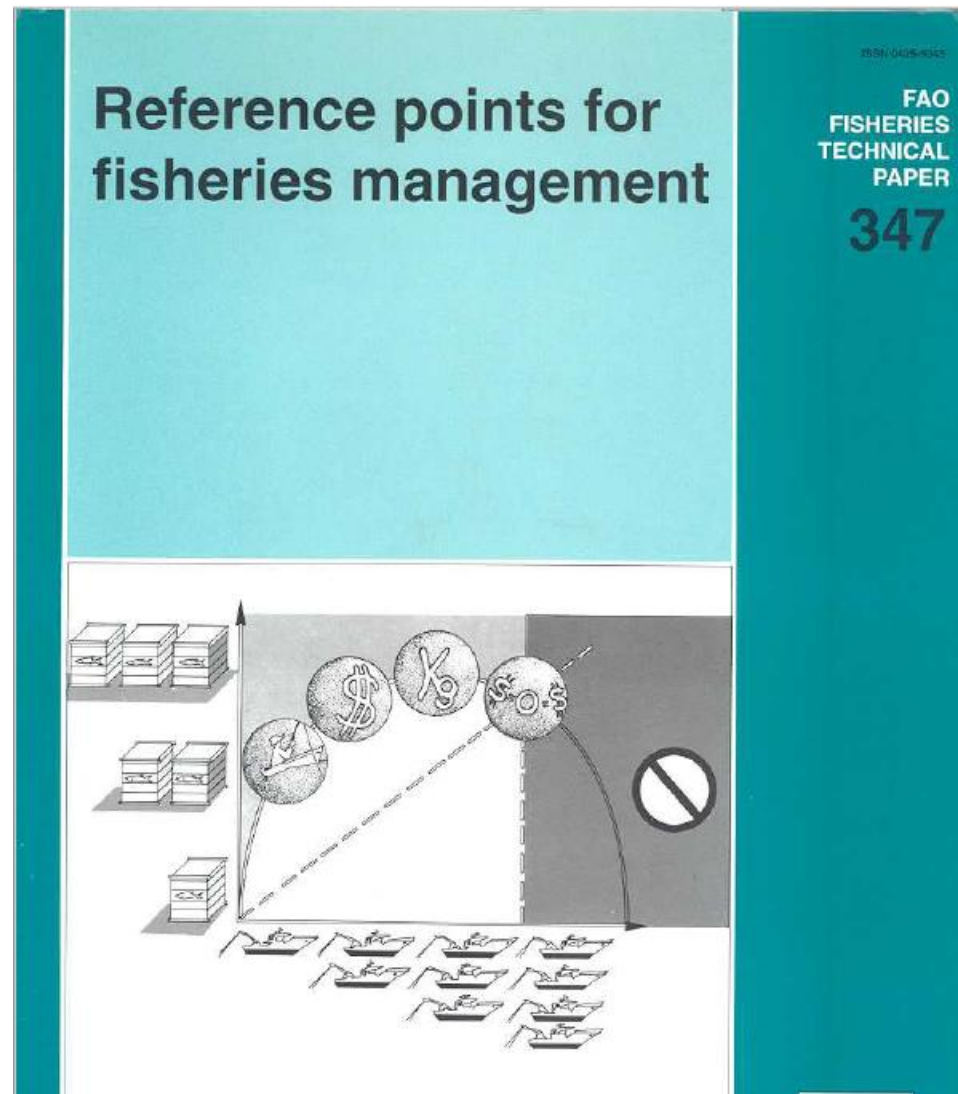
Reference points do not have to be quantitative

An approach for identifying qualitative or empirical indicators and reference points - From Jones (2010)

OUTCOME :
Indicator:
Monitoring actions: (e.g. timeframe, frequency, seasonality, sites, etc.)
Reporting actions: (e.g. how and when the findings of monitoring will be reported)
Great result:
Satisfactory/Acceptable result:
Unsatisfactory/Unacceptable result:
Reference conditions: (e.g. photos, data and/or other evidence documenting the conditions for this planned outcome)

- Particularly useful when:
 - identifying indicators and reference points from experience rather than theory
 - When drawing on diverse experiences
 - When there is no explicit theoretical or policy basis for reference points (common with social and governance issues)
- Will illustrate this later

Lots of
guidance on
this issue



Reference points and Marin Trust

- Marin Trust standard based on FAO Code of Conduct and many FAO agreements rely on reference points in best practice fisheries management
- Need for reference points is a key part of good management which Marin Trust looks for.
- FIP client and agency staff need to work together to develop a practical way forward.

Next steps

- Report on this workshop – distributed to interested parties
- Liaise with government about plans for fisheries management in Goa and Maharashtra
- Evaluate options for establishing management rules, including reference points and associated indicators and a harvest strategy

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APPENDIX 5

***“REVIEW OF STOCK ASSESSMENT
PROJECT OF INDIAN OIL SARDINE
AND INDIAN MACKEREL ALONG
THE COASTAL WATERS OF GOA
AND MAHARASHTRA”***

Stock assessment of Indian oil sardine and Indian mackerel



International workshop
on

Reference Points and Harvest Strategy for the sardine stocks

Dr. Mangesh M Shirdhankar
Professor & Principal

Diploma in Fisheries Engineering, Shirgaon -Ratnagiri
(Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli)

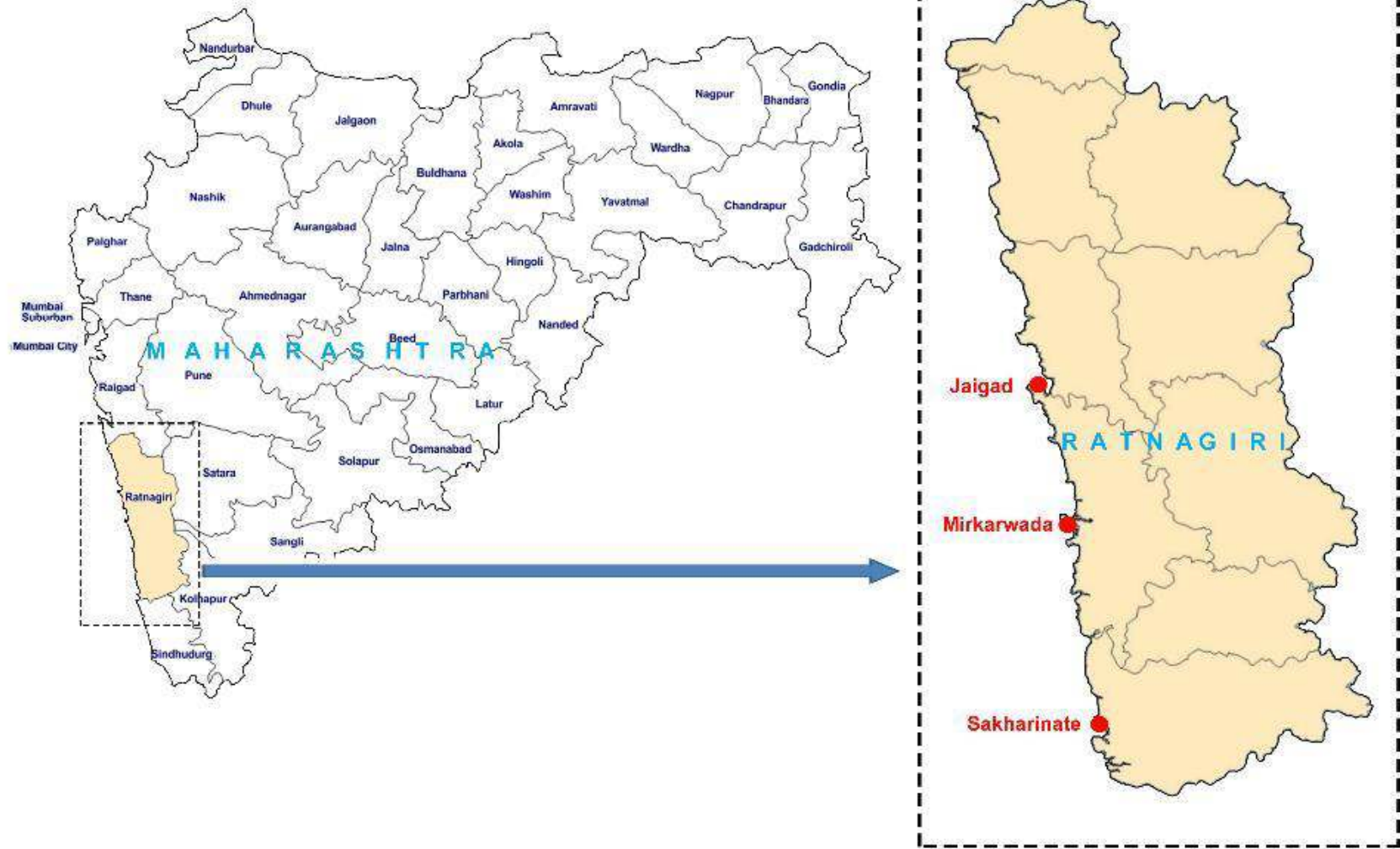
Objectives

Target species: Indian oil sardine and Indian mackerel

- **To collect data on fisheries of the species**
- **To study the biology of the species**
- **To study growth and mortality parameters of stocks**
- **To study the percentage bycatch in purse seines**
- **To observe any interactions between fishing operations and protected species**

Study area

Fig. 1 Study Area



Expected Outcomes

- **Length-weight relationship**
- **Food and feeding habits**
- **Gonado-somatic Index**
- **Season wise maturity stages**
- **Ova diameter**
- **Size at first maturity**
- **Breeding season**
- **Maximum Sustainable Yield (MSY)**
- **f_{MSY}**
- **Percentage bycatch**

Sample size (Indian Mackerel)

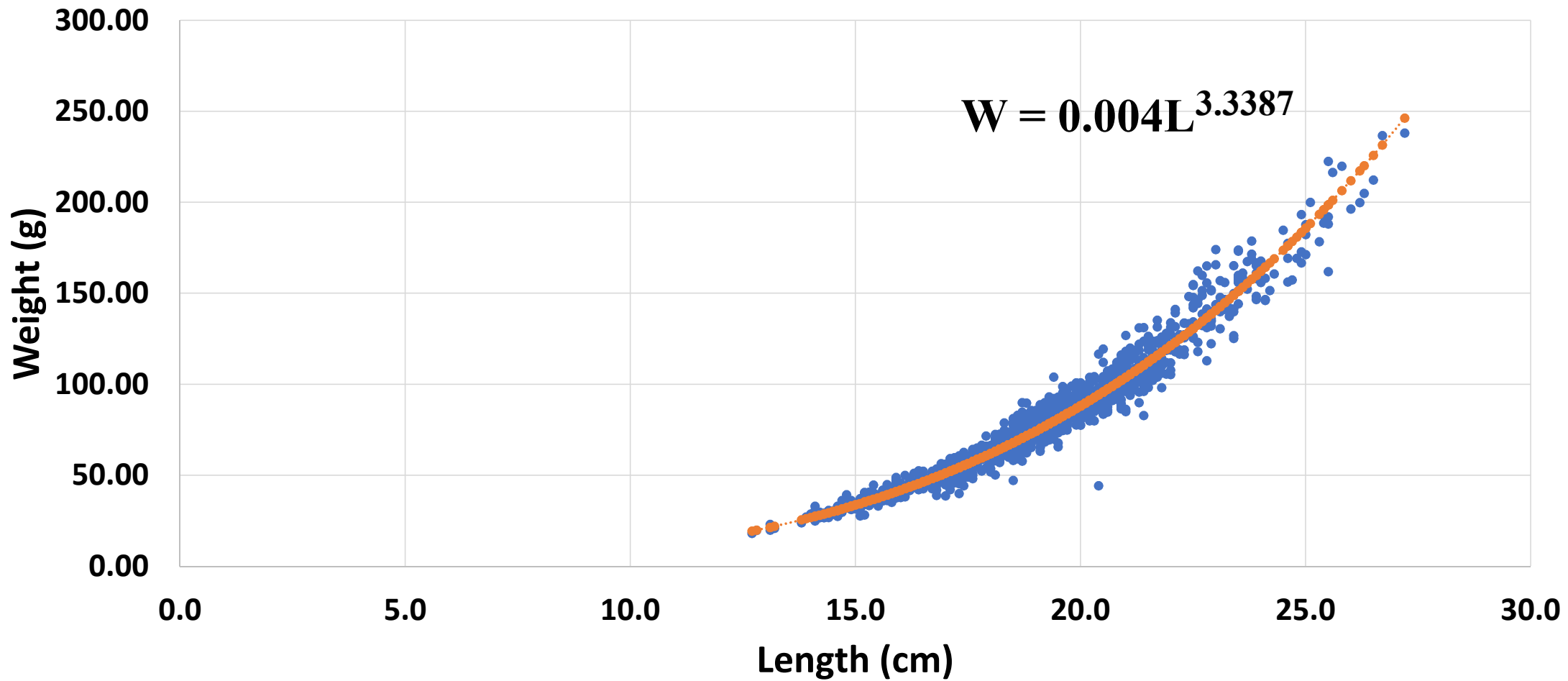
Biology	2020-21	2021-22	Total
Male	714	529	1243
Female	728	652	1380
Indeterminant	1069	1094	2163
Total	2511	2275	4786
Length frequency	2020-21	2021-22	Total
August	136	261	397
September	316	410	726
October	433	417	850
November	496	380	876
December	553	462	1015
January	410	339	749
February	407	344	751
March	467	423	890
April	262	237	499
May	194	0	194
Total	3674	3273	6947

Sample size (Indian Oil sardine)

Biology	2020-21	2021-22	Total
Male	18	49	67
Female	28	72	100
Indeterminant	19	297	316
Total	65	418	483
Length frequency	2020-21	2021-22	Total
August	0	0	0
September	0	42	42
October	0	117	117
November	47	192	239
December	19	273	292
January	0	0	0
February	0	36	36
March	0	67	67
April	0	182	182
May	0	0	0
Total	66	909	975

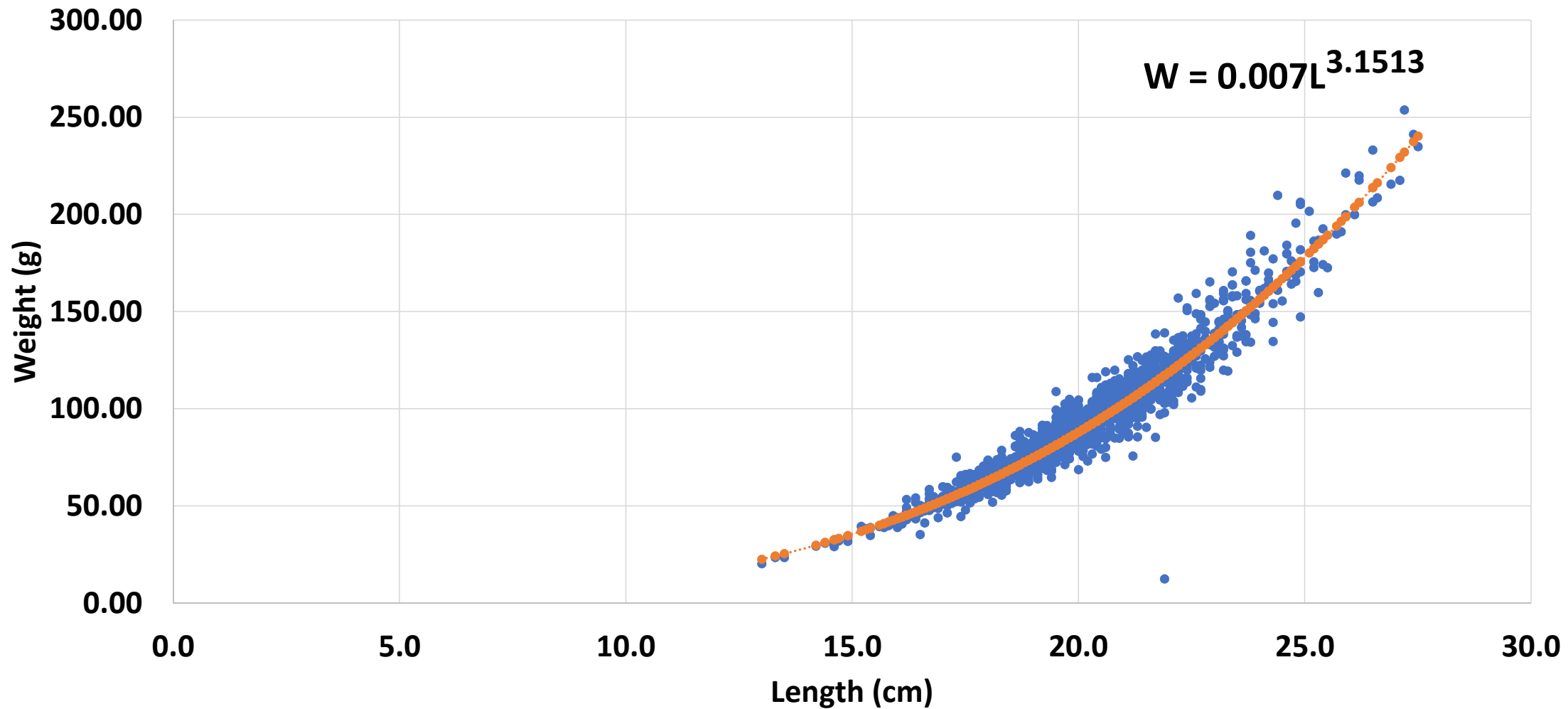
Length-weight relationship: Indian mackerel

Males (N = 1243) $r=0.9800$



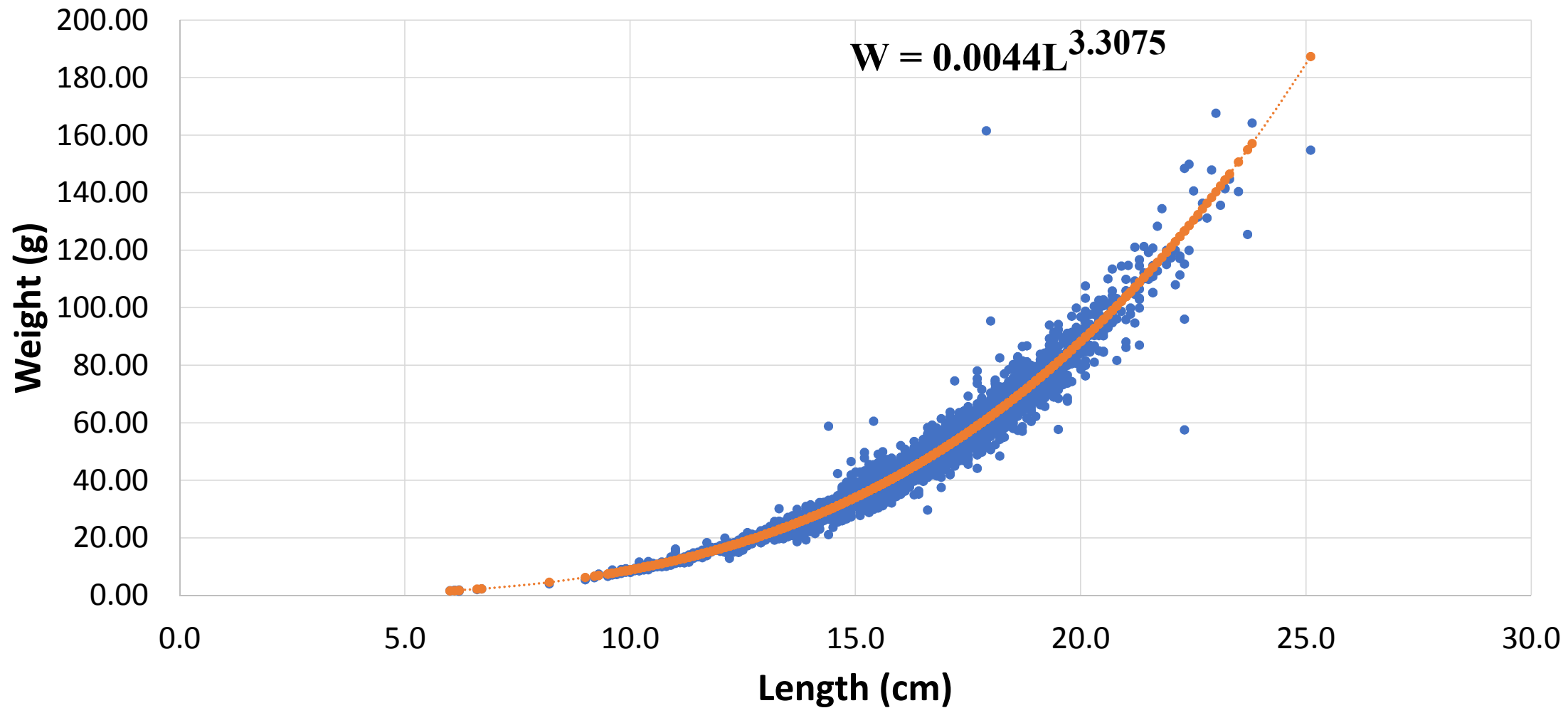
Length-weight relationship: Indian mackerel

Females (N = 1380) $r = 0.9528$



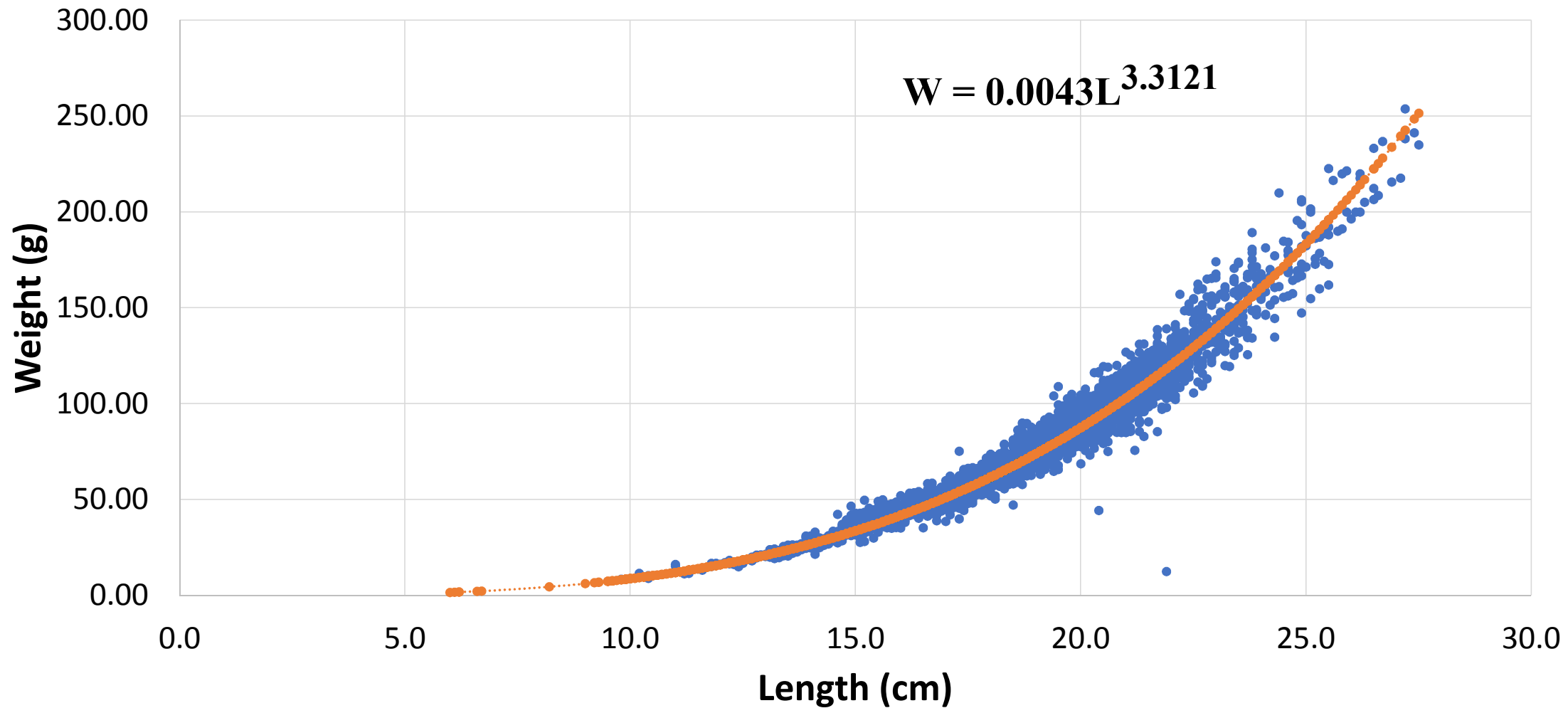
Length-weight relationship: Indian mackerel

Indeterminant (N=3276) $r = 0.9874$



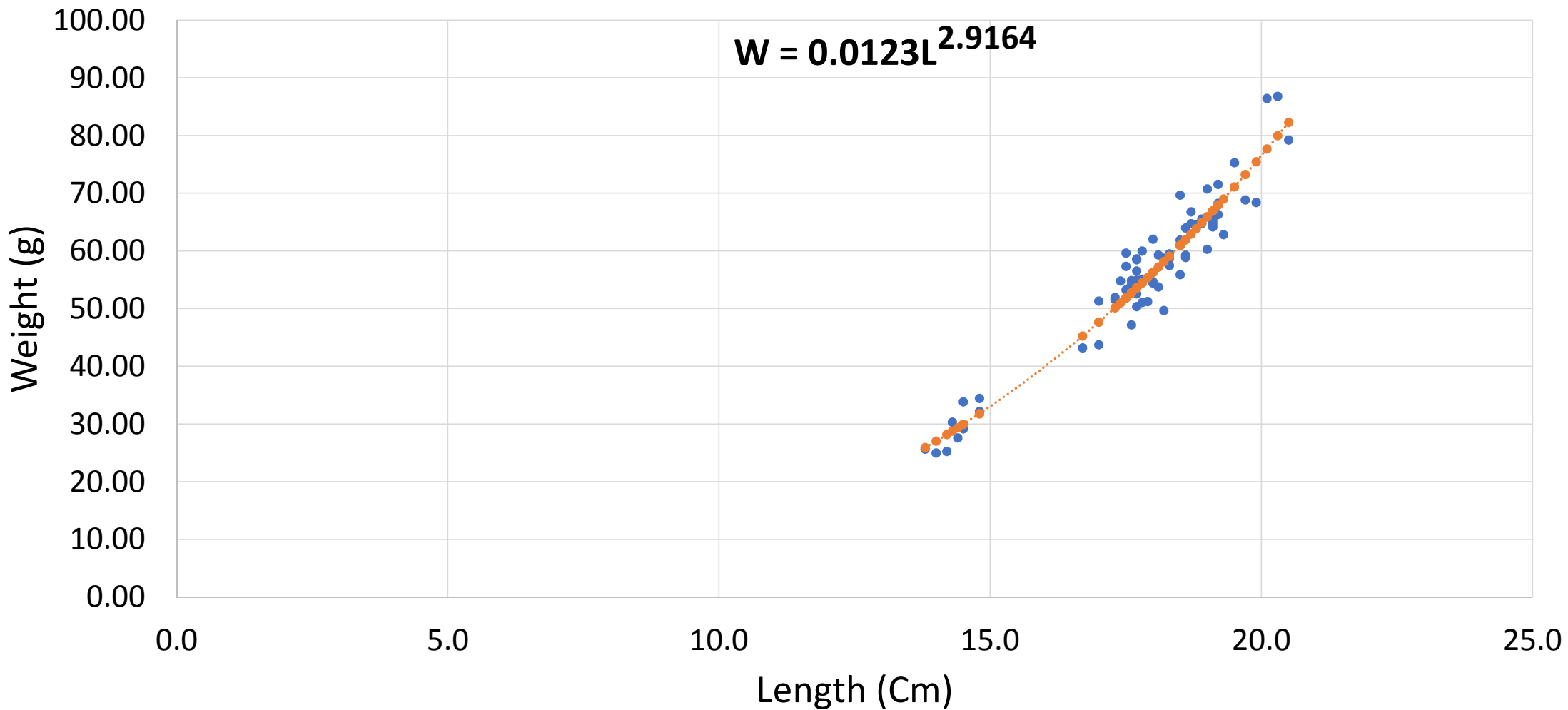
Length-weight relationship: Indian mackerel

Combined (N =5899) $r = 0.9879$



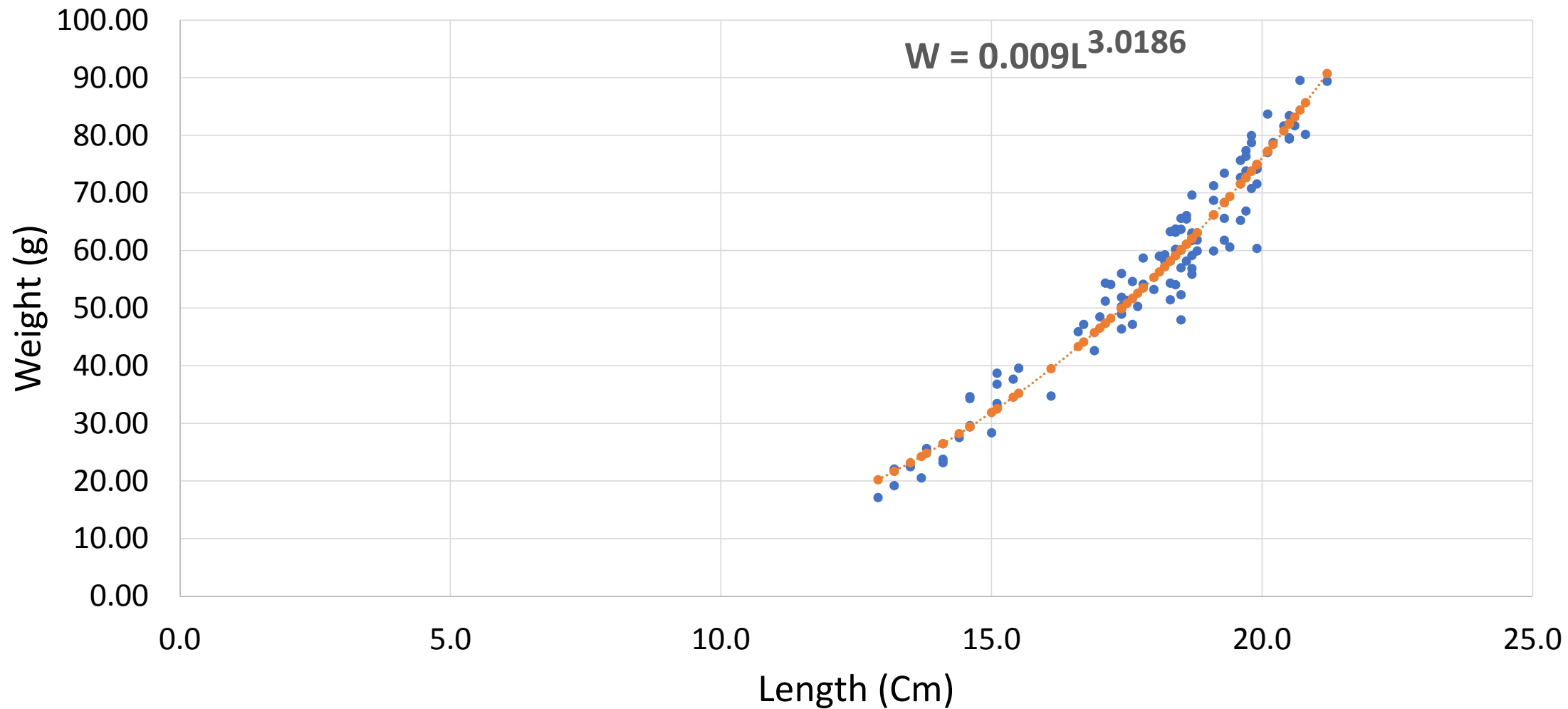
Length-weight relationship: Indian oil sardine

Male (N= 68) $r = 0.9716$



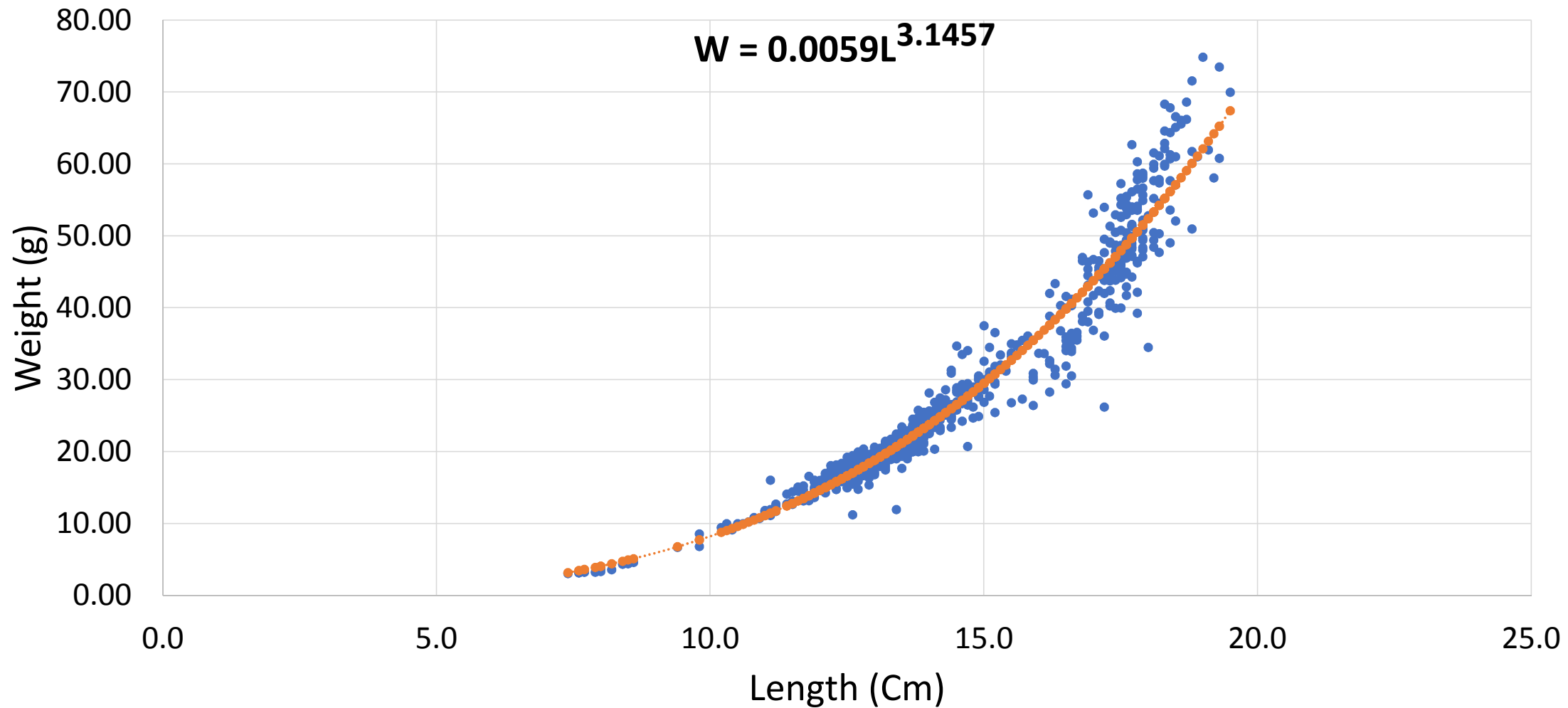
Length-weight relationship: Indian oil sardine

Females (N= 100) $r = 0.9747$



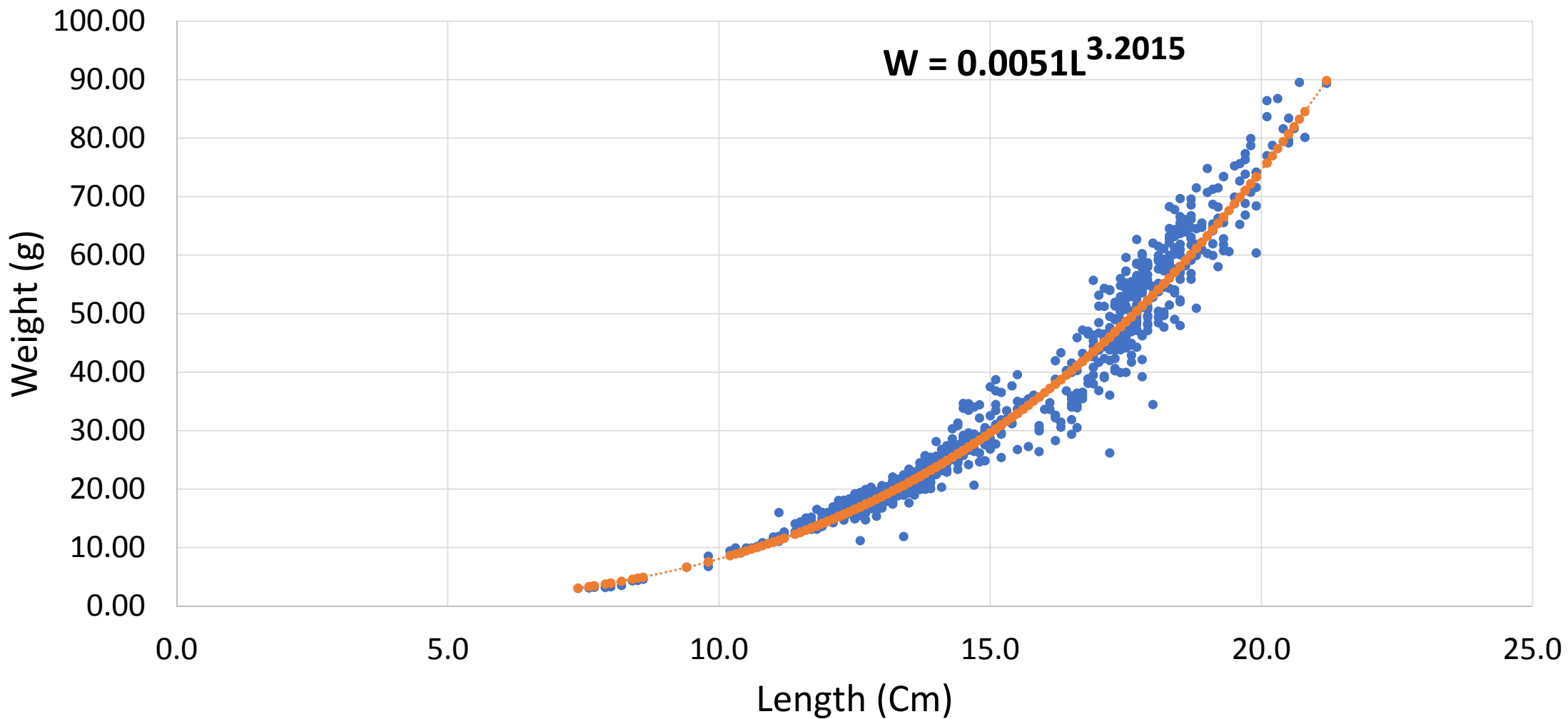
Length-weight relationship: Indian oil sardine

Indeterminant (N= 807) $r = 0.9843$



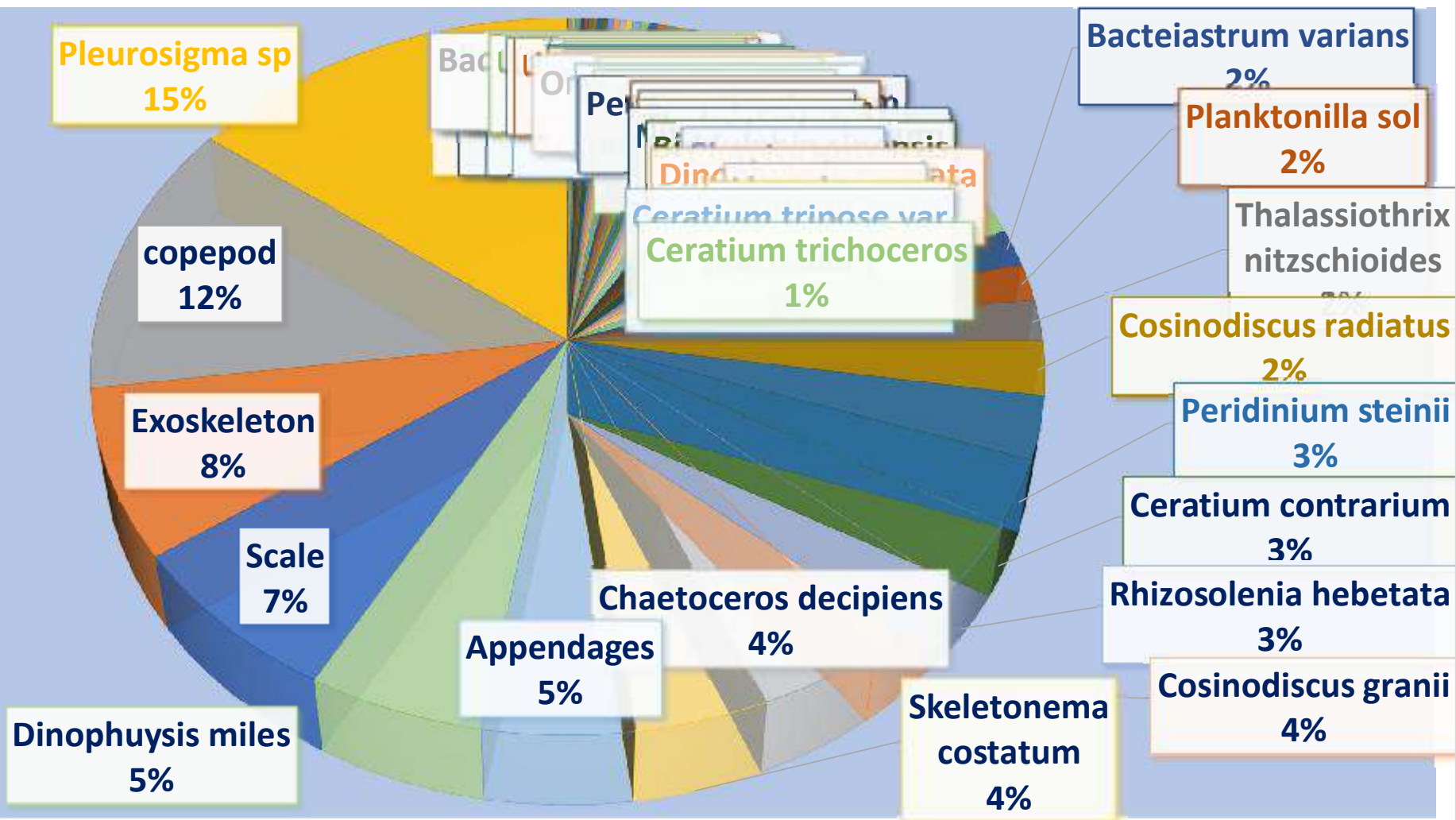
Length-weight relationship: Indian oil sardine

Combined (N= 975) $r = 0.9872$

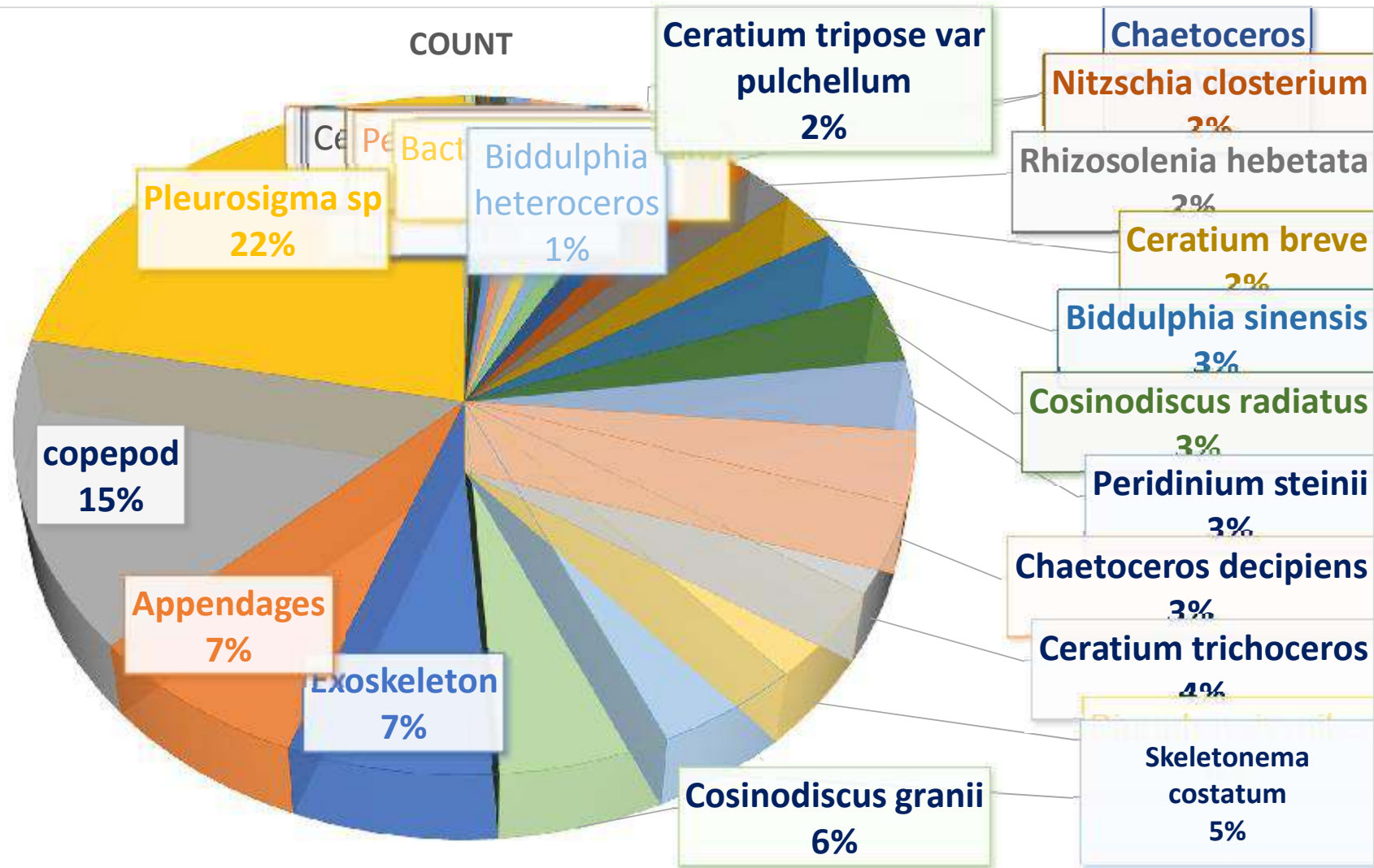


Food and feeding habits: Indian mackerel

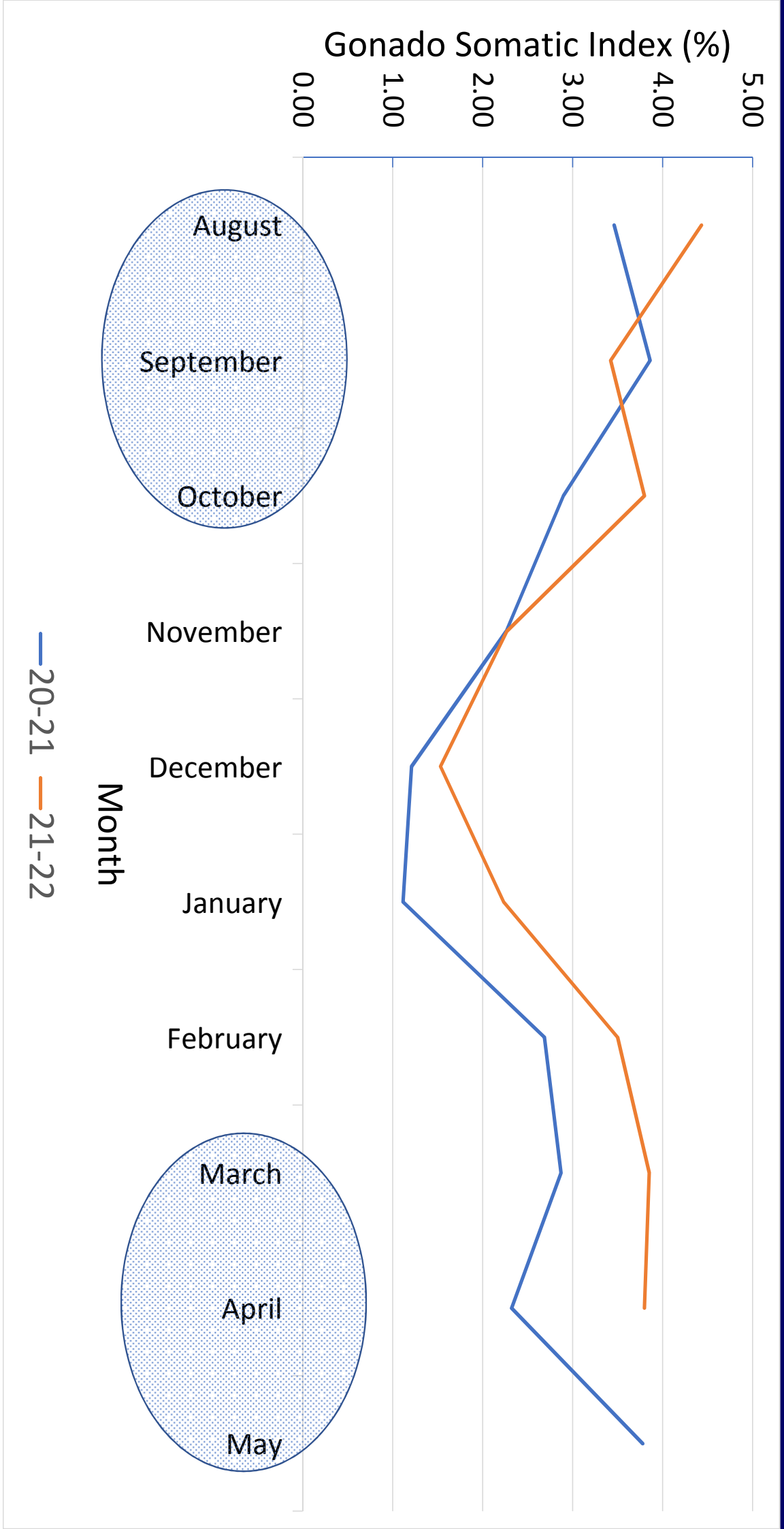
TOTAL



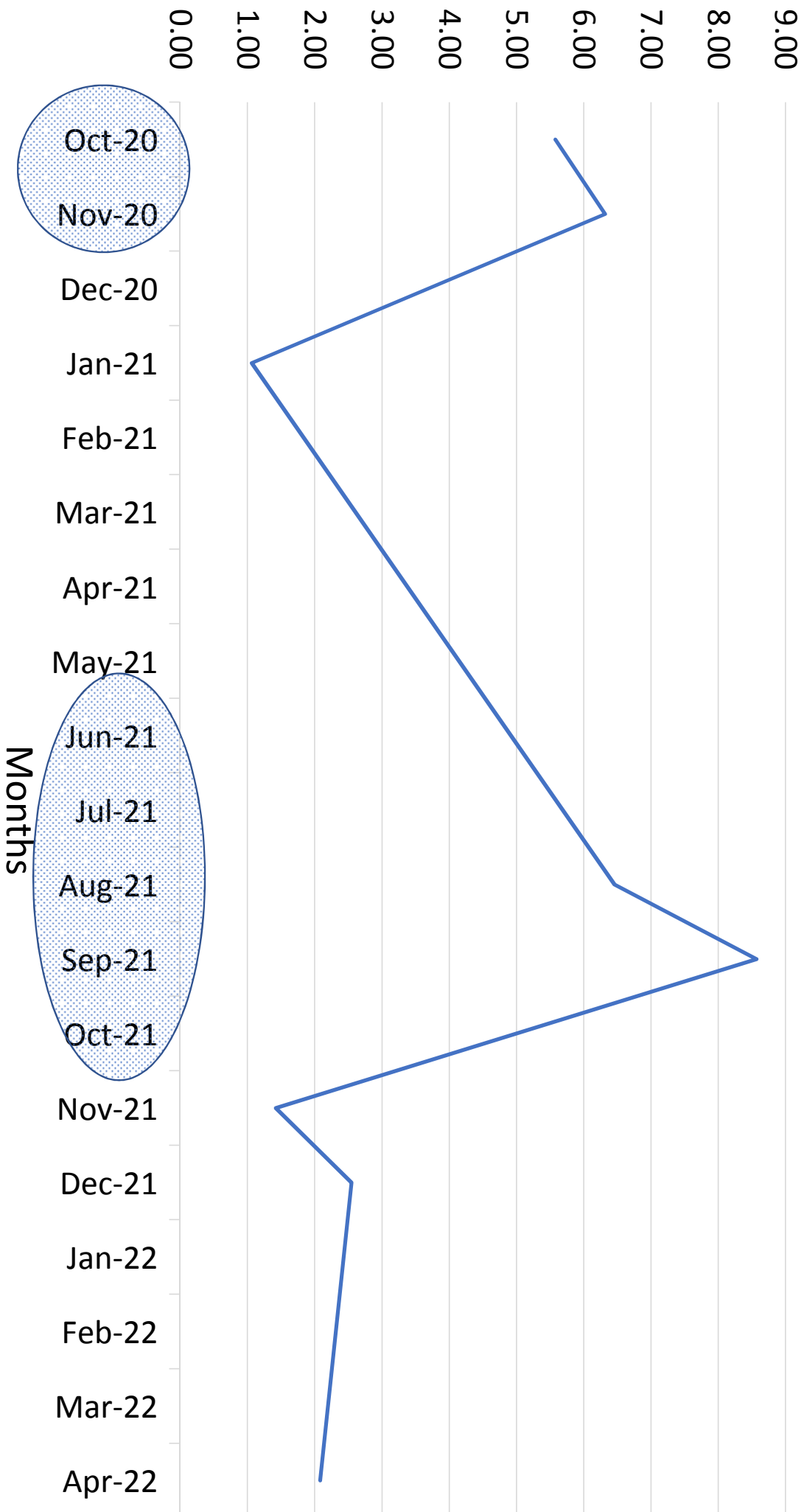
Food and feeding habits: Indian oilsardine



Gonado Somatic Index : Indian mackerel

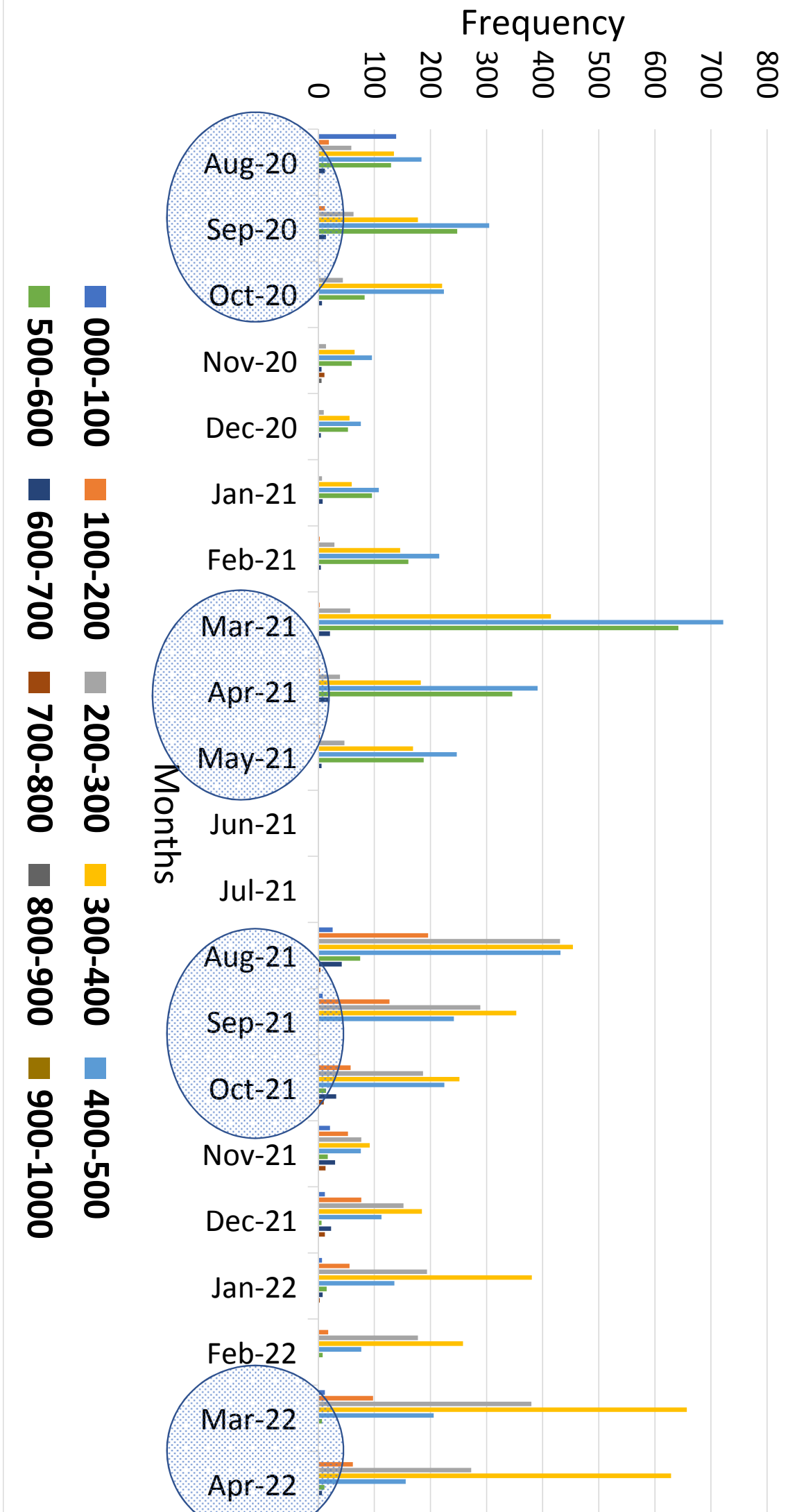


Gonado Somatic Index

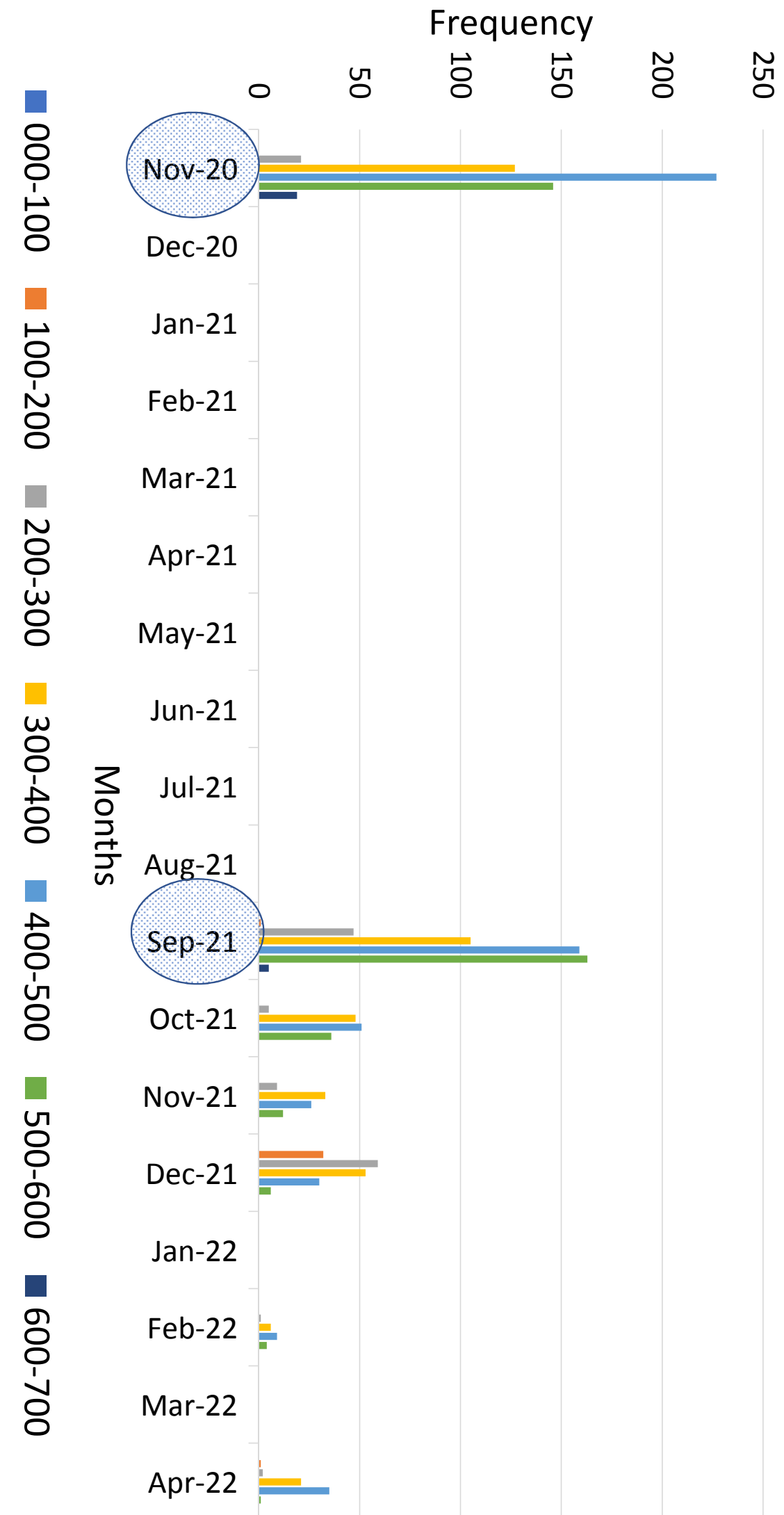


Gonado Somatic Index: Indian oil sardine

Ova diameter: Indian mackerel



Ova diameter: Indian oil sardine



Size at first maturity

Sr. No.	Species	Size at first maturity (cm)
1	Indian mackerel	13.0
2	Indian oil sardine	12.9

Sex ratio (Indian Mackerel)

Month	Male	female	Significance
Aug-20	32	48	NS
Sep-20	98	91	NS
Oct-20	88	53	Significant
Nov-20	62	49	NS
Dec-20	45	66	NS
Jan-21	86	78	NS
Feb-21	67	42	Significant
Mar-21	101	131	NS
Apr-21	81	110	NS
May-21	54	60	NS
Aug-21	59	92	Significant
Sep-21	114	68	Significant
Oct-21	71	60	NS
Nov-21	39	45	NS
Dec-21	58	105	Significant
Jan-22	64	97	NS
Feb-22	33	35	NS
Mar-22	43	85	Significant
Apr-22	48	65	NS
Total	1243	1380	Significant

Sex ratio (Indian oil Sardine)

Month	Male	female	Significance
Aug-20	0	0	--
Sep-20	0	0	--
Oct-20	0	0	--
Nov-20	19	28	NS
Dec-20	0	0	--
Jan-21	0	0	--
Feb-21	0	0	--
Mar-21	0	0	--
Apr-21	0	0	--
May-21	0	0	--
Aug-21	0	0	--
Sep-21	19	23	NS
Oct-21	7	7	NS
Nov-21	2	6	NS
Dec-21	12	31	Significant
Jan-22	0	0	--
Feb-22	0	1	NS
Mar-22	0	0	--
Apr-22	9	4	NS
Total	68	100	NS

Breeding season

Sr. No.	Species	First season	Second season
1	Indian mackerel	August to September	March to May
2	Indian oil sardine	August to September	March to May

Maximum Sustainable Yield

Sr. No.	Parameter	Fox	Schaefer
1	MSY (tonnes)	57008	56142
2	f_{MSY} (trips)	52774	41415

Growth and mortality parameters of Indian mackerel

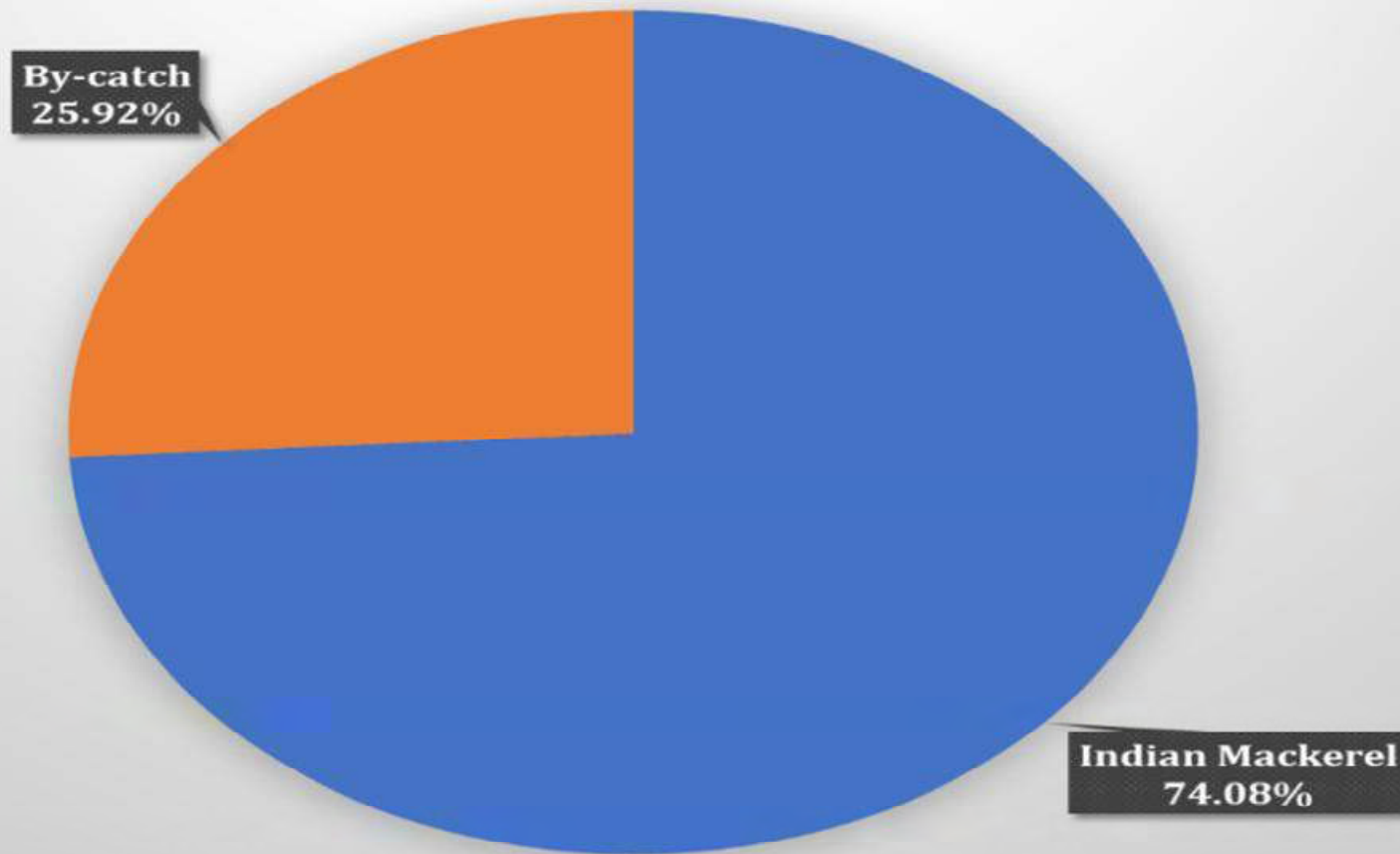
Growth parameter	Estimates
Minimum Length :	5.8 cm
Maximum Length	27.5 cm
Average Length	17.8 cm
Asymptotic Length (L_{∞})	28.88 cm
Growth Constant (K)	0.85
Mortality parameter	Estimates
Natural Mortality (N)	1.62
Fishing Mortality (F)	1.89
Total Mortality (Z)	3.51
Exploitation Rate (E)	0.54

Growth and mortality parameters of Indian oil Sardine

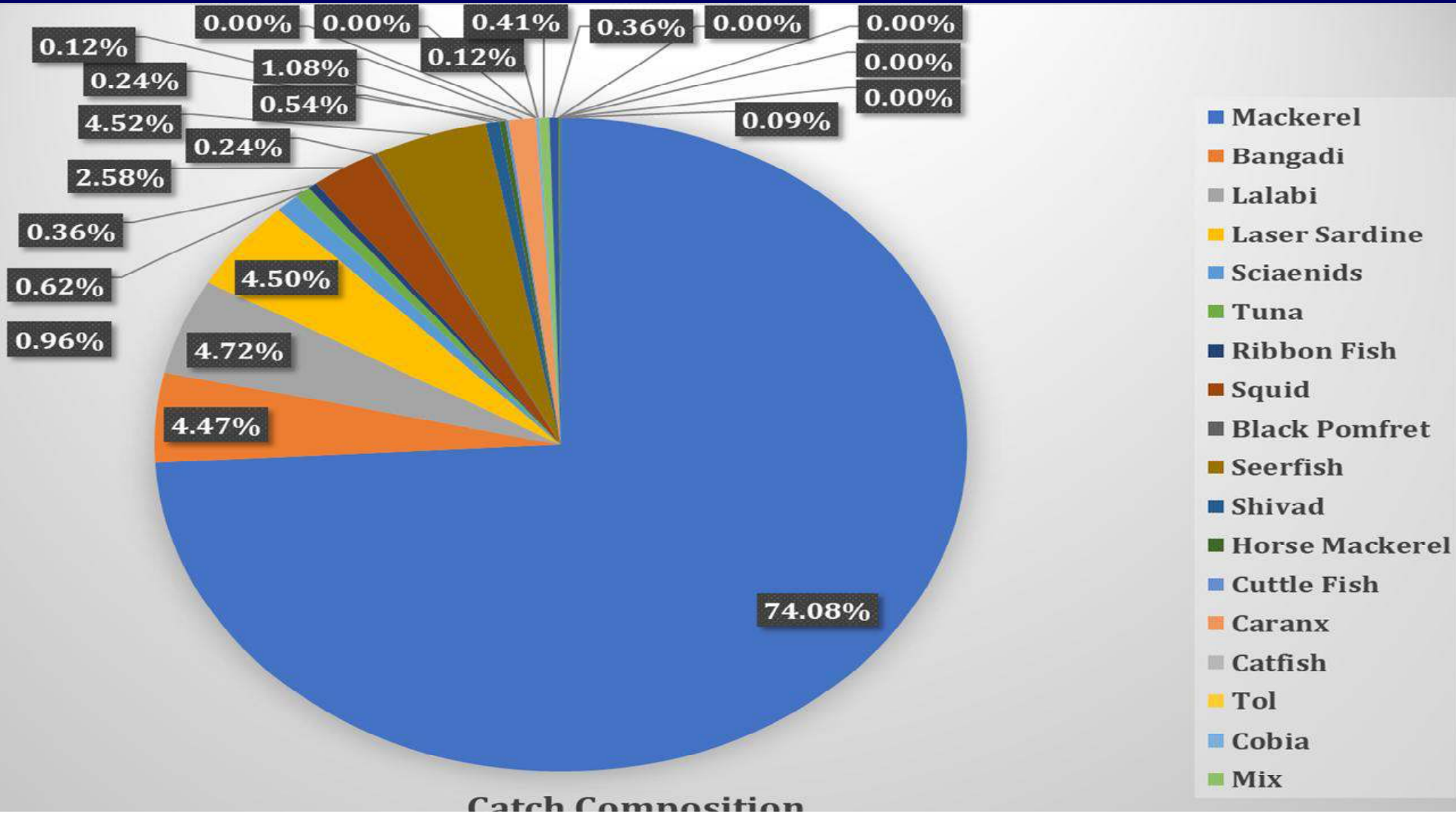
Growth parameter	Estimates
Minimum Length :	7.4 cm
Maximum Length	21.2 cm
Average Length	14.95 cm
Asymptotic Length (L_{∞})	23.10 cm
Growth Constant (K)	1.5
Mortality parameter	Estimates
Natural Mortality (N)	2.51
Fishing Mortality (F)	4.94
Total Mortality (Z)	7.44
Exploitation Rate (E)	0.66

Catch composition : Indian mackerel

Catch Composition



Detailed Catch composition : Indian mackerel



Catch Composition

Reference Points and Harvest Strategy for the sardine stocks

Thank you very much

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT JUNE 2022

APPENDIX 6

***“ REFERENCE POINTS IN SARDINE
FISHERIES MANAGEMENT IN
AUSTRALIA ”***

Reference points used in Australia's small pelagic fisheries; insights to inform the development of new fisheries

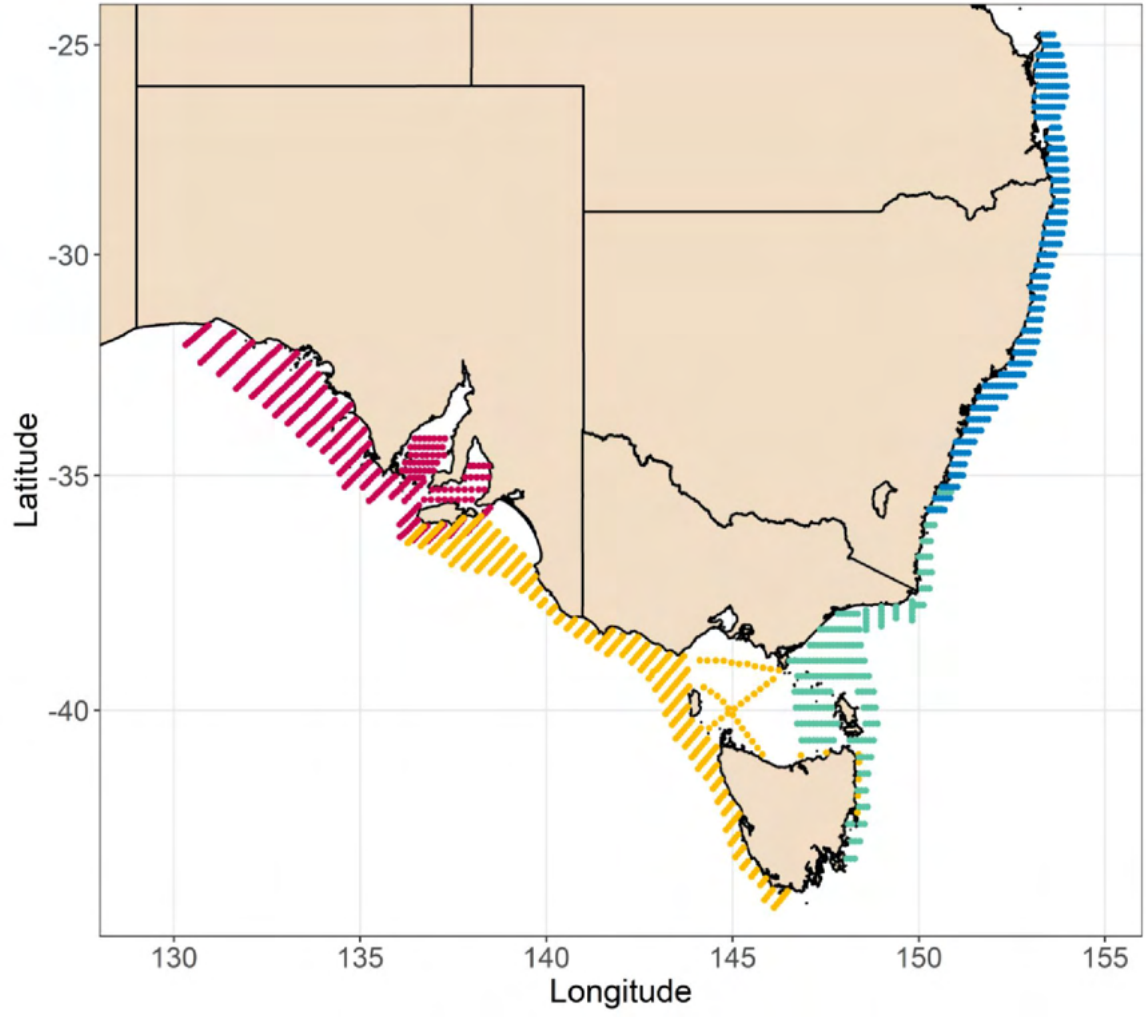
Associate Professor Tim Ward

Institute of Marine and Antarctic Studies

April 2022



Daily Egg Production Method: South Eastern Australia



Surveys funded by PIRSA, AFMA, FRDC, industry

Target Species

- Blue Mack, Sardine 2014, 2019, 2024 (Aug-Sept)
- Jack Mack, Sardine 2014, 2019, 2024 (Dec-Jan), Redbait 2020 (Oct)
- Jack Mack, Sardine 2016/17 (Dec-Jan), Redbait 2017 (Oct)
- Sardine 1998-2020, 2022 (Feb-Mar)



NB. CTD data for most casts

Photo by Dr John Keane

Spawning biomass can be estimated by dividing:

the mean number of pelagic eggs produced per day throughout the spawning area (i.e. total daily egg production) (Plankton surveys)

by

the mean number of eggs produced per day per unit weight of adult fish (i.e. mean daily fecundity) (Adult sampling)

(Parker 1980; Lasker 1985, Ward et al. 2021).

Daily Egg Production Method

P_0 : mean daily egg production (eggs.m⁻².day⁻¹)

A : total spawning area (km⁻²)

R : mean sex ratio (proportion females by weight)

S : mean spawning fraction (propn females spawning/night)

F' : mean relative fecundity (eggs.g⁻¹)

Spawning
Biomass

$$SB = \frac{P_0 A}{R \cdot F' \cdot S}$$

ICES Journal of
Marine Science

ICES International Council for
the Exploration of the Sea
CIEM Conseil International pour
l'Exploration de la Mer

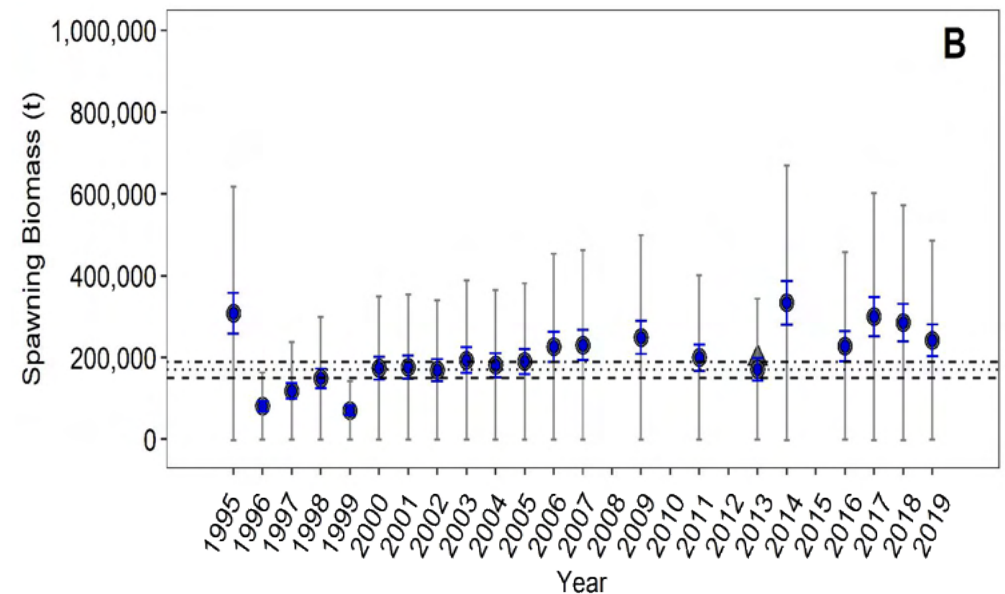
ICES Journal of Marine Science (2021), doi:10.1093/icesjms/fsab015

Review Article

Increasing the precision of the daily egg production method;
2020's remix of a 1980's classic

Timothy M. Ward ^{1,2,*}, Gretchen L. Grammer ^{1,2}, Alex R. Ivey ¹, Jonathan J. Smart ^{1,2}, and
Richard McGarvey ^{1,2}

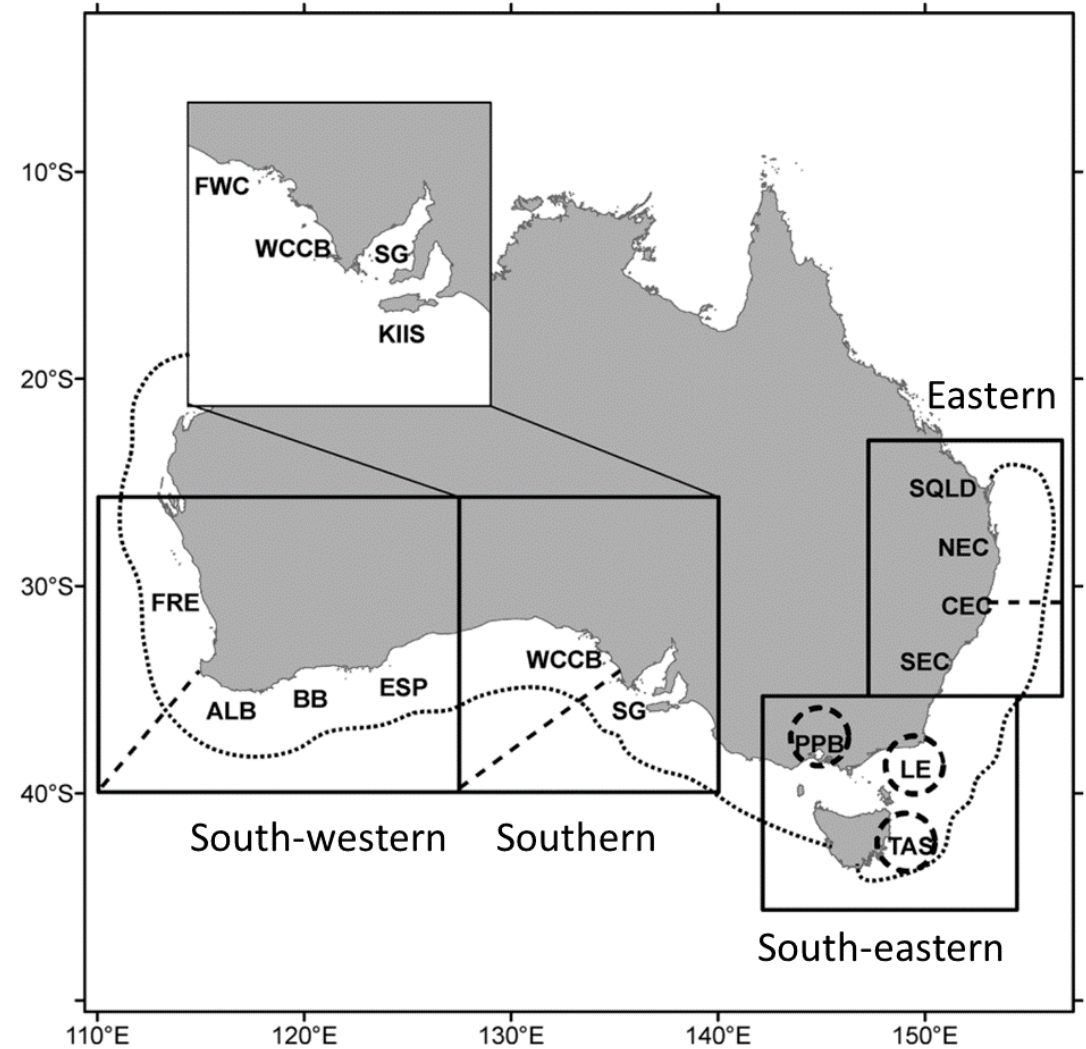
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Stock structure

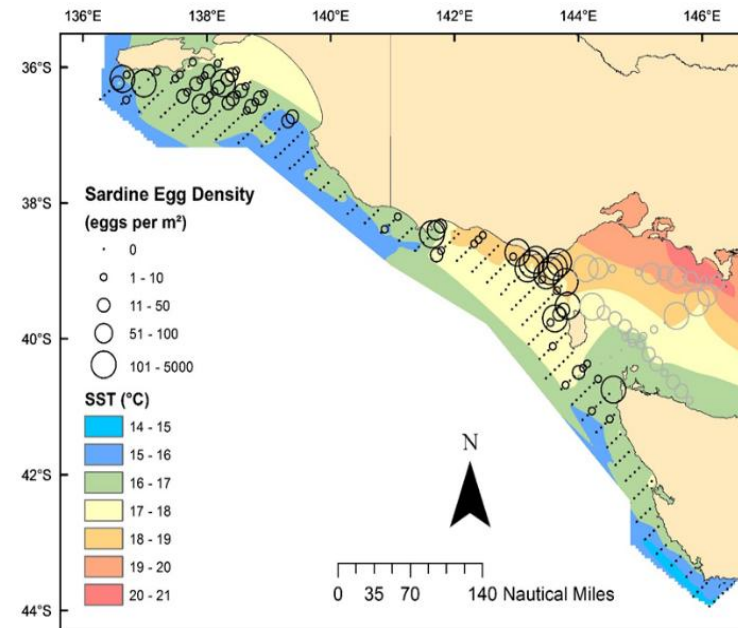
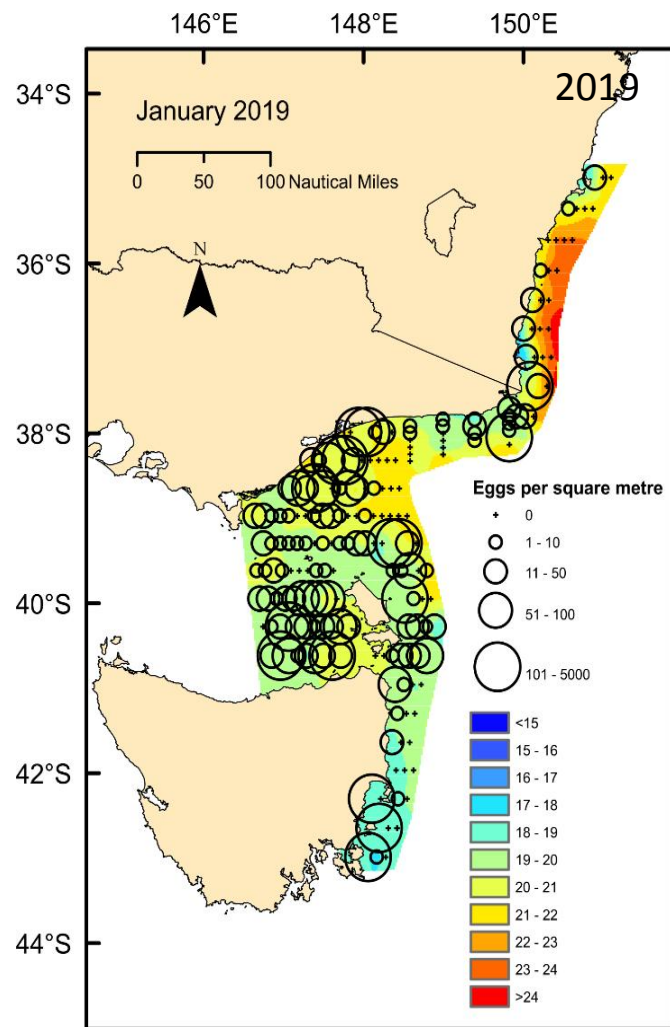


Australian Sardine, *Sardinops sagax*



Adapted from Izzo et al. (2017, *Rev. Fish. Biol. Fisheries*) with permission of Springer

South-eastern Sardine Stock



SB > 30,000 t (Ward et al. 2018, SARDI Report to AFMA)

SB + 30,000 t = >200,000 t

SB + 16,000 km² = ~253,000 t

SB = 184,721 (95% 86,282–283,158 t) Ward et al. 2022 IMAS Report to NRE Tas

Australia's small pelagic fisheries: contrasting histories and status

Success stories: South Australian Sardine Fishery and Commonwealth Small Pelagic Fishery (?)

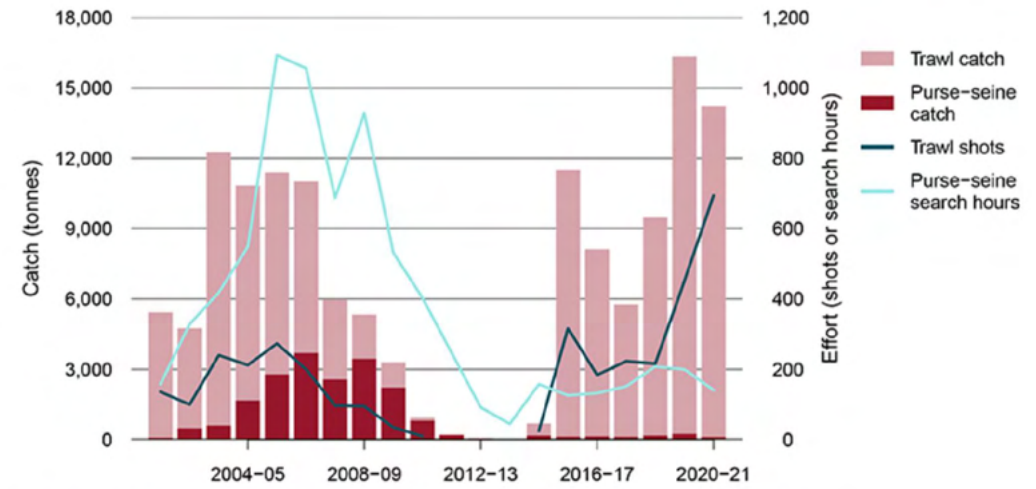
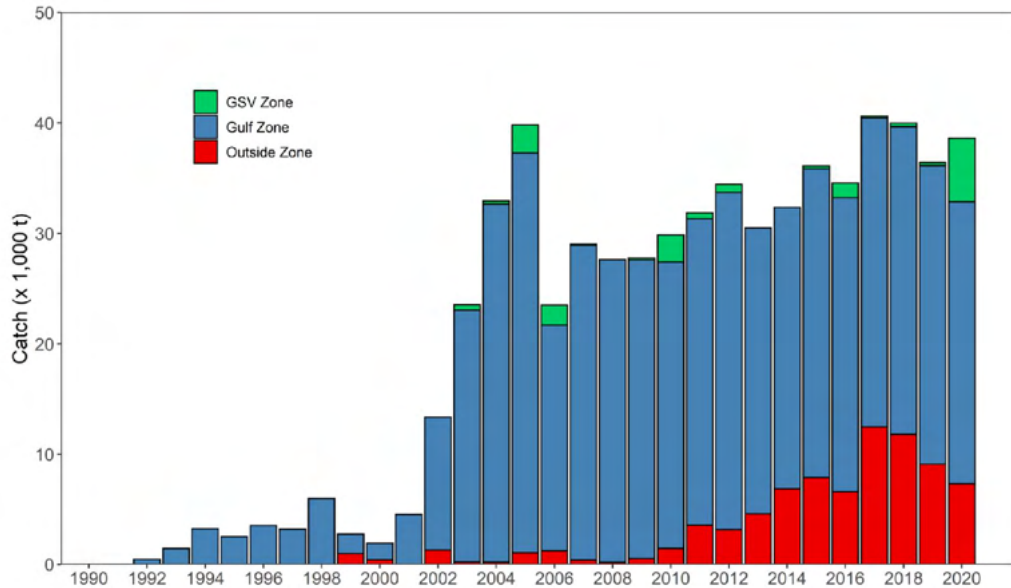
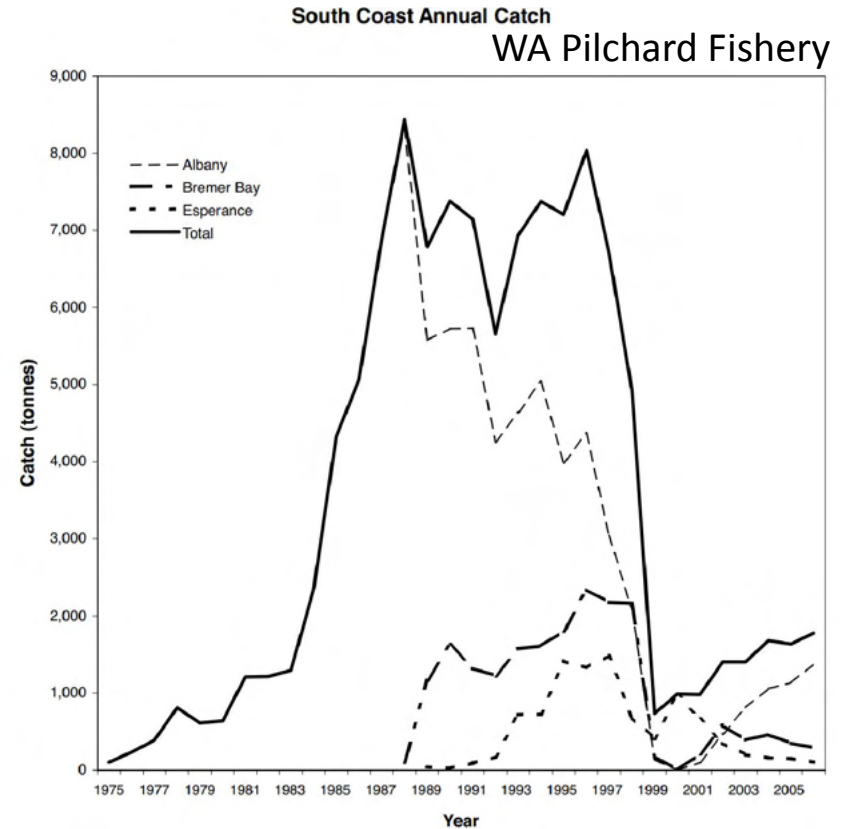
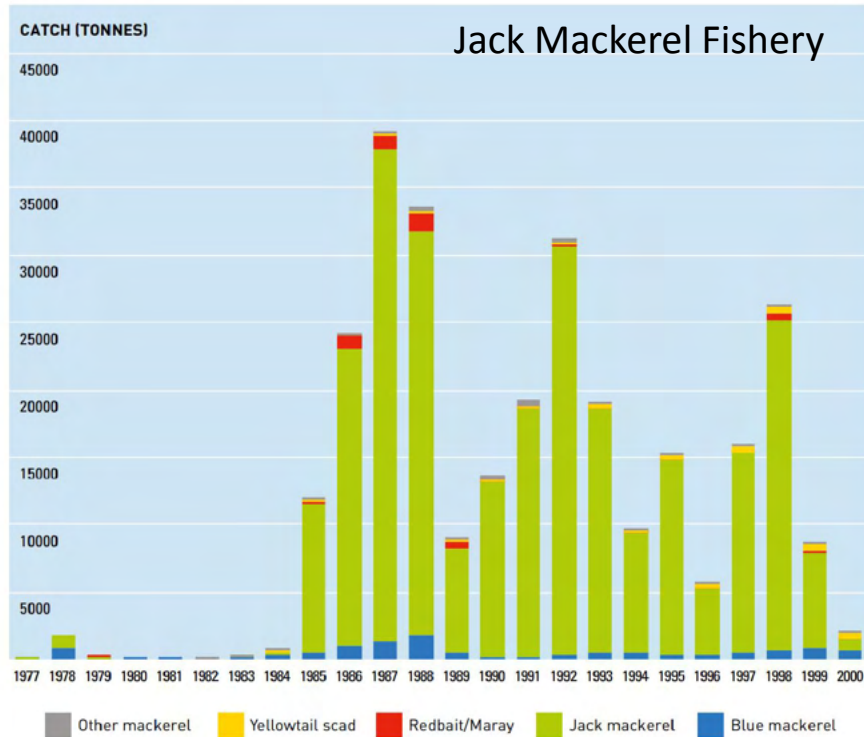


Figure 7.2 Total catch and fishing effort for the SPF, 2001-02 to 2020-21 fishing season

- Robust (conservative) stock assessment procedures and precautionary management arrangements
- Large reliable markets (e.g. for tuna feed and fish meal, respectively) needed to support large volume fisheries
- Social license to operate is important

Australia's small pelagic fisheries: contrasting histories and status

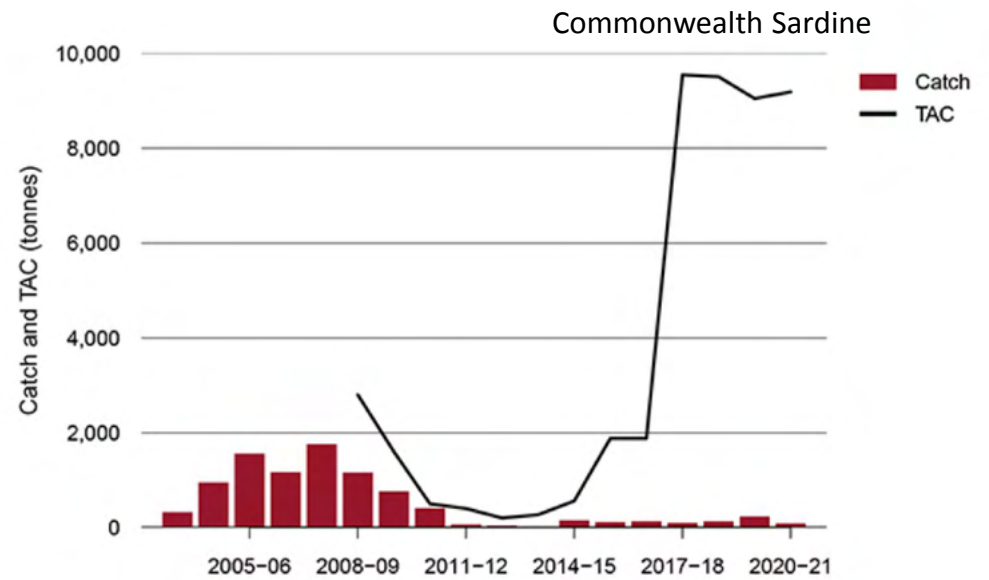
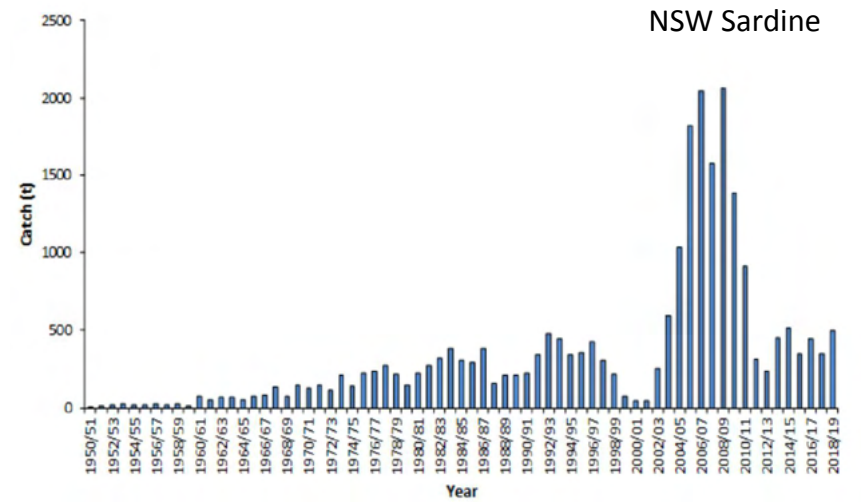
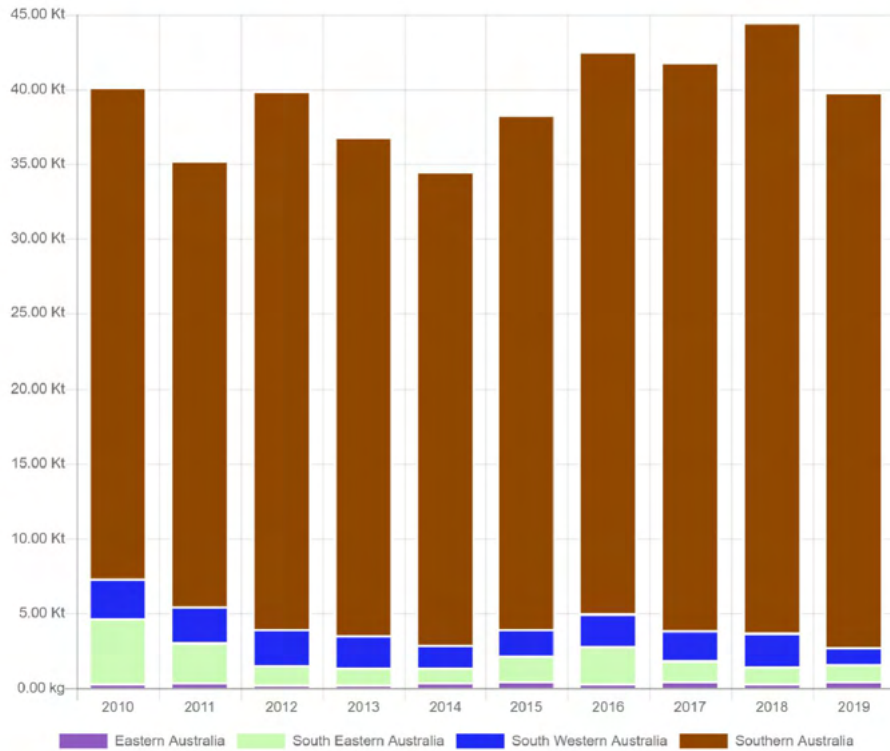
Cautionary tales



Don't allow pelagic fisheries to grow quickly before establishing:

- 1) robust (conservative) stock assessment procedures and/or
- 2) precautionary management arrangements that reflect levels of scientific uncertainty about stock status

Total Australian Sardine Catch



Difficult to develop small pelagic fisheries (sardine) based only on markets for human consumption, recreational bait and/or pet food.

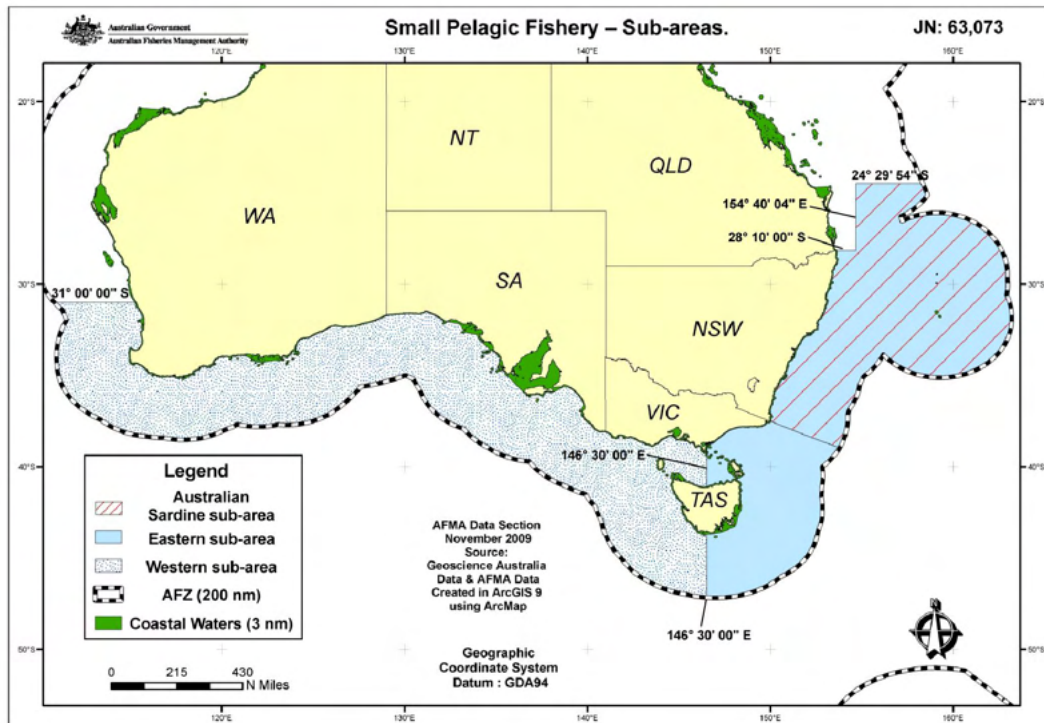
Target and Limit Reference Points

- Marine food webs of south-eastern Australia are not as dependant on small pelagic fishes (i.e. Jack Mackerel, Redbait, Blue Mackerel and Sardine) as those off North and South America, southern Africa and elsewhere (e.g. Bulman et al. 2011; Goldsworthy et al. 2013; Smith et al. 2015)
- Target reference point for SPF species can be safely set at 50% virgin biomass (B_{50}) and the limit reference point can be safely set 20% virgin biomass (B_{20}).
- Exploitation rates that achieve a median depletion of 0.5 or B_{50} , while maintaining less than a 10% chance of falling below the limit reference point of B_{20} are:

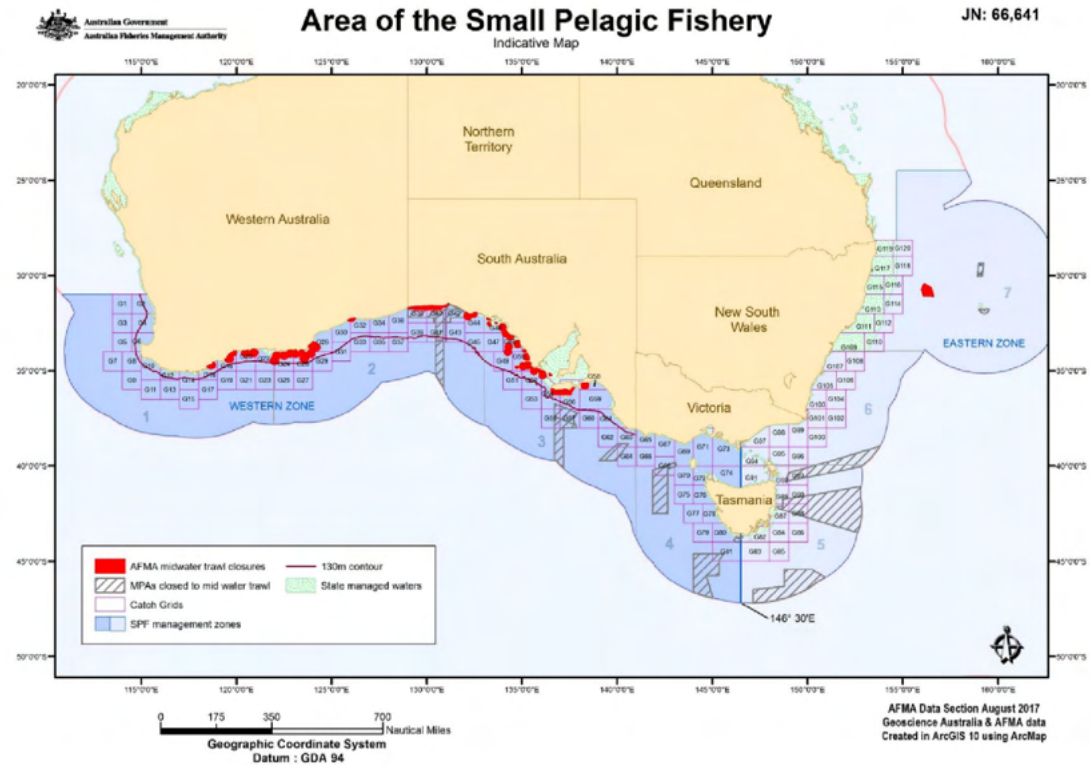
Species	East sub-area	West sub-area
Jack Mackerel, <i>Trachurus declivis</i> , <i>T. murphyi</i>	12%	12%
Blue Mackerel, <i>Scomber australasicus</i>	23%	23%
Redbait, <i>Emmelichthys nitidus</i>	9%	10%
Australian Sardine, <i>Sardinops sagax</i>	33%	33%*

Smith et al. 2015

Small Pelagic Fishery



- 3 sub-areas, seven stocks
 - Jack Mackerel E & W
 - Redbait E & W
 - Blue Mackerel E & W
 - Sardine E



- Management zones (7)
- Catch grids for limiting catches (catch by month)
- Closed areas
- Also engage with other stakeholders to reduce conflicts

SPF Harvest Strategy.

- Objective: ecologically sustainable, profitable, maximises net economic returns to Australian community
- Target and limit references points of B_{50} and B_{20}
- Based on the Daily Egg Production Method (DEPM). Done every 5 years to remain at Tier 1.
- RBCs are based on estimates of spawning biomass obtained using the DEPM
- Exploitation rates vary among species and reduce as estimates of SpB get older (conservative)
- TACs calculated by subtracting known sources of mortality from the RBCs
- Annual stock assessment reports at Tiers 1 and 2

Species	East Sub-area			West sub-area		
	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Jack Mackerel, <i>Trachurus declivis</i> , <i>T. murphyi</i>	12%	6%	3%	12%	6%	3%
	5 years	10 years	indefinite	5 years	10 years	indefinite
Blue Mackerel, <i>Scomber australasicus</i>	15%	7.5%	3.75%	15%	7.5%	3.75%
	5 years	5 years	indefinite	5 years	5 years	indefinite
Redbait, <i>Emmelichthys nitidus</i>	10%	5%	2.5 %	10%	5%	2.5 %
	5 years	10 years	indefinite	5 years	10 years	indefinite
Australian Sardine, <i>Sardinops sagax</i>	20%	10%	5%	NA	NA	NA
	5 years	5 years	indefinite			

Implications for new fisheries

- Although MSEs have shown that exploitation rates of up to 33% are likely to be sustainable for Sardine, a more conservative maximum exploitation rate of 20% has been established in the SPF. It would be prudent to establish conservative exploitation rates for new fisheries (e.g. 20%).
- DEPM surveys undertaken every 5 years in SPF. Potential primary source information for ongoing management of new fisheries.

**Australian Sardine,
*Sardinops sagax***

20%
5 years

10%
5 years

5%
indefinite

SASF Harvest Strategy 1 (Management Plan 2005)

Spawning biomass estimate	Presence of age classes	Management action (as % of spawning biomass).
< 100,000 tonnes		10% or 500 tonnes (which ever is greater).
100,000 – 150,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of catch).	10%
100,000 – 150,000 tonnes	2 and 3 year old age classes strong (>40% of catch).	12.5%
150,000 – 250,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of the catch).	12.5%
150,000 – 250,000 tonnes	2 and 3 year old age classes strong or of average strength (>40% of the catch).	15%
>250,000 tonnes	2 and 3 year old age classes weak or of average strength (<40% of the catch).	15%
>250,000 tonnes	2 and 3 year old age classes strong or of average strength (>40% of the catch).	17.5%

- One of first Australia fisheries to have a formal Harvest Strategy
- Downside: TACs highly variable among years. Addendum 2007. Baseline TAC set at 30,000 t if SpB > 150,000 t

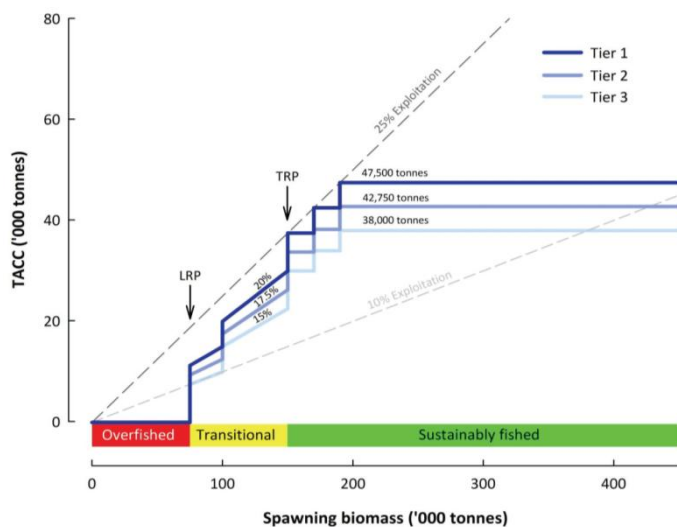
SASF Harvest Strategy 2 (Management Plan 2014)

The objectives of the Harvest Strategy for the SASF are to:

- Maintain the sardine spawning biomass at a sustainable stock status
- Optimise economic returns within these sustainability imperatives
- Provide certainty and stability for industry stakeholders
- Establish a simple guide for fishery managers, researchers and industry stakeholders
- Ensure cost-effectiveness of management.

SASF Harvest Strategy 2 (Management Plan 2014)

Spawning Biomass			Tier 1		Tier 2		Tier 3	
			TACC (t)	Maximum Exploitation	TACC (t)	Maximum Exploitation	TACC (t)	Maximum Exploitation
190000 t <	SpB		47,500 t	25%	42,750 t	22.5%	38,000 t	20%
170000 t <	SpB	≤ 190000 t	42,500 t	25%	38,250 t	22.5%	34,000 t	20%
150000 t <	SpB	≤ 170000 t	37,500 t	25%	33,750 t	22.5%	30,000 t	20%
100000 t <	SpB	≤ 150000 t	20% of SpB	20%	17.5% of SpB	17.5%	15% of SpB	15%
75,000 t <	SpB	≤ 100000 t	15% of SpB	15%	12.5% of SpB	12.5%	10% of SpB	10%
	SpB	≤ 75000 t	Closed	0%	Closed	0%	Closed	0%



Tier 1 – annual DEPM, annual stock assessment

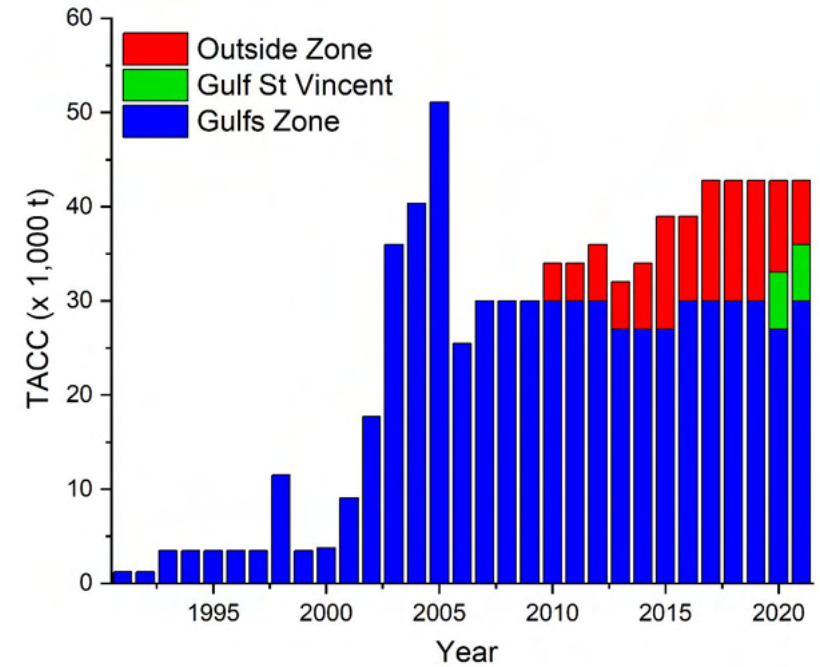
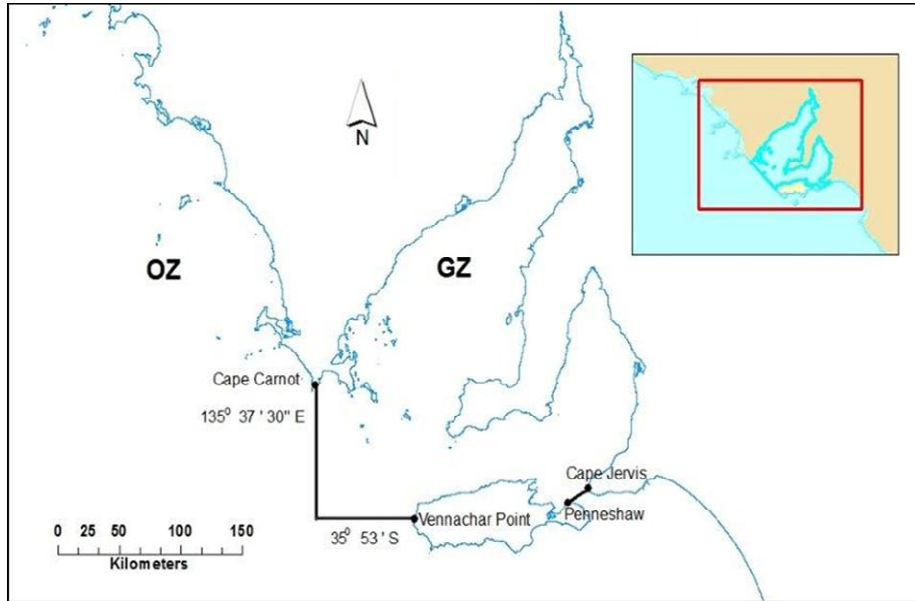
Tier 2 – annual DEPM, biennial stock assessment

Tier 3 – biennial DEPM, biennial stock assessment

TACs – relatively stable among years

Stepped approach designed to address imprecision of DEPM (ER applied to lower limit of each band)

SASF Harvest Strategy 2: Zones and Size Rules in Management Plan



Mean size of Sardines (MSS, mm Fork Length) in GZ	Maximum catch limits for GZ
142 mm < MSS	30,000 t
135 mm < MSS ≤ 142 mm	27,000 t
MSS ≤ 135 mm	24,000 t

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APPENDIX 7

***“ PELAGIC FISHERIES OF GOA
AND MAHARASHTRA WITH
SPECIAL REFERENCE TO INDIAN
MACKEREL AND INDIAN OIL
SARDINE ”***

**Pelagic fisheries of Goa and Maharashtra with special reference to
Indian mackerel and Indian oil sardine**

**Workshop on Reference Points and Harvest Strategy
for the sardine stocks**

Prathibha Rohit

Principal Scientist, ICAR CMFRI

19th May 2022, Ratnagiri

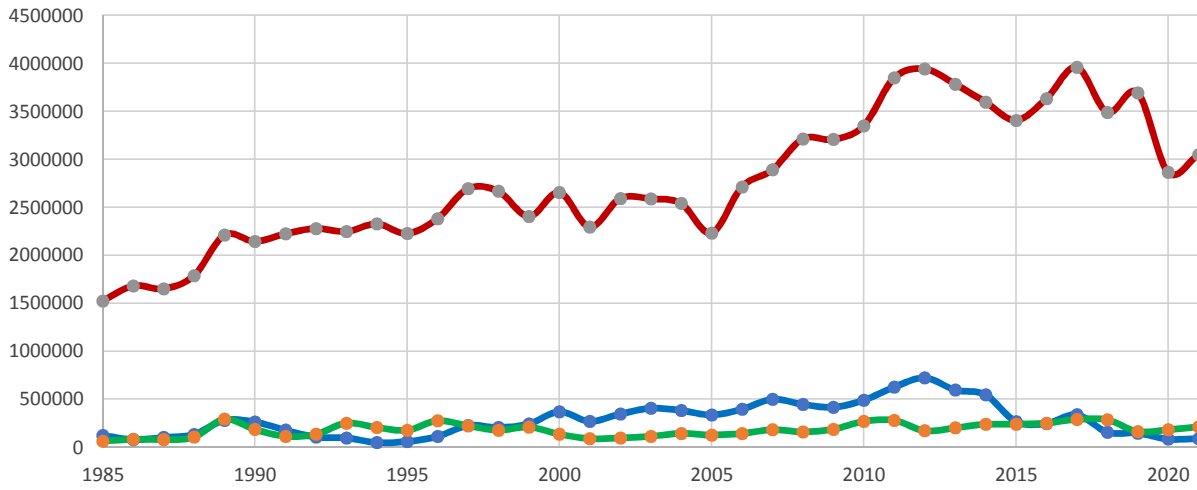
Pelagic fishes

- Pelagic fishes encompass an array of species residing in all realms of the pelagic region and include the small unicorn cod to the large billfishes, the planktivorous to the highly carnivorous fishes. Their vast distributional range makes them vulnerable to exploitation by different categories of gears (seines, gillnets, lines and pelagic & mid-water trawls).
- The pelagic fishes play a multi-faceted role in the food web of the marine system forming an important prey item of several larger fishes and as a predator of several other marine organisms and play a significant role in maintaining the balance in the marine ecosystem..
- The Indian marine fisheries is mainly dominated by the pelagic fishes such as the clupeids, scombroids, carangids and the Bombay duck, and they have always played a pivotal role in dictating the general trend of the marine capture fisheries of the country through their sheer bulk catches.

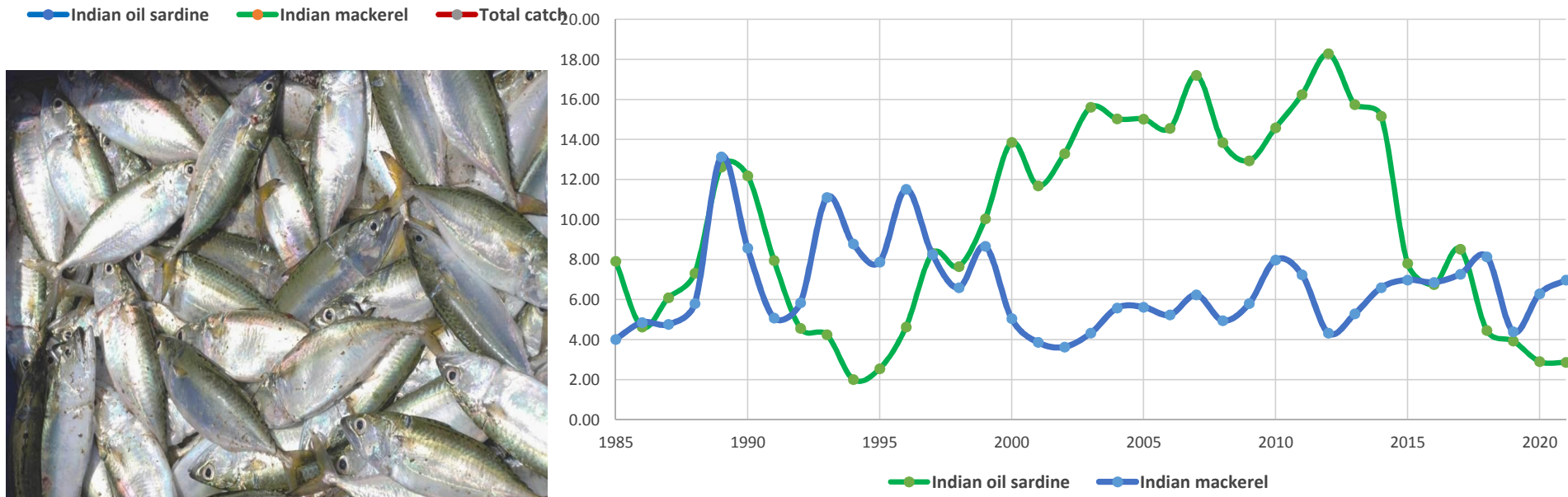
Pelagic fishes

- They contribute to the food chain at several levels: directly, through actual consumption (fresh, frozen or processed) contributing significantly to the protein food basket and indirectly, by providing products used for animal feeds and fertilizers or by serving as bait.
- They form a considerable part of the marine domestic and export trade and supporting fishing industries (fishmeal, surimi and fish processing plants) and several ancillary industries.
- Its mainly a single species of these major groups that forms the bulk of the catch and generally set the trend for the country's marine fish landing trends. Of these, the **Indian oil sardine**, *Sardinella longiceps* and the **Indian mackerel**, *Rastrelliger kanagurta* are the major contributors followed by Bombay duck *Harpodon nehereus* and the the hairtail ribbonfish *Trichiurus lepturus*

Total catch (t) and catch (t) of IOS and IM (1985-2021)



Annual contribution (%) of IOS and IM to total catch

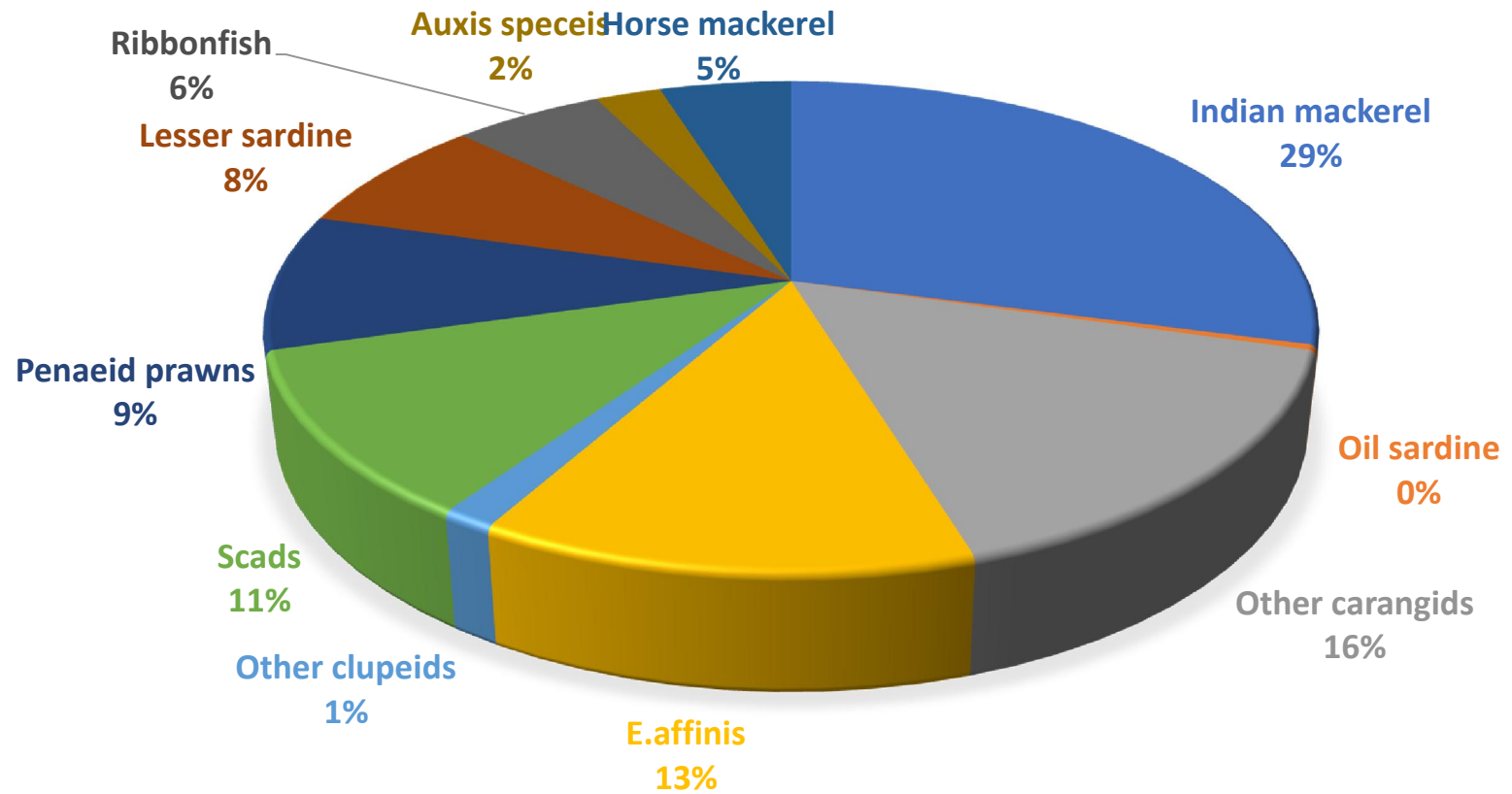


Goa: Marine fisheries Profile



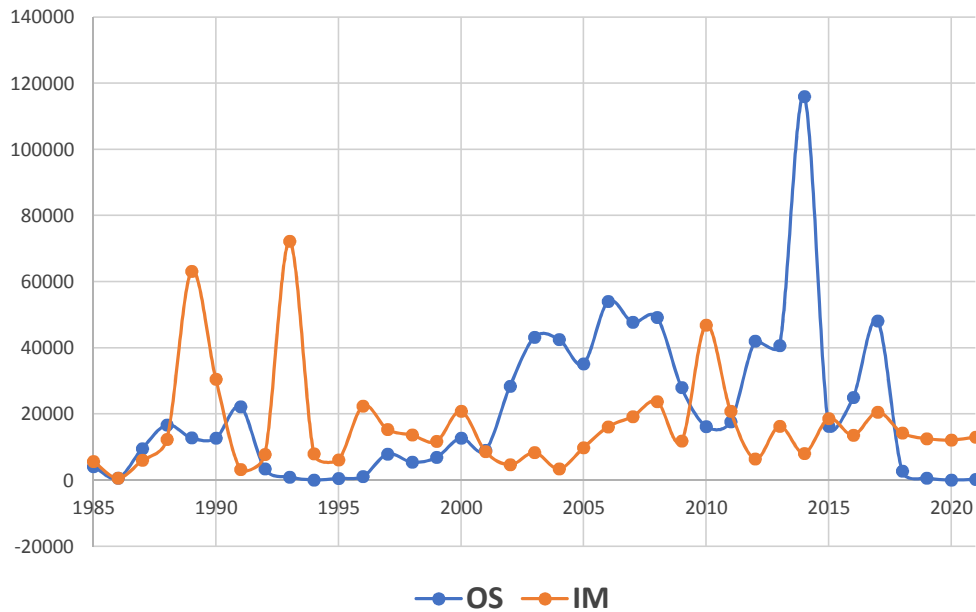
Coastline	160	
Coastal districts	2 (North Goa and South Goa)	
Number of fishing villages	41 (17+24)	
Number of marine fish LC	32 (12+20)	
Number of fishermen families	2986	
Number of fishing crafts	1982	
	Mechanised	858 (43%) TN (70%), PS (24%)
	Motorised	942 (48%)
	Non motorised	180 (9%)
Avg. Marine fish production (17-21)	60,466 t	
IOS (2017-2021)	10,295 t (17%)	
IM (2017-2021)	14,456 t (24%)	

Major resources contributing (%) to the fishery in Goa

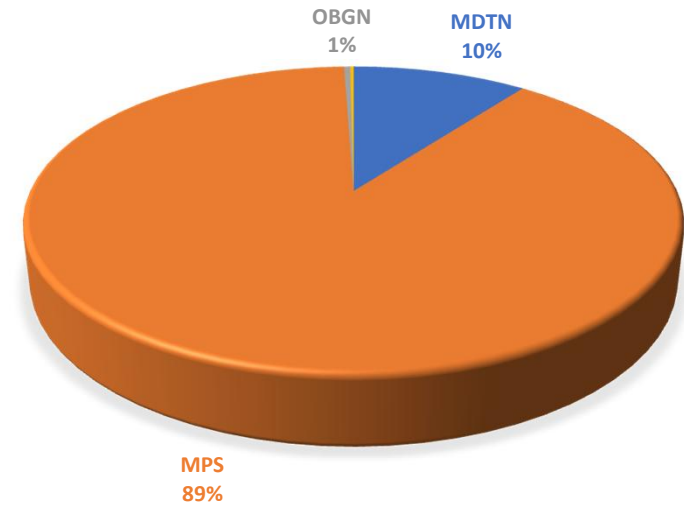


Goa: Trends in the landings of IOS & major gears contributing to their exploitation

Trends in IOS and IM landings- Goa



CONTRIBUTION OF DIFFERENT GEARS TO IOS LANDINGS IN GOA

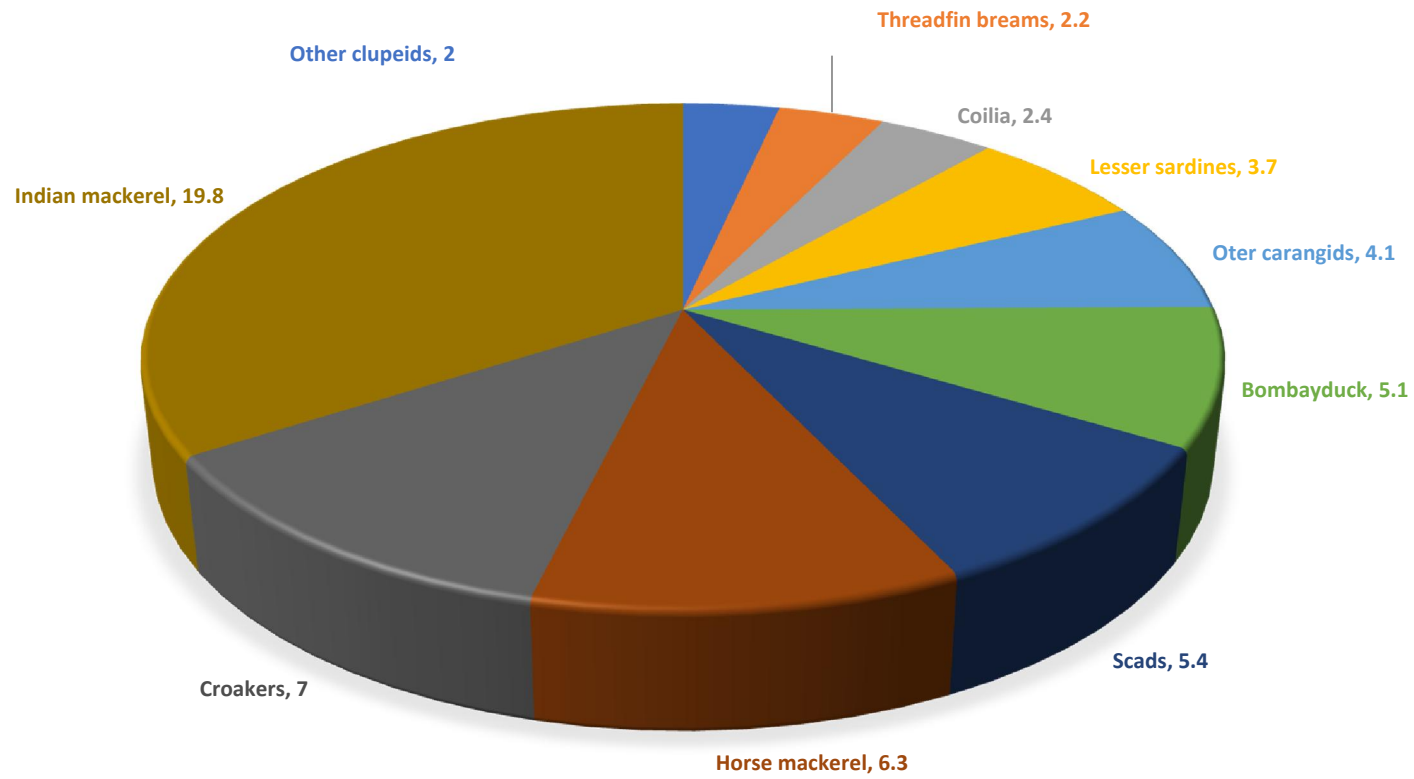


Maharashtra: Marine fisheries Profile



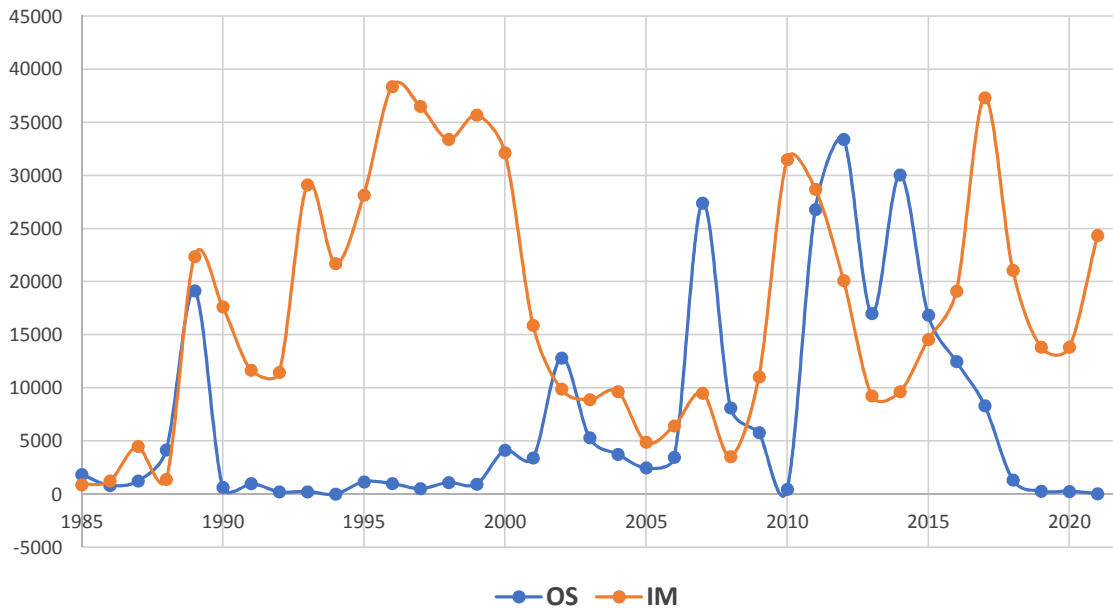
Coastline	720 km	
Coastal districts	7 (Palghar, Thane, Mumbai Suburban, Mumbai City, Raigad, Ratnagiri, Sindudurgh)	
Number of fishing villages	526	
Number of marine fish LC	155	
Number of fishermen families	87717	
Number of fishing crafts	15520	
	Mechanised	5867 (38%) TN (58%), DN (28%),GN (9%) PS (6%)
	Motorised	6788(44%)
	Non motorised	2865 (18%)
Avg.Marine fish production (17-21)	167363	
IOS (2017-2021)	2045 (1.2%)	
IM (2017-2021)	22070 (13.2%)	

MAJOR RESOURCES CONTRIBUTING (%) TO THE FISHERY IN MAHARASHTRA

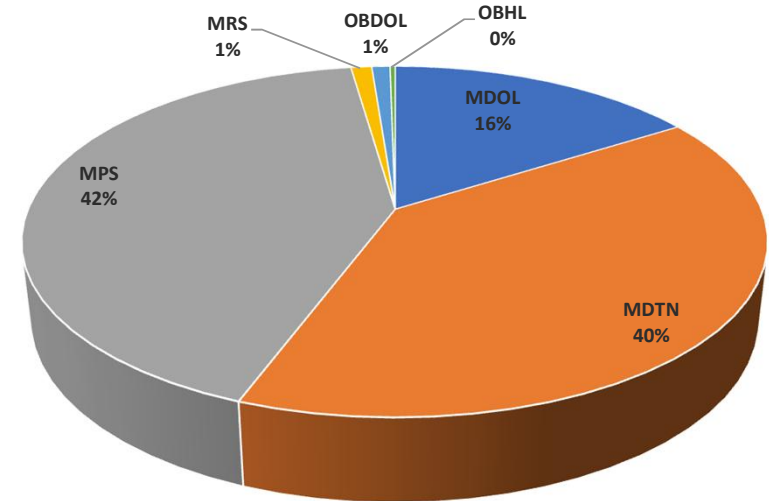


Maharashtra: Trends in the landings of IOS & major gears contributing for their exploitation

Trends in IOS and IM landings -Maharashtra

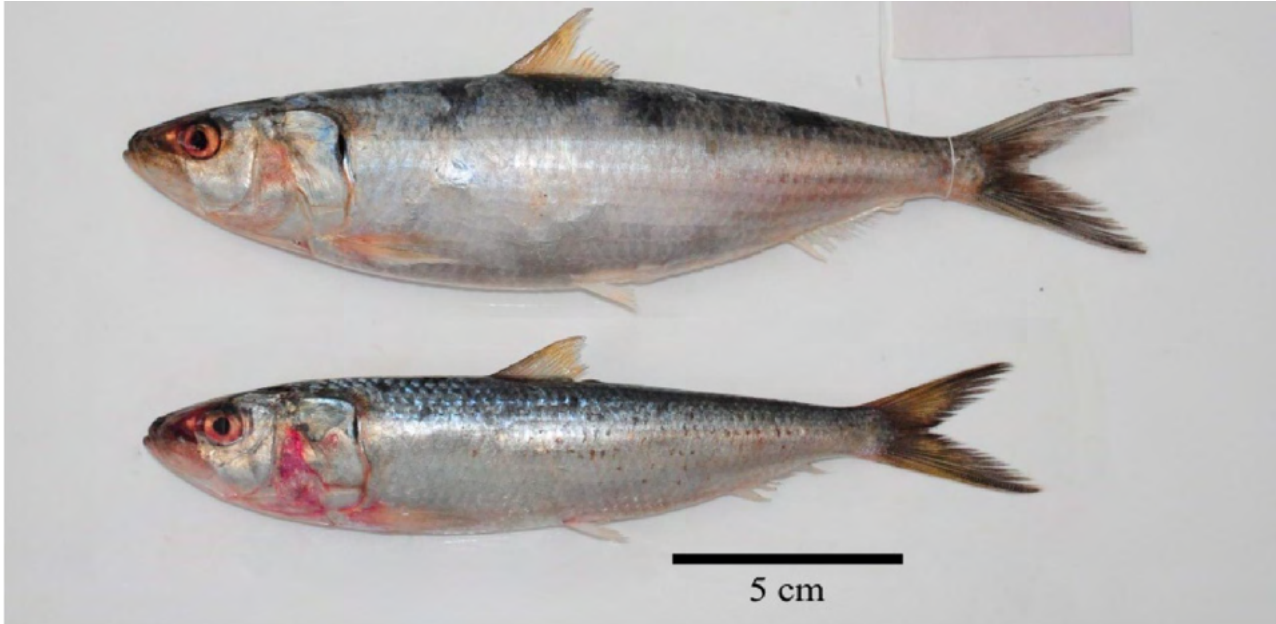


Contribution of different gears to IOS landings in Maharashtra



Morphotypes of Oil sardine

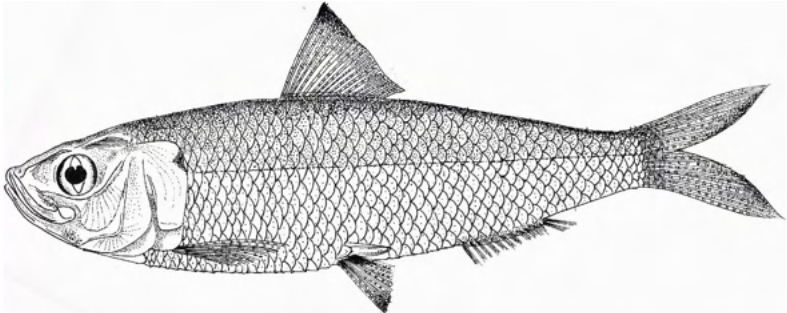
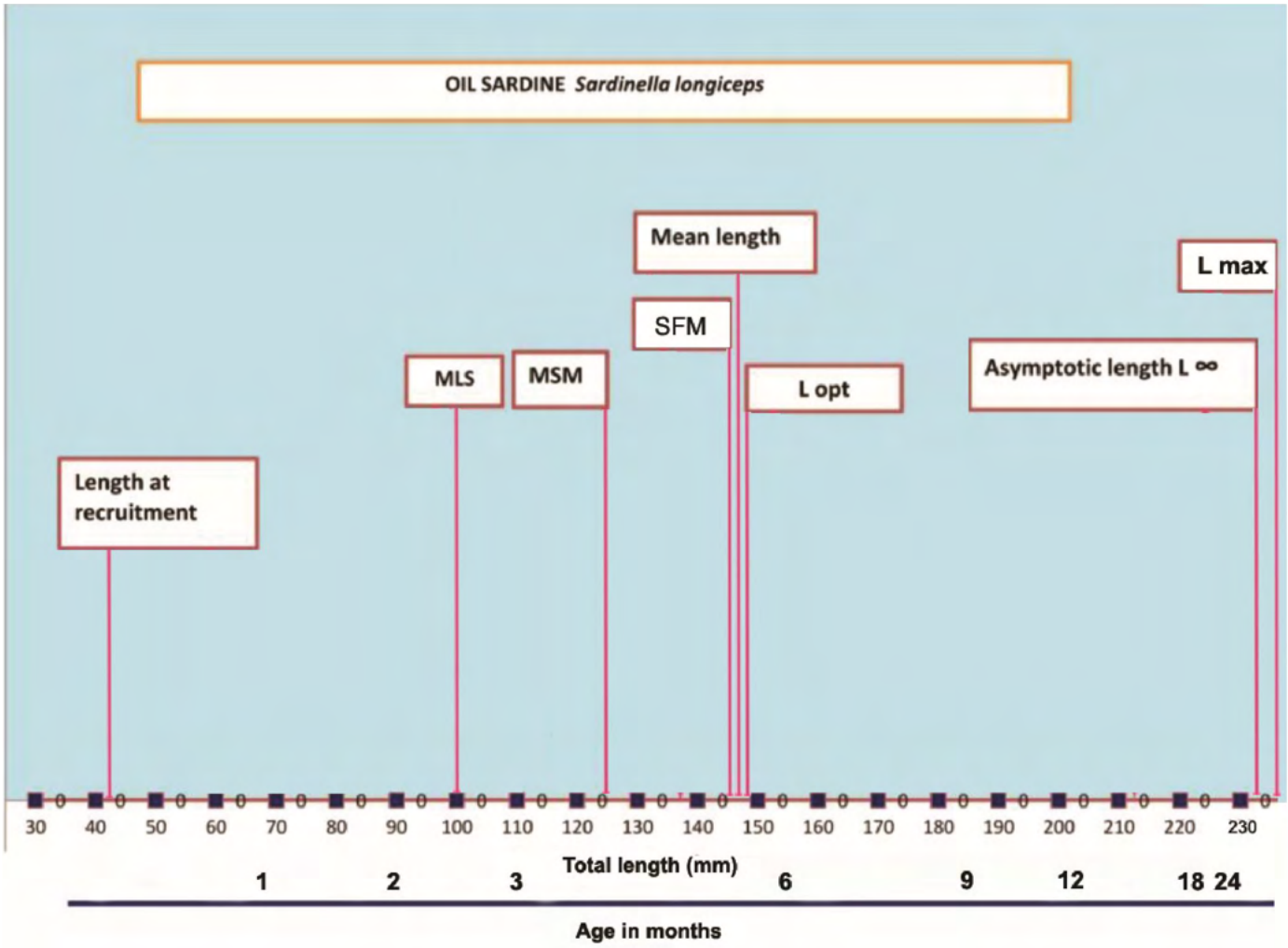
Species level identification with Mitochondrial DNA markers



Mitochondrial cytochrome c oxidase I and control region sequences did not show any significant variation between the three variants. The genetic distance values based on DNA barcodes (mtDNA; partial sequences of Cytochrome C Oxidase (655bp)) were low ranging from 0.1-0.2% and indicated that the three morphotypes belonged to the same species *Sardinella longiceps*

Proximate composition of oil sardine

Sample type	Dry matter (%)	Moisture (%)	Crude protein (%)	Crude fat (%)	Crude ash (%)	Crude fibre (%)	Acid insoluble ash (%)	Nitrogen free extract (%)
Normal sardine range	26.72 - 31.3994	68.6-73.3	17.45-19.52	3.71-12.64	1.24-6.96	0.03-0.3	0.02-0.30	0.02-0.45
Lean sardine	28.50	71.50	12.68	4.55	1.32	0.1	-	-
Oman sardine	43.5447-49.3588	50,6412-56,4553	19,05-20.09	22.09-29.10	0.75-0.88	0.13-0.18	0,02-0.07	0.20-0.45



Diagrammatic presentation of different Length milestones in Indian oil sardine

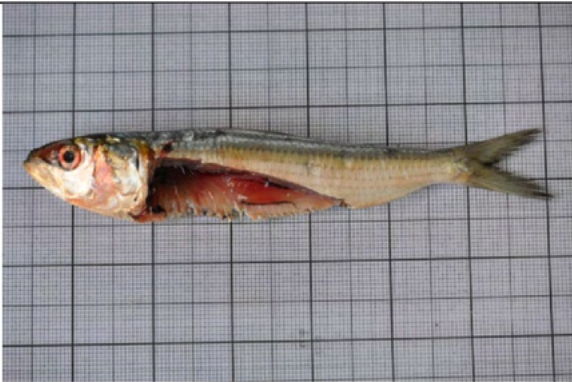


Age (month)	Length-cm	
	(Hard inscription)	Length-cm (LF analysis)
1	6.8	6.1
2	9.0	8.3
3	11.0	10.1
6	15.4	14.4
9	18.3	17.4
12	20.1	19.3
15	21.3	20.7
18	22.1	21.6
21	22.5	22.2
24	22.9	22.6
30	23.2	23.0
36	23.4	23.3

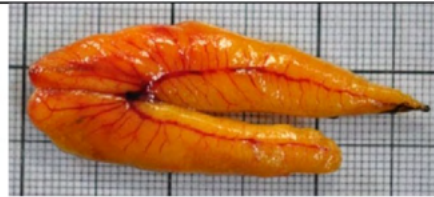
Recruitment (%) pattern of Indian oil sardine

Month	India	West coast	Goa	Maharashtra
Jan	1.6	0	1.8	0.1
Feb	9.0	0.5	4.1	1.2
Mar	22.4	3.2	11.5	2.5
Apr	0.4	6.4	14.7	5.1
May	27.8	11.6	20.5	11.8
Jun	14.9	17.4	30.8	17.3
Jul	3.2	21.2	7.6	30.3
Aug	10.4	18.3	6.8	16.1
Sep	7.8	6.1	1.1	11
Oct	1.8	6.4	0.9	3.8
Nov	0.7	8.1	0.2	0.8
Dec	0.01	0.0	0.0	0.0

Stage II



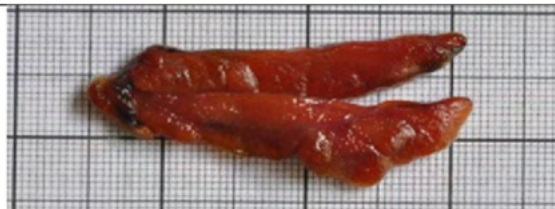
Stage V



Stage VII a



Stage II b



Mortality and exploitation rate of Indian oil sardine

Area	M	F	M:F	Z	E_{curr}
India	1.33914	4.23142	1:3.2	5.57	0.75968
West coast	1.33914	4.93086	1:3.7	6.27	0.78687
Goa	1.33914	8.42086	1:6.3	9.76	0.86279
Maharashtra	1.33914	5.23086	1:3.9	6.57	0.79617

The exploitation rates in Goa and Maharashtra were much higher than E_{max} , indicating heavy pressure on the resources in these states

The oil sardine is a highly preferred fish in Kerala and Karnataka and due to the acquired taste for the fish in these two states, the demand for the same in the domestic market is very high, hence fetches a very high price and is subjected to very high exploitation.

The existing gears have been modified or new nets have been designed for targeted fishing of sardines alone. However, being a small pelagic fish with all its characteristics, when all conditions for its recruitment, survival and growth is good, is landed in huge quantities leading at most times in a glut situation.

However, with a good market price and demand in fresh condition for domestic market in Kerala and Karnataka and in any condition from the fish meal plants the oil sardine is being exploited all along the coast and used for purposes as mentioned above.

Being rich in oil content, spoilage commences quickly and hence has to be marketed quickly if it is for consumption in the fresh condition. As already indicated, when landings are in huge quantity resulting in glut conditions, part of the catch is made into value added products (Canned and other ready to eat products) and the rest is used for extraction of oil and preparation of fish meal.

Major reasons for fluctuations in landings of oil sardine

The changes brought about by ENSO had a staggering effect on most other environmental parameters (SST, thermal fronts, Chlorophyll a, ONI). The altered 'Walker-circulation' pattern during ENSO events transfers more heat in the Indian Ocean region with a lag of four to six months depending upon the intensity of El-nino. There are a lot of associated changes in the northern Indian Ocean during ENSO. The impact and cascading effect of these changes on the oil sardine fishery of the country with special reference to the south west and south east coast is evident.

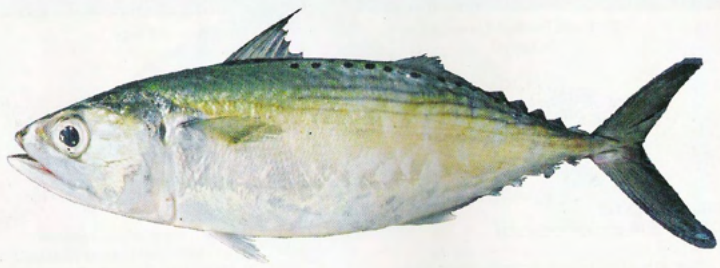
Regime shifts caused by a strong El Nino closely followed by a strong La Nina or vice versa leads to loss of resilience in the ecosystem and leads to alteration in distribution and production of sardine.

Analysis indicated that stock abundance and catch of oil sardine show very clear coincidence with El Nino occurrence. Both abundance and catch from the conventional grounds decline two years preceding the EL Nino year and start revival thereafter.

The revival of Indian oil sardine during 2001-2002 may be attributed to combination of high negative anomaly values of SST and MEI and high positive anomaly values of Chl a and UPI.

Mackerel: *Rastrelliger* spp.

- A major component of the fisheries of the region and the Konkan coast is also known as the mackerel coast
- Three species of mackerel contribute to the mackerel fisheries of the country.



R. Kanagurta
Indian mackerel



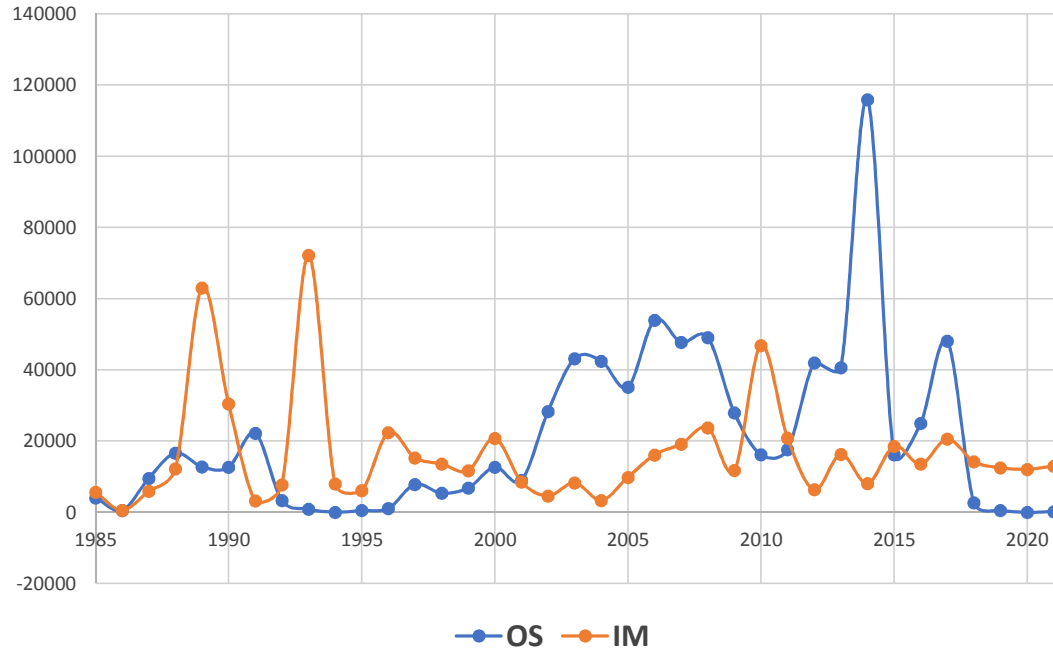
R. brachysoma
Short bodied mackerel



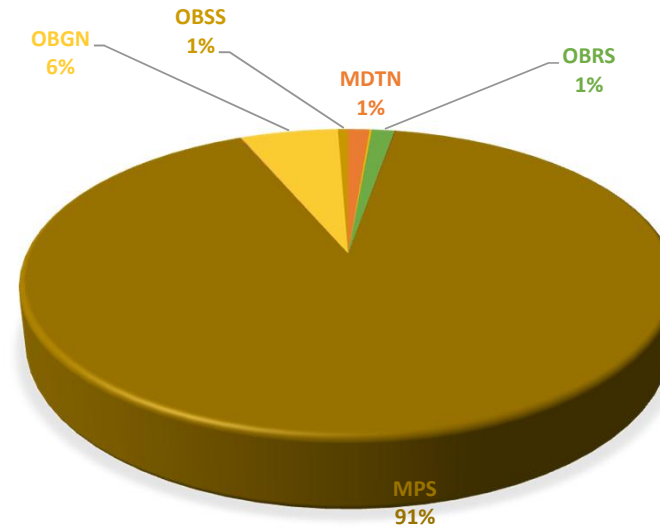
R. faughni
Island mackerel

- *R. kanagurta* is the dominant species forming more than 98% of the total mackerel catch. The other two species occur seasonally and in small quantities along the east coast.

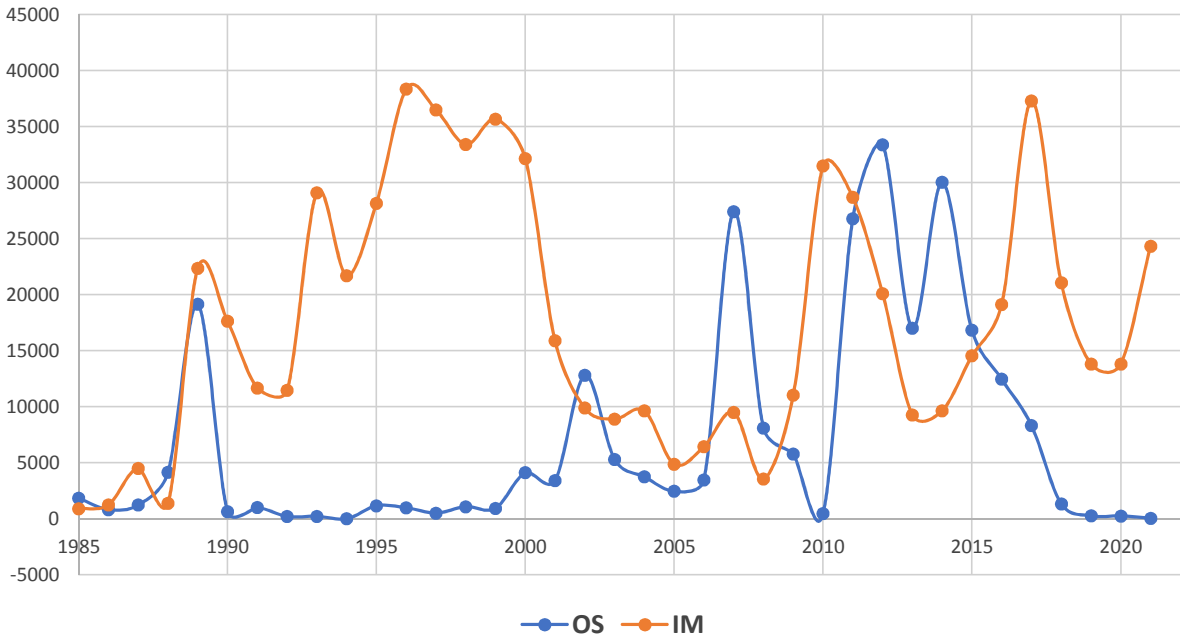
Trends in IOS and IM landings- Goa



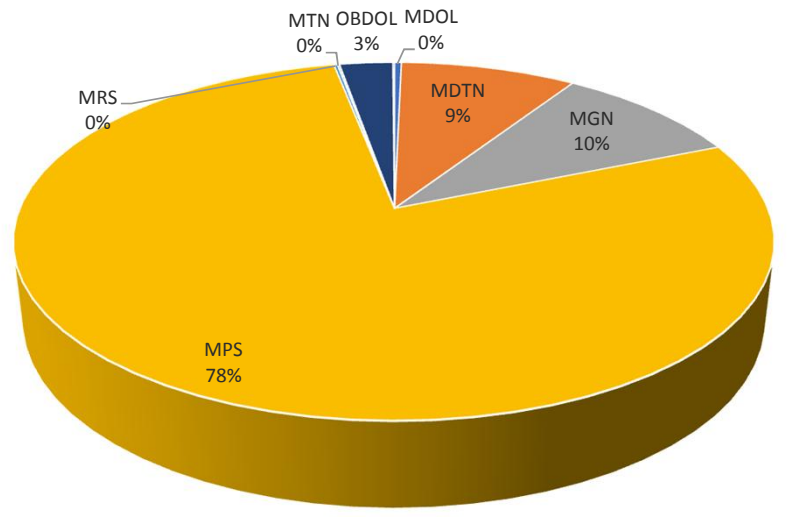
CONTRIBUTION OF DIFFERENT GEARS TO IM LANDINGS IN GOA



Trends in IOS and IM landings -Maharashtra



Contribution of different gears to IM landings in Maharashtra



R.kanagurta

- Exploited by diverse set of gear the seines, gill net, trawls & dol nets and forms a fishery throughout the year.
- Major contributor to commercial fishery is 'o' year class (96 %) followed by the 1 yr and 2 yr.
- Mackerel attains a total length of 220 mm, 250 and 280 mm during the 1st, 2nd and 3rd year.
- Predominantly a zooplankton feeder (copepods, cladocerans, Lucifera, amphipods)

Total length (mm)

Mean(mm)

• All gears	:	50-290	214
• Trawls	:	50-270	210
• Purses seines:		150-260	228
• Ringseines	:	130-205	188
• Gillnets	:	135-290	240

Environment preference of mackerel

- Mackerel generally prefers to stay immediately above the thermocline
- Comes to the surface with upwelling (August to October) and sinks to deeper waters with the sinking of thermocline (February to May)
- Post-monsoon catches are mainly by surface gears like purse seines, ring seines, pelagic trawls and drift gill nets
- Pre-monsoon catches are mostly from deeper waters are mainly landed by trawls.

Important biological reference points

- Size at first maturity (L_m) = 175 mm
- Length at recruitment (L_r) = 80 mm
- Size at first capture (L_c) = 140 mm (0.5yrs)
- L_{opt} = 195 mm (0.86 yrs)

- Length-weight relationship: $W = 0.0000017L^{3.3403}$

Disposal of catch

- Fresh form - 68%
- Curing both wet and dried form - 25%
- Canning & Pickling - 6%
- Fish meal & manure - 1 %
- Mackerel (fresh and iced) is popular as bait and used extensively by hook and line operators for catching tunas.

Purse seine





Management Practices

- i. Closed fishing season. All the coastal states follow a closed fishing season and along the south west coast it coincides with the peak spawning season of oil sardine and the period immediately after that.
- ii. Fishing trips for oil sardine by the seine fleet by choice depending on market demand and availability of fish shoals. Fishermen abstain from fishing when market demand in general is low or when very young fish not valued much only is available in the fishing grounds. However, in Kerala, an overcapacity of ring seines and targeted fishing for oil sardine almost throughout the year has resulted in excess effort. It is evident that such high exploitation levels during the later years could have contributed to growth over fishing and decline in catch in some years.
- iii. In Karnataka, the purseseines which are the main gear exploiting pelagic resources operate two specific nets one targeting oil sardine with the mesh size of 24 mm and the other targeting large pelagic with as mesh size of 45 mm and above. The large meshed purse seines '*kotibale*' are operated both during day and at night time. With '*kotibalae*' getting good catches and a higher price for the catch, more than 90% of the purse seine fishers are using '*kotibalae*' since the last three years. This has automatically reduced targeted fishing pressure on oil sardine.

- i. The Minimum Legal Size (MLS) suggested for oil sardine is 10cm (Mohammed et al, 2014 Rohit et al. 2016). MLS is in force in Kerala and observers keep strict vigilance at the landing centres. With strict enforcement, the Kerala fishers especially those operating the highly efficient ring seines abstain from fishing when small sized (<10 cm) sardines are abundant in the fishing grounds.
- ii. In Karnataka, it has been decided to implement the MLS at the procurement stage of fish processing, fish meal and fish drying yards. When small sized oil sardine is not taken up by the fish meal /processing plants, the fishers are automatically discouraged from harvesting these small fishes. Implementation of MLS for oil sardine at procurement stages in Karnataka will have wide implications on oil sardine fishing patterns in all maritime states as most fish meal plants are situated in Karnataka.
- iii. Most landing centres have weekly, monthly or occasional holidays (local festivals) which help in reducing the fishing pressure in general.
- iv. The pelagic trawls especially pair trawls (bull-trawls) are operated in nearshore waters and oil sardine forms a part of the catch. Pair trawling is banned in all states.

Namaskar

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(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT JUNE 2022

APPENDIX 8

***“ FISHERIES MANAGEMENT IN
INDIA ”***

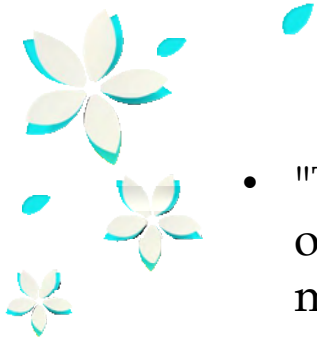


Fisheries Management in India

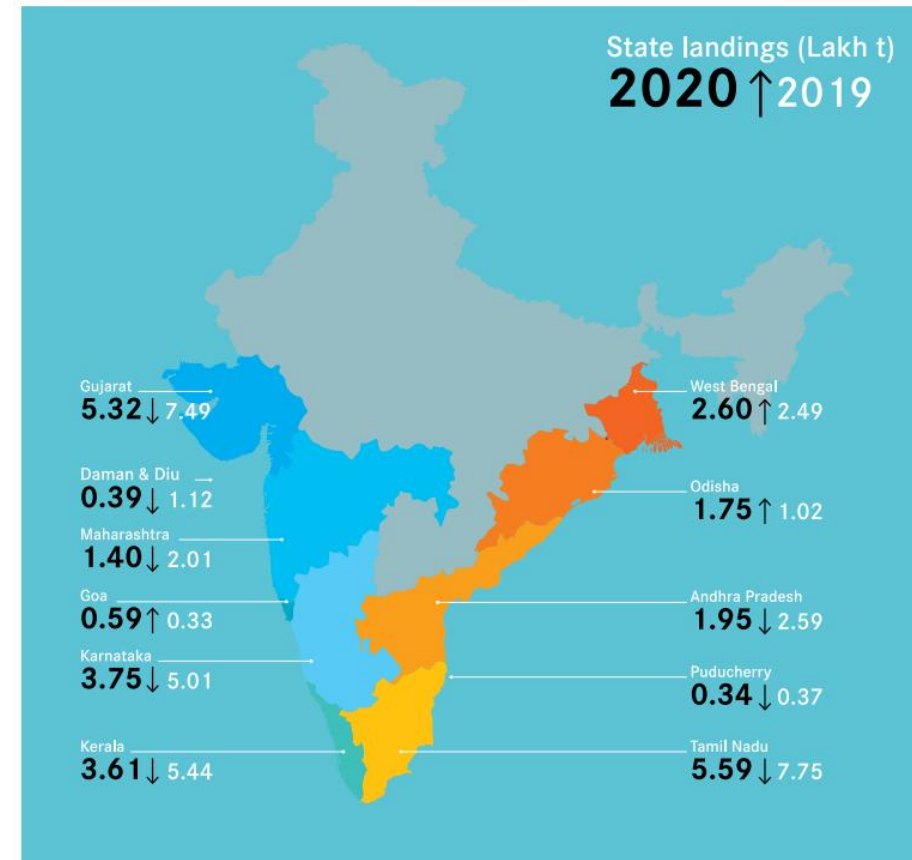
Leela Edwin
Director (Acting)

ICAR- Central Institute of Fisheries Technology
Cochin-29





- "The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources." CCRF -FAO
- Fisheries management in India, can be categorised into management of fisheries in the EEZ and in the territorial waters.
- According to the Constitution of India, the central government has jurisdiction over the fisheries in the EEZ, while the State governments have jurisdiction over fisheries in the territorial waters.





International Agreements

- Agreement for the implementation of the provisions of the United Nations Convention on the Law of the Sea of 10 December, 1982 relating to the Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stock.
- Agreement to promote compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1995).
- International Plan of Action to prevent, deter and eliminate, illegal, unreported and unregulated fishing (2001).
- International Plan of Action for Management of Fishing Capacity, Conservation and Management of Sharks, reducing incidental catch of Sea Birds in long line fishing (1999).



Indian Fisheries Act, 1897

- Indian fisheries act, 1897 is considered as the mother act of fisheries in India meant to regulate riverine fisheries and fisheries in inshore waters, to prohibit the use of poisons and dynamite in fishing, and to protect fish resources.

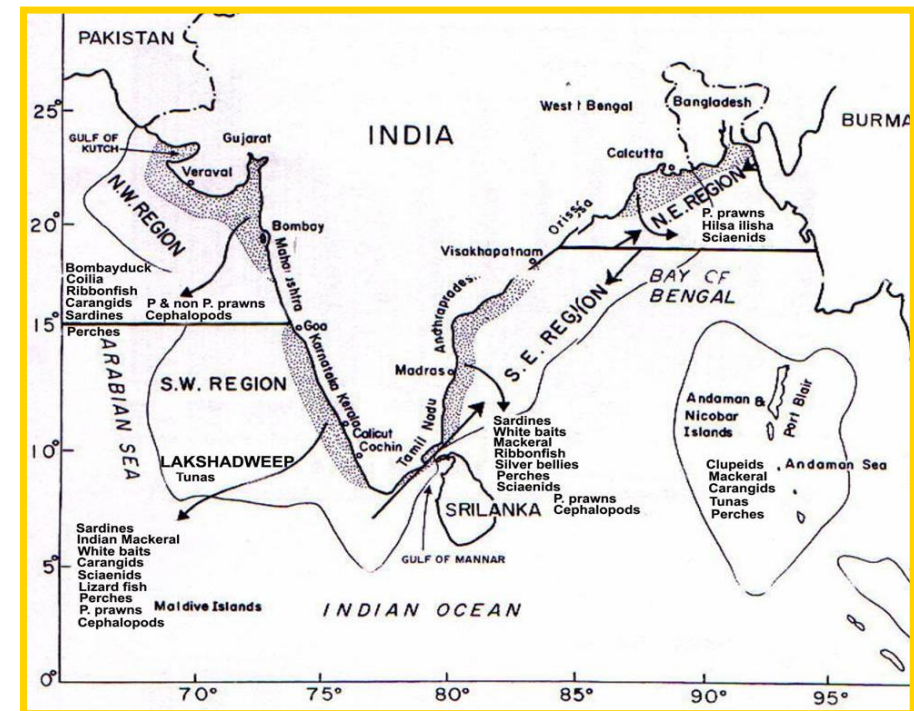
Indian Wildlife (Protection) Act, 1972

- It is under this act marine protected areas/ sanctuaries are declared.
- Marine protected areas (% of territorial waters) in India was 1.67% as of 2010. Its highest value over the past 20 years was 1.67% in 2010, while its lowest value was 1.55% in 1990.

Marine species are poorly represented on the IUCN Red List, largely because of the lack of information about them. The status of most of the larger species (marine mammals, seabirds and turtles) has been assessed and many are considered globally threatened. Threatened marine fish are currently being assessed and many are being added to the Red List including swordfish, sawfish, all tuna species except Yellowfin and Skipjack, sharks, groupers, seahorses, manta rays and the coelacanth. Very few marine invertebrates are on the IUCN Red List, with the exception of six species of Giant clam.

The Territorial Waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976

- This act recognizes the sovereign rights to conservation and management of living resources in the Indian EEZ, in addition to their exploration and exploitation.
- The EEZ is a sea zone prescribed by the UN Convention on the Law of the Sea over which a state has special rights over the exploitation and use of marine resources, including energy production from water and wind.
- The territorial sea extends to 200 nautical miles on the seas around India through enactment of territorial waters, Continental Shelf, EEZ and other maritime act, 1976.





The Majumdar Committee (1976)

- The committee was appointed to study the situation regarding conflicts between traditional and modern workers.
- It proposed the Marine Fishing Regulation Bill, and suggested a seasonal ban on trawlers.

The Indian Marine Fishing Regulation (IMFR) Act 1980

- The Indian Marine Fishing Regulation (IMFR) Act 1980 was the first comprehensive national legislation designed to regulate marine and coastal fishing activities along the Indian coast.
- IMFRA (1980) was enacted to protect the interests of different sections of people using traditional fishing crafts, to conserve fish, to regulate fishing on a scientific basis and to maintain law and order in the sea.



Marine Fisheries Regulation Acts

States	Year Adopted	Area reserved for traditional craft	Area reserved for Mechanized craft (upto 12 nautical miles)
Gujarat	2003	5 nautical miles (nm)	Beyond 5 nm (9km)
Maharashtra	1981	5 fathoms (Mumbai, Raigad, Thane) 10 fathoms (Ratnagiri, Sindhudurg)	
Goa, Daman and Diu	1980	2.6 nm(5 km)	Beyond 2.6 nm (5 km)
Karnataka	1986	3.23 nm (6 km)	Vessels upto 50ft beyond 3.23 nm (6 km) Vessels above 50ft beyond 10.79 (20 km)
Kerala Southern sector (1): Kollengode to Paravoor Pozhikkara Southern sector (2): Pozhikkara to Kovilthottam Northern Sector: Kovilthottam to Manjeswaram	1980	Southern sector (1): upto 25 fathoms Southern sector (2): upto 18 fathoms Northern sector: upto 12 fathoms	Motorized fishing zone Southern sector: area upto 20 fathoms Northern sector: area upto 10 fathoms Mechanized fishing vessels less than 25 GRT Southern sector: upto 35 fathom line Northern sector: upto 20 fathom line
Tamil Nadu	1983	3 nautical miles	Beyond 3 nautical miles
Andhra Pradesh	1994	upto 8 km	*Mech. boats - beyond 8km *20 m OAL and above - beyond 12.4 nm(23 km)
Orissa	1982	2.6 nm (5 km)	* upto 15 m - beyond 2.6 nm (5 km) *above 15 m - beyond 5.39 nm (10 km)
West Bengal	1993	Non -mechanized: up to 9 mts - till 4.3 nm (8 km) Non -mechanized above 9 mts - upto 10.7 nm (20 km) but not below 8 km	Mechanized upto 15m - upto 50 km but not 10.7 nm (20 km) Mechanized above 15m - beyond 26. 99 (50 km)



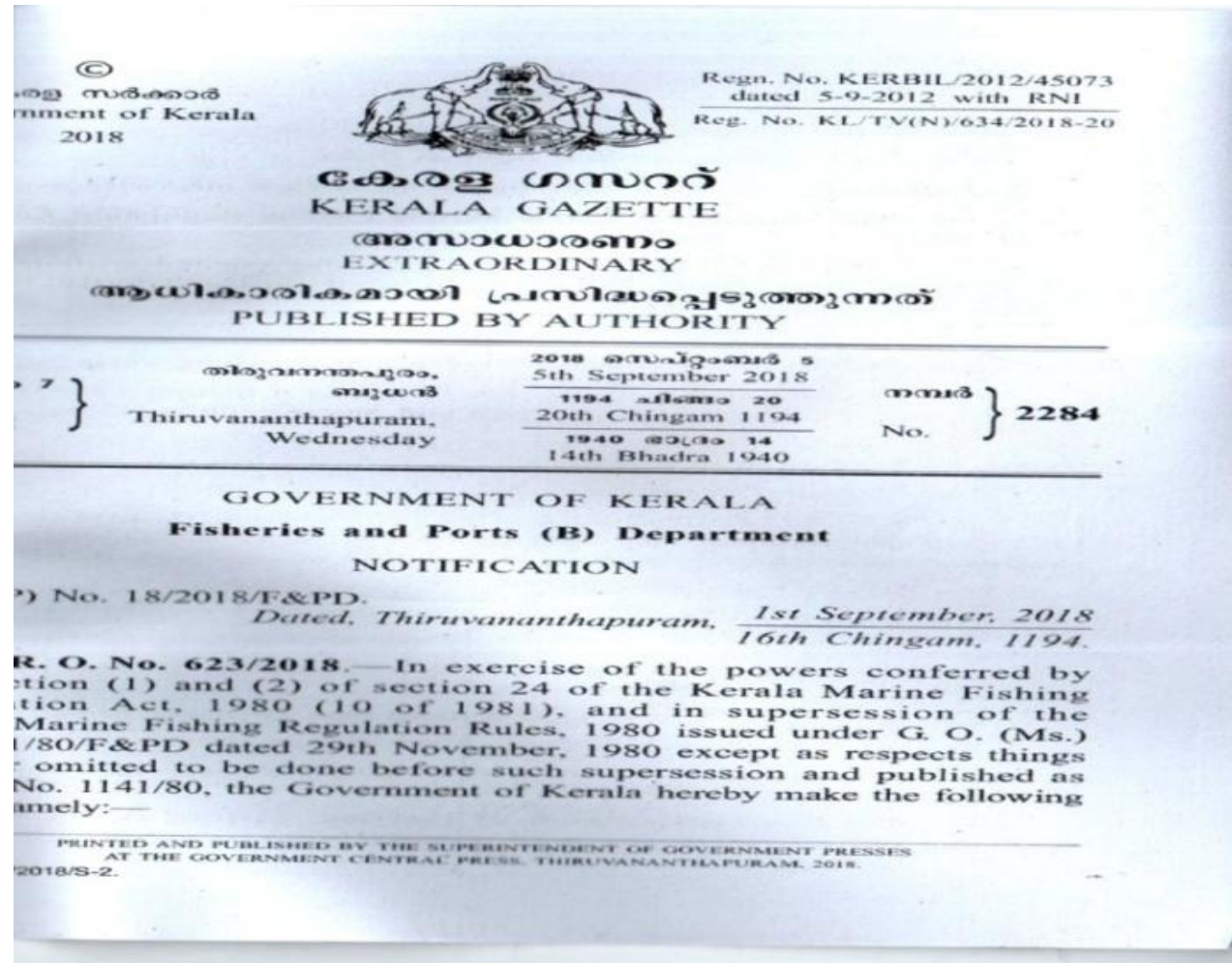


Kerala Marine Fisheries Regulation Act



- Government of Kerala enacted the Kerala Marine Fishing Regulation Act, 1980 (KMFR Act, 1980) based on the recommendation of the Majumdar Committee appointed by the Government of India.
- This act mainly envisaged to protect the interests of traditional fishermen, to conserve fish and to regulate fishing activities on scientific lines.
- The KMFR Act came into force on the 24th November, 1980.
- This Act empowers the Government to regulate, restrict or prohibit fishing in the interests of different sections of persons engaged in fishing using traditional fishing craft, to conserve fish and for maintaining law and order in the sea.
- The Act gives wide range of powers to regulate fishing operations and impose penalties for violation of provisions under the Act or Rules framed there under.

- The Govt. of Kerala has incorporated the same *in toto* in its amendment of the Marine Fisheries Regulation Act, 2018

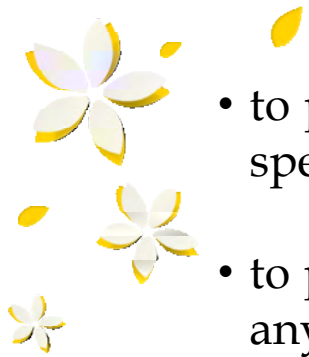




Kerala Marine Fishing Regulation Act (KMFRA) (2018)

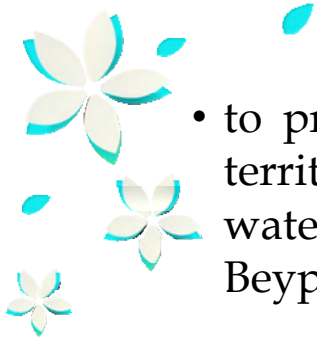
- to prohibit the construction of new fishing vessel of more than 12 M L_{OA} in boat yard or elsewhere with an intention to be used for fishing without obtaining prior permission by the vessel owner from the authorized officer.
- to prohibit the operation of multiday mechanized inboard fishing vessels with L_{OA} of more than 20 M without possessing a toilet, kitchen and at least 5 sleeping berths.
- to regulate the production, keeping, transportation and operation of certain such fishing gears by limiting maximum dimension and minimum size and type of mesh
- to prohibit introduction of new type of fishing gear with intension for fishing without the prior approval from the authorised officer
- to prohibit the use of dynamite, chemicals, toxicants, lights having more than 12 volt in fishing vessel.





- to prohibit the operation of mini trawling and pair trawling in the entire period in the specified area.
- to prohibit the use of all types of fishing methods except hand line/Trap for fishing of any species of fish from an artificial reef in the specified area.
- to prohibit fishing by fishing vessel fitted with mechanical means of propulsion from the area upto 20 -m depth line and notification should also be issued to prohibit fishing vessel fitted with mechanical means for setting or hauling of fishing gear, from the area upto 12 nautical mile along the coast from south kollenkode to Paravoor Pozhikara.
- to prohibit fishing by fishing vessel fitted with mechanical means of propulsion having more than 250 horse power and fishing craft having more than 20 meter L_{OA} , from the area upto 12 nautical mile along Paravoor Pozhikara to Manjeswaram area.
- to prohibit catching of any species of fish for the entire season from the notified protected area/Sanctuary/Refugia/Mari culture Park for the purpose of protection, conservation, management and development of marine fisheries in the specified areas.





- to prevent the passage of mechanized fishing vessel those are involved in fishing beyond territorial waters without obtaining license from the authorised officer into the territorial waters of the state other than through the passage of Neendakara, Kochi, Munambam and Beypure fishing harbours.
- to cancel, suspend or amend a license granted under Section (6), if the fishing vessel registered under KMFRA / M.S.Act illegally entered into the exclusive economic zone of other countries.
- to prohibit trawling during the month of July and November.
- to prohibit operation of any type of seine nets operated with fishing vessel having mechanical winch for hauling during the month of May to protect pelagic spawning stocks.
- to prohibit the fishing of squid and cuttle fish during the month of November in every odd year.
- to prohibit the issue of registration and licensing of new mechanized fishing vessels, in the light of the overcapacity of the fishing fleets in Kerala. However, replacement of the vessel without increasing the size can be allowed, but it should be done with the prior approval.



Regulation on fishing gear

Name of Gear	vernacular name	Minimum mesh size (mm)	Type of mesh	Maximum Dimension (hung length and hung depth)
Trawl nets				
Fish/ cephalopod trawl net	Trawl vala	35	Square	
Shrimp trawl net	Trawl vala	25	Square	
Seine net*				
Sardine/Mackerel seine nets	Chalavala	22	Diamond	600 m X 60 m
Anchovy seine nets	Netholivala	10	Diamond	250 m X 50 m
Gill net/ Drift net*				
Sardine net	Mathi/Chaalavala	33	Diamond	2000 m X 10 m
Mackerel net	Aiylavala	50	Diamond	2000 m X 10 m
Seer fish net	Ayakoora/ Ney-meenvala	104	Diamond	5000 m X 18 m
Pomfret net	Avolivala	126	Diamond	5000 m X 18 m
Prawn net	Konchu/ chem-meenvala	38	Diamond	2000 m X 10 m
Tuna net	Chooravala	80	Diamond	5000 m X 18 m
Croaker net	Kora vala	40	Diamond	2000 m X 10 m

*Stretched mesh size Source: CIFT, Kochi





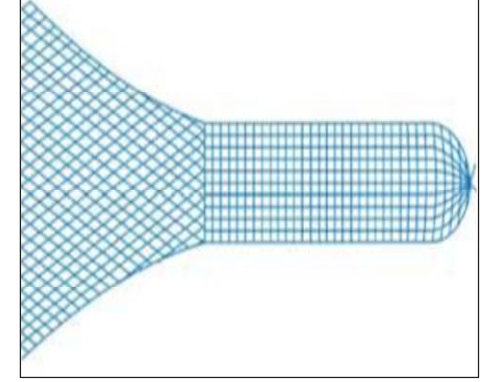
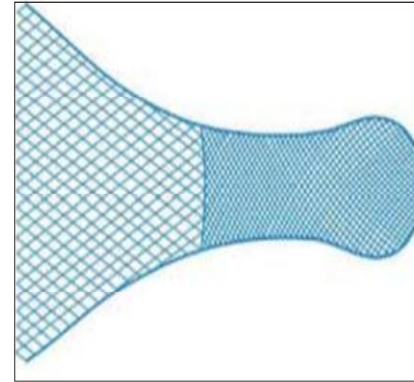
Engine Power regulations

- An all India survey conducted by CIFT (2014) shows that at present the engine horse power of all types of mechanised fishing boats exceed the prescribed limit based on speed/ length ratio.
- ICAR-CIFT classifies dimensions and maximum allowable engine horse power for different length classes of
 - trawlers
 - gillnetters
 - purse seiner
 - ring seiner
 - longliner cum trawlers

By-catch Reduction Devices (BRD)

Square mesh codend

25 B (50x50 cm
40mm mesh)

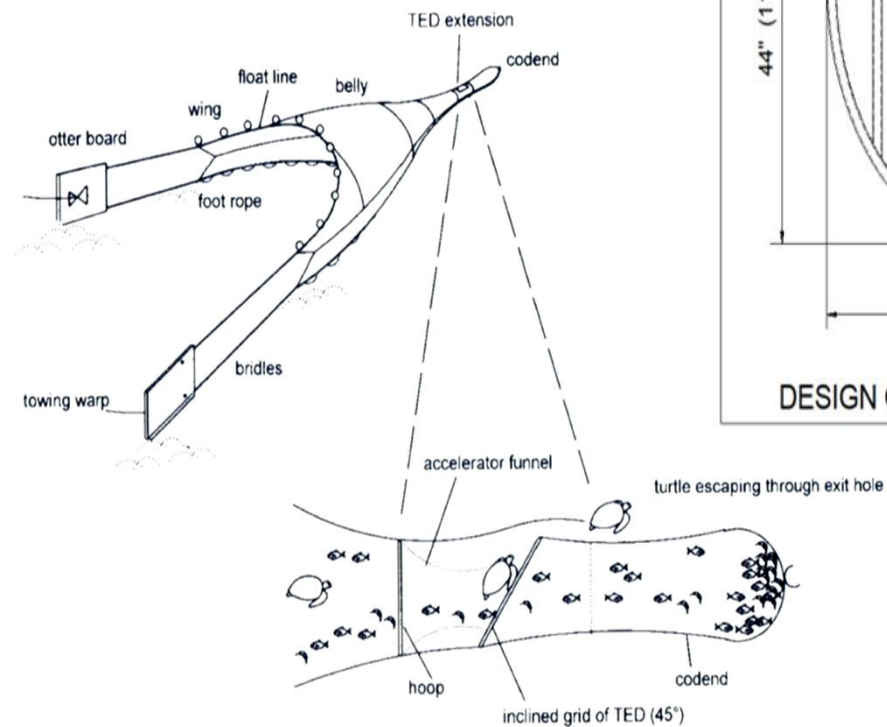


About 150 kg of juvenile fishes were excluded through the bottom panel in 1h of dragging in experimental operation



CIFT-Turtle Excluder Device (TED)

- 100% turtle exclusion
- Less than 2% shrimp catch loss





Light Fishing



- The widespread use of lights in purse-seine fishing in Goa and Karnataka has led to conflicts between traditional fisher groups and the operators of light fishing units.



- This new fishing method has come into vogue at a time when the overall marine catches along southwest coast has declined by 17% and that in Goa by a steep 55% mainly due to decline in oil sardine catches which is the mainstay of traditional fishers, and this has also compounded the issue.




Directorate of Fisheries,
Government of Goa,
Dayanand Bandodkar Marg, Panaji-Goa.
Tel. (0832) 2224838 Fax (0832) 2231049
Email No. dir-fish.goa@nic.in

Ref.No.DF/ENF/ORDER/2016-17/

Dated: 10/05/2016

ORDER

Read:- The Government Notification No. 2-1-81-FSH (V) dated 04/09/2001, published in the Official Gazette, Series I No. 24, dated 13/09/2001.

In exercise of the powers conferred by sub section (1) and (2) of section 4 of the Goa Daman and Diu Marine Fishing Regulation Act, 1980 (Act No:3 of 1981), the Government of Goa having regard to the need to conserve fish and to regulate fishing on a scientific basis and need to protect the interest of different section of persons engaged in fishing particularly those engaged in fishing using traditional fishing craft such as catamaran, country craft or canoe and the need to maintain law and order in the sea, hereby prohibits,

- i. Fishing in the specified area by bull or pair trawling.
- ii. Use or installation of the fishing gears such as LED lights, fish light attractors or any other light equipment with or without generator, on mechanized fishing vessel or motorized fishing craft, for trawling, purse-seining or gill netting.

This order shall come into force with immediate effect.

Light Fishing Banned order in
Goa and Daman & Diu

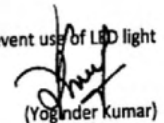
F.No.21001/3/2014-Fy(Ind)
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Animal Husbandry, Dairying & Fisheries

Krishi Bhawan, New Delhi
Dated 10th November, 2017

ORDER

The Government of India, Ministry of Agriculture & Farmers Welfare, Department of Animal Husbandry, Dairying & Fisheries being the nodal Department for matters relating to fishing and fisheries in the Indian Exclusive Economic Zone (EEZ) beyond territorial waters, vide Entry 57 list 1 of Seventh Schedule of the Constitution, orders in exercise of the powers conferred, hereunder to prohibit:

- (i) Fishing in the EEZ beyond territorial waters by bull or pair trawling;
 - (ii) Use or installation or operation of surface or submerged artificial lights / LED lights, fish light attractors or any other light equipment with or without generator on mechanized fishing vessel or motorized fishing craft for trawling, purse-seining and gill netting operations in the Indian EEZ beyond Territorial waters.
2. The order will be binding on all fishing vessels and their supporting, supply and auxiliary vessels operating in the Indian EEZ from the date of issue of this order. The advisory issued by this Department vide O.M. of even number dated 29th August, 2016 regarding use of LED light fishing stands withdrawn, henceforth.
 3. Coast Guard is requested to take necessary steps to prevent use of LED light fishing in the Indian EEZ beyond territorial waters.
 4. All the maritime States / UTs are advised to take necessary steps to prevent use of LED light fishing within and beyond the territorial waters.


(Yoginder Kumar)

Under Secretary to the Government of India

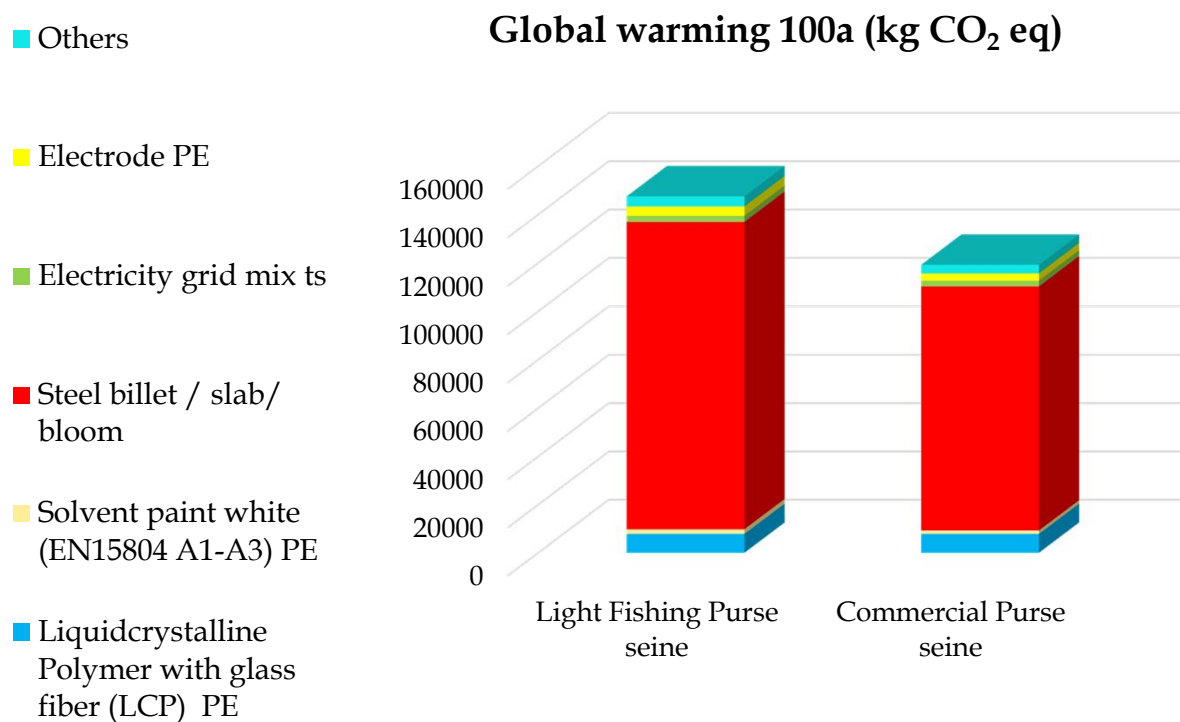
Light Fishing, Bull and pair trawling
ban order in Indian EEZ





Light fishing vessel construction - energy analysis

- Around 15% more GWP is estimated in purse seiners using light fishing.



Materials contributing towards GWP in purse seiner



Development of Deep sea fishing in India at a glance

Attempts made since the 1950s for the development of deep-sea fishing

1st Five Year Plan (1951-'56) encouraged the introduction of mothership operations and chartering of fishing grounds for deep-sea fishing operations

The 2nd Five-Year Plan envisaged the construction of fishing harbours and exploratory fishing operations.

3rd and 4th Five-year plans (1961-'74) imported Shrimp trawlers from Japan and Mexico

The first deep-sea policy (1977) was made for chartering arrangements with foreign operators.

In 2002, a new set of Guidelines for deep-sea fishing was announced by the Government of India.

Murari Committee (1996) protected interest of artisanal fishermen

Sudarshan Committee (1994)

The new deep-sea-fishing policy was announced in March 1991.

The GoI revised this policy 1986 to rectify deficiencies

Review on Deep-sea Fishing Policy, 2014

Blue Revolution Scheme 2016

National Fisheries Policy 2020

Pradhan Mantri Matsya Sampada Yojana, 2021

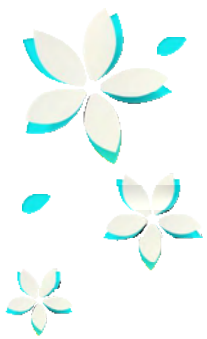
Union Budget 2021 - 5 fishing harbours to be modernised



Blue Revolution - Neel Kranti Mission (2016)

- Central outlay of Rs.3000 crore for implementation (2015-16 to 2019-20)
- Assistance for Deep Sea Fishing Vessel (Size 18-24 m OAL) for Traditional Fishermen and their Societies in Coastal States/ UTs
 - Implemented through the State Governments, UTs, State agencies/ organisations, corporations, federations, boards, Fishers Cooperatives, Central Fisheries Institutes etc. including ICAR, Central Government organizations/ Departments etc.
- Conversion of Bottom Trawlers into Deep Sea Tuna Long Liners
 - Implementation of this activity will be through NFDB or any other agency identified by the DADF
 - Only traditional/artisanal fishermen and their societies/ associations/SHGs who have registered bottom trawlers are eligible for the benefits under this scheme





National Fishery Policy, 2020

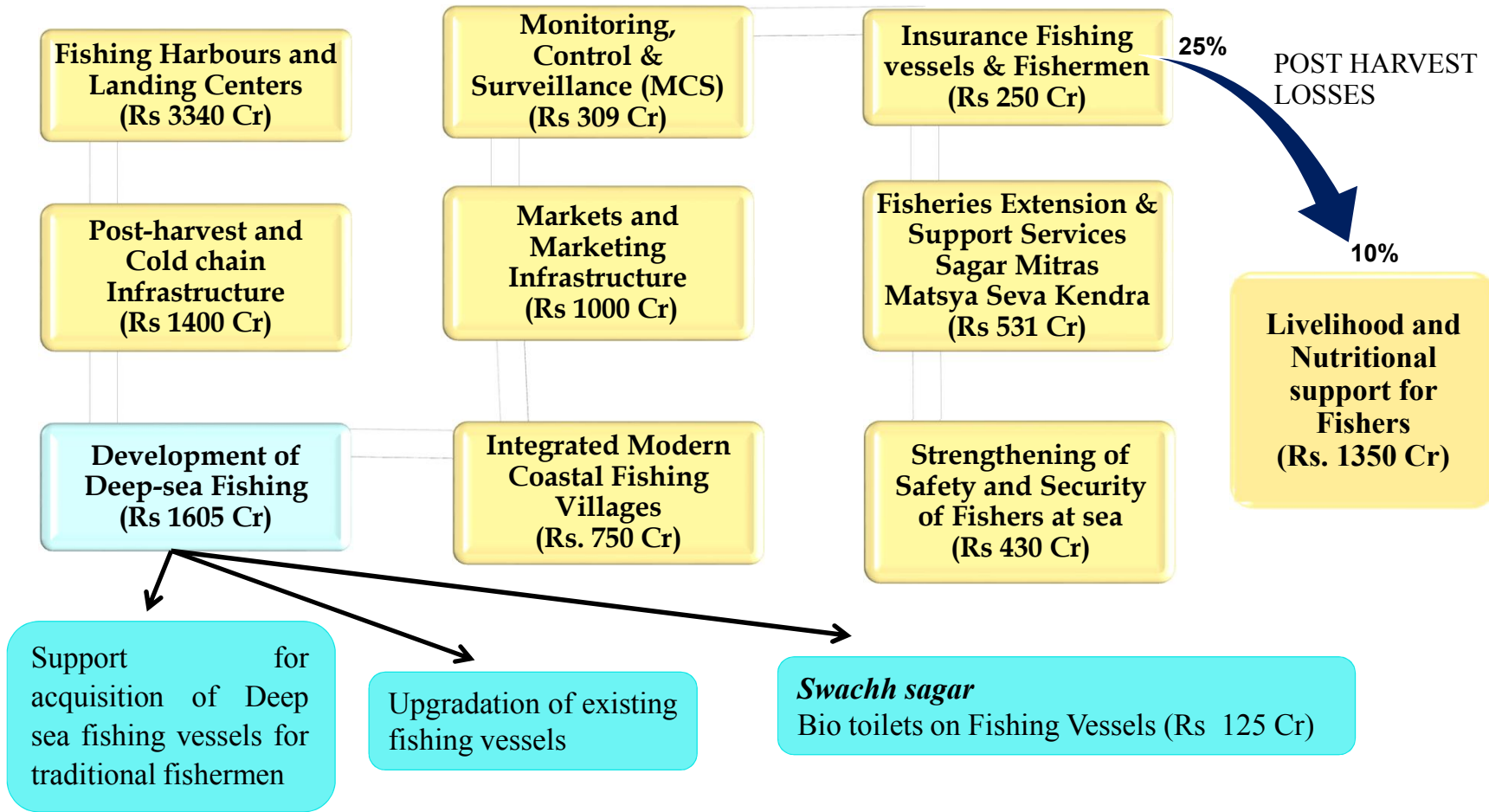
- Center will encourage and empower traditional and small-scale fisher and fisher groups for undertaking resource specific deep sea fishing.
- Untapped potential of high value resources like tuna, tuna-like species, myctophids and oceanic squids should be tapped in a sustainable manner with a precautionary approach in line with the global standards regarding wild fish harvests.
- Deep-sea Fisheries resources are to be exploited by an optimum fleet size of modern fishing vessels capable of undertaking extended voyages, infusion of modern technology and capacity building.

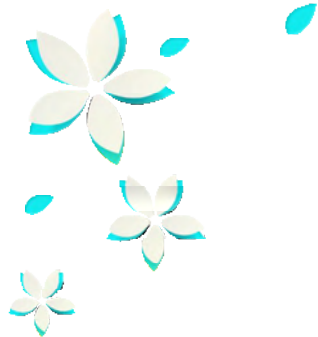


Pradhan Mantri Matsya Sampada Yojana (PMMSY)

Estimated investment of Rs 20,050 crore for its implementation during 2020-21 to 2024-25

Key activities and investments under centrally sponsored scheme component





ISSN: 2394-8019

CMFRI Marine Fisheries Policy Series No. 4

Indian Marine Fisheries Code

Guidance on a marine fisheries management model for India



INDIAN MARINE FISHERIES CODE:

GUIDANCE ON A MARINE FISHERIES MANAGEMENT MODEL FOR INDIA

K. Sunil Mohamed, K. Vijayakumaran, P.U. Zacharia, T.V. Sathianandan, G. Maheswarudu, V. Kripa, R. Narayanakumar, Prathibha Rohit, K.K. Joshi, T. V. Sankar, Leela Edwin, K. Ashok Kumar, Bindu J, Nikita Gopal and Pravin Puthra



ICAR - Central Marine Fisheries Research Institute
Post Box No. 1603, Ernakulam North P.O.,
Kochi-682 018 | Kerala | India
www.cmfri.org.in

&

ICAR - Central Institute of Fisheries Technology
CIFT Junction, Willingdon Island, Matsyapuri P.O.,
Kochi-682 029 | Kerala | India
www.cift.res.in





Thank you

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT JUNE 2022

APPENDIX 9

***“ FISHERIES REGULATION FOR
PURSE SEINE FISHING IN GOA ”***

Fisheries Regulation for Purse seine Fishing in Goa



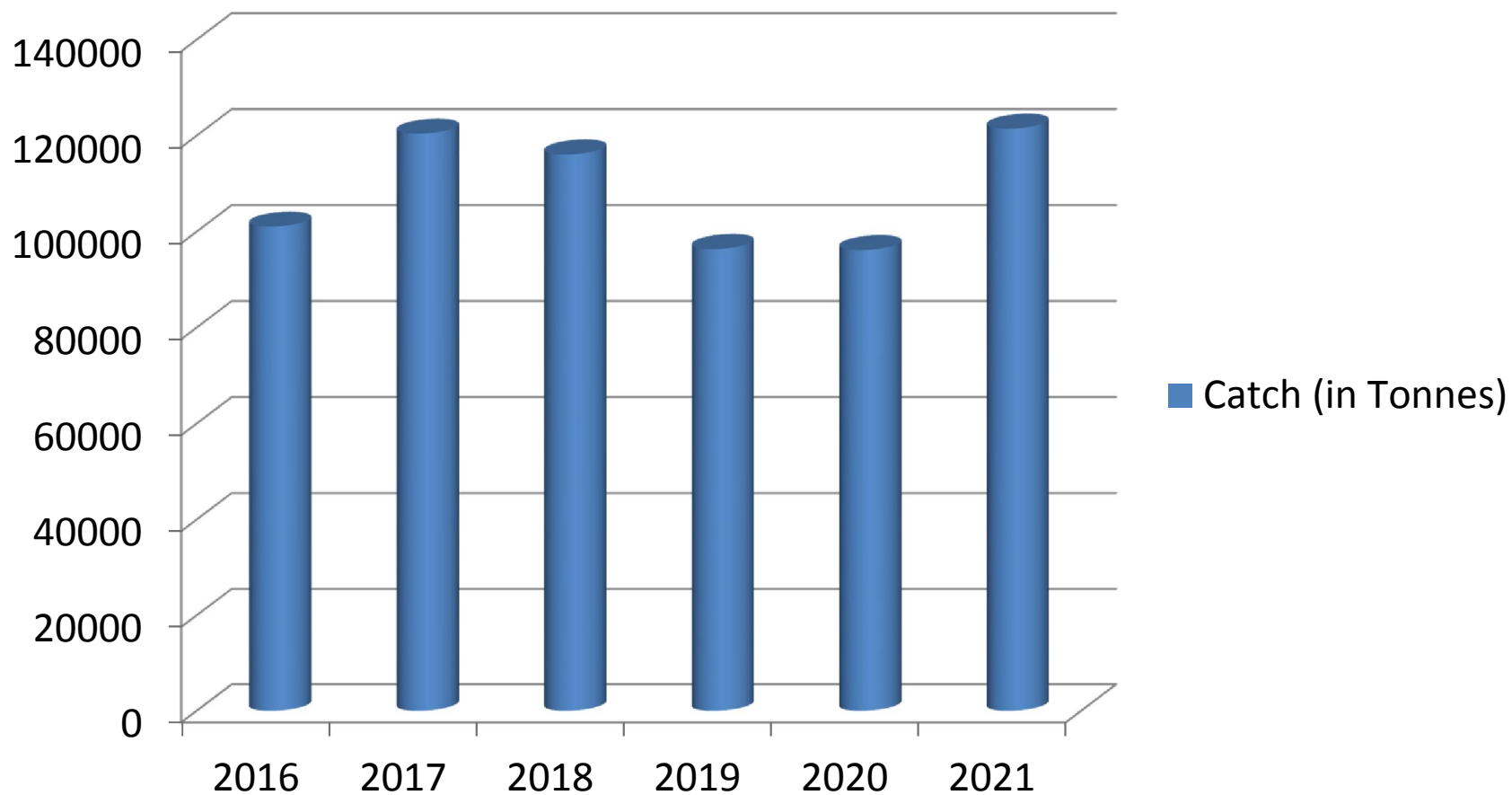
**Department of Fisheries
Government of Goa**

GOA FISHERIES AT A GLANCE

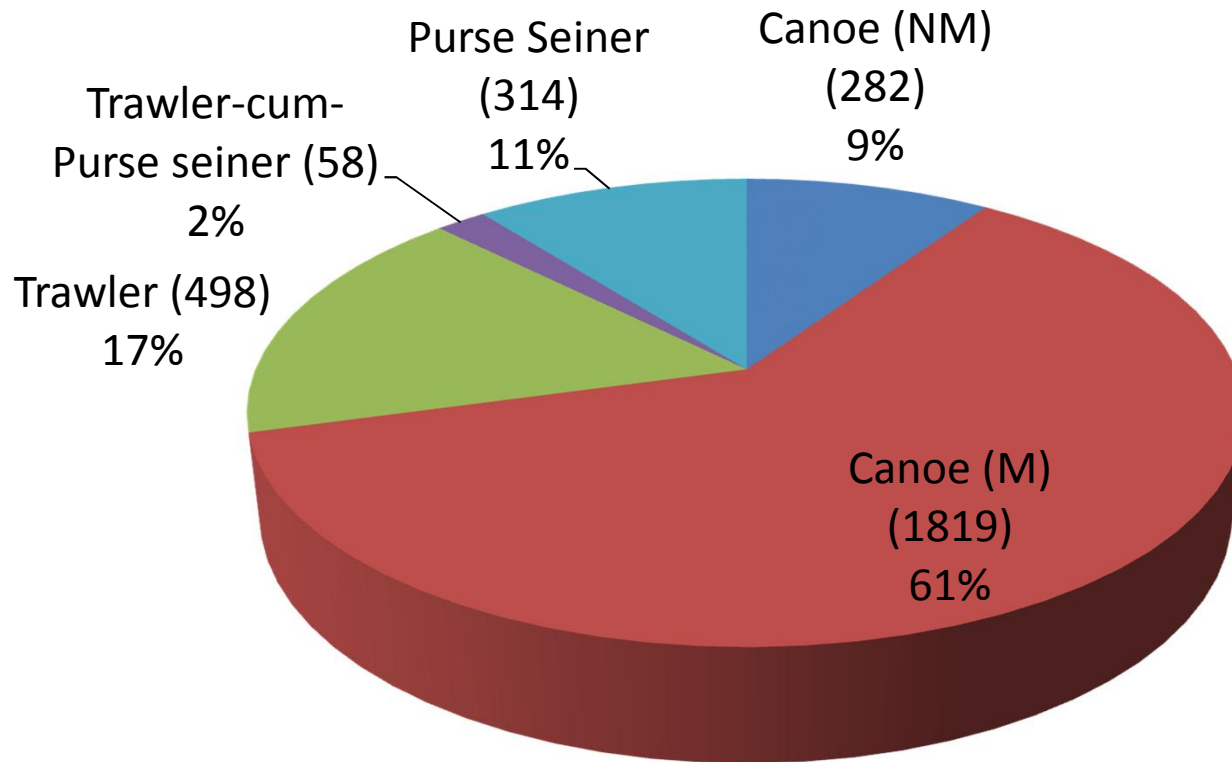
1.	Coastal length	104 km
2.	Inland waterways in Goa	250 km
3.	Inland water tanks (area)	100 ha
4.	No. of Fishing talukas	7
5.	No. of Fishing villages(North)	23
6.	No. of Fishing villages (South)	16
7.	Fisheries population	30,225
8.	Active Fisherman population	11,944
9.	No. of Mechanized Trawlers	1104
10.	No. of Motorized crafts registered	1753
11.	No. of Non-motorized crafts registered	288
13.	Fish landing centers (Major Jetties)	6
14.	Fish landing centers ramps	28

Marine Fish Production of Goa for the period from 2016 to 2021
(In Tonnes)

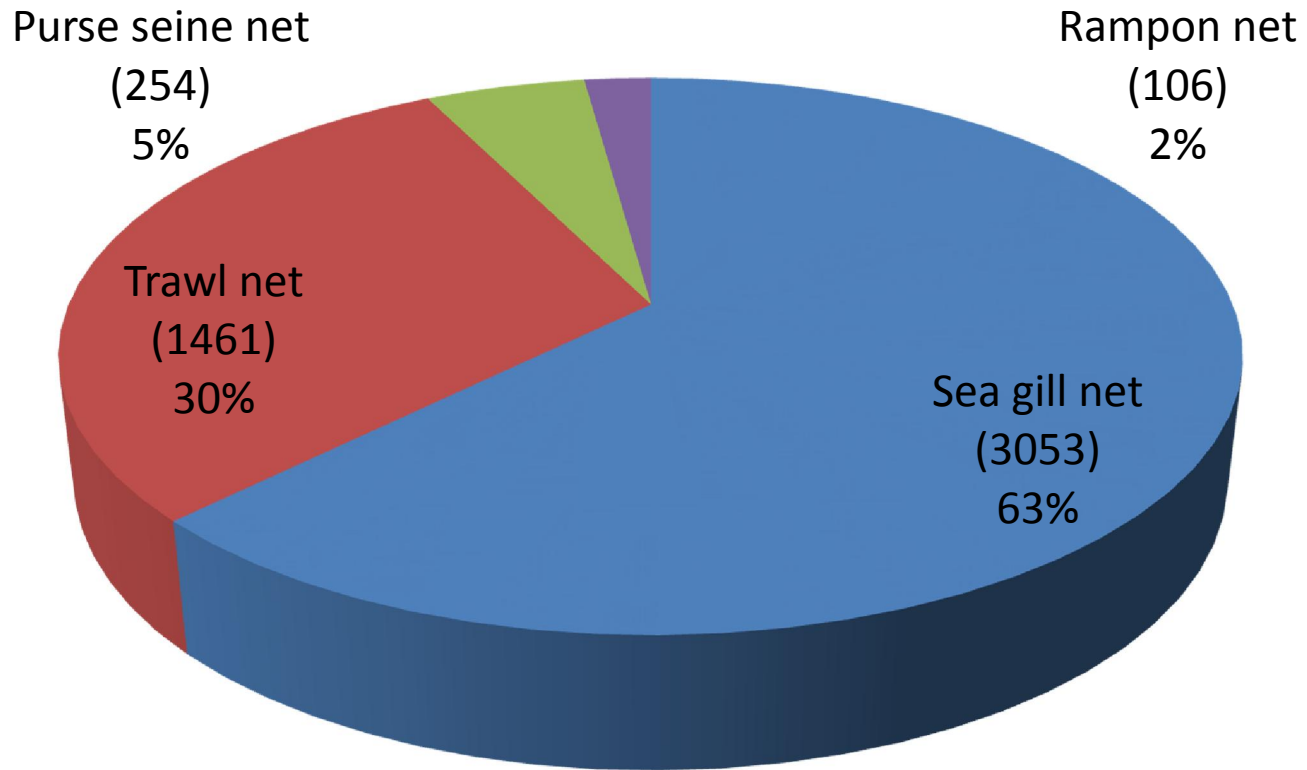
Year	2016	2017	2018	2019	2020	2021
Catch (in tonnes)	101053	120430	116095	96398	96162	121469



Crafts registered in the State



Gears registered in the State



POLICY DECISION



Regulation of Mesh size & Area of Operation

- Fishing Net License is granted to fishing net having mesh size not less than 24 mm for catching fish and 20 mm for catching prawns.

Sr. No.	Type of fishing Net	Area of operation
1	Purse-seine net	Beyond 5 km off coast in the Arabian sea within territorial waters of State of Goa
2	Trawl Net	Beyond 5 km off coast in the Arabian sea within territorial waters of State of Goa
3	Drag/ Singel/ Rampon net	Inland water /sea
4	Barrier nets (Funtaunim)	Inland water only
5	Sea-gill net (suspension nets) in sea	Sea only
6.	River Gill net (suspension nets) in river	Inland water only
7.	Stake net	Inland water only
8	Sluice gate net	Inland water only
9	Cast net	Inland water /sea
10.	Traps for catching fish, prawns, lobsters, crabs or any other molluscs	Inland water /sea
11.	Set of hooks and lines	Sea and Inland water
12.	Net not described above	Sea/inland water (as applicable)



Monsoon Fishing Ban

- As a conservation measure the Department is implementing a uniform fishing ban for the period of 61 days i.e. from 1st June to 31st July every year



Restriction On Vessel Numbers & Sizes (Policy Decisions)

- Allow fishing vessels owners to construct or purchase new fishing vessel against replacement of old cancelled Vessel Registration Certificate (VRC) only. (Since year 2001)
- Fishing vessels (trawler/Purse-seiner) are registered upto length of **23 meters** and allowed to be fitted with engine of horse power upto **300BHP**.
- Allow only **100 numbers** of new permission to construct new fishing canoes of **length 26-38 ft** fitted with **OBM up to 10 HP** per financial year.



Continued.....

- **Ban on:**
 - Fishing in Specified area by bull or pair trawling
 - Use or Installation of fishing gear such as LED light, fish light attractors or any other light equipmnet with or witout generator on mechanized fishing vessel or motorized fishing craft, for trawling, purse-seining or gill netting

(Official Gazette Series II No. 6 dated 12/05/2016)
- **Specified area**
 - Upto 5km from the coast in the sea along the entire coastline is specified as “Specified Area” i.e. ban for Mechanized fishing
- **Prohibited fishing with mechanized fishing vessel from 7.00 pm to 5.00 am**

Minimum Legal sizes

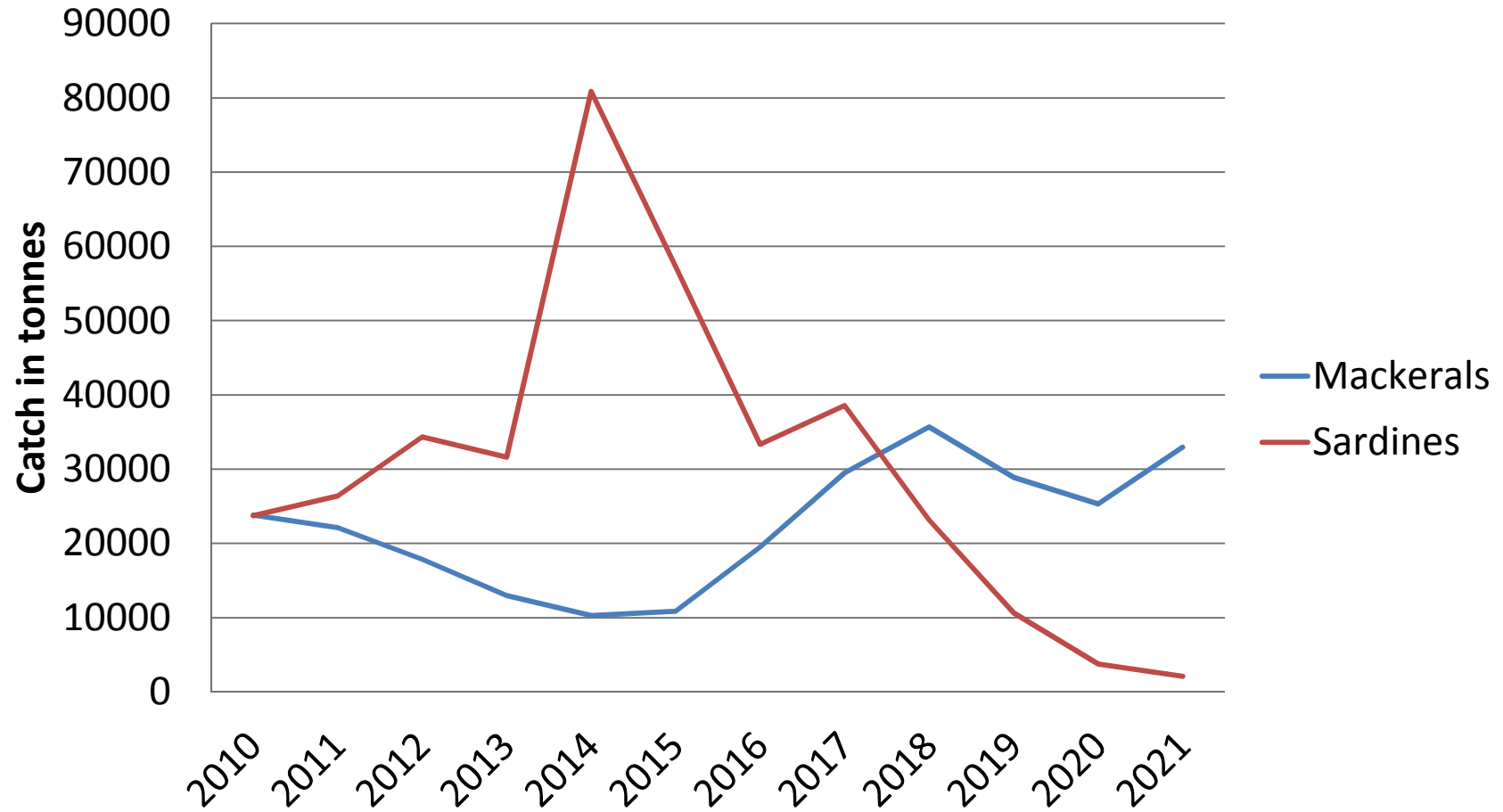
- Implementation of Minimum Legal Size (MLS) in Fisheries for 20 fish species in the State of Goa

Guide for Implementation of Minimum Legal Size in Fisheries in Goa for following Fish Species

Sr. no. (1)	Species Name (2)	Common Name (3)	Local Name (4)	MLS (mm) (5)
1.	<i>Sardinella longiceps</i>	Indian oil sardine	Taalo (ಕರಗ)	100L
2.	<i>Acanthaluteres heteroptera</i>	Indian mullet	Bhaagla (ಭಾಗಲ)	140L
3.	<i>Trichurus lepturus</i>	Robbon fish	Shala (ಶಲಾ)	400L
4.	<i>Scorpaenopsis commersoni</i>	King seer	Wassan (ವಾಸಾ)	500L
5.	<i>Jerdoniichthys indiana</i>	Indian anchovy	Motiyala (ಮರಿಯಲಾ)	700L
6.	<i>Parasiphrurus nigres</i>	Black pomfret	Saangal (ಸಾಂಗಲ)	170L
7.	<i>Eleutheronotus affinis</i>	Little tuna	Bokdo (ಬೊಡೊ)	500L
8.	<i>Sillago sillago</i>	Brown snapper	Makutala (ಮಕುತಲಾ)	1100L
9.	<i>Sardinella decussata</i>	White sardine	Vello (ವೆಲ್ಲೊ)	800L
10.	<i>Siganus lineatus</i>	Thrausilla	Rau (ರಾ)	120L
11.	<i>Lateolabrax lanceolatus</i>	White fish	Soodhaka (ಸೂಡಾಕಾ)	900L
12.	<i>Cynglossus maculatus</i>	Sole fish	Lepo (ಲೆಪೊ)	90L
13.	<i>Pomprax orientalis</i>	Silver pomfret	Paplet (ಪಾಪಲೆ)	100L
14.	<i>Sprattellus obtusirostris</i>	Grooper	Gulice (ಗುಲೀ)	300L
15.	<i>Jalilichthys spp.</i>	Sriomad	Dhodhano (ದ್ಧೊಡ್ಧಾ)	100L
16.	<i>Otolabrus spp.</i>	Coralreef	Dhodhano (ದ್ಧೊಡ್ಧಾ)	100L
17.	<i>Urosetella phyllorhiza</i>	Indian Squid	Manki (ಮಾಂಕಿ)	EDML
18.	<i>Portunus sanguinolentus</i>	Spothead crab	Kaali (ಕಾಳಿ)	70W
19.	<i>Parapenaeopsis stylirostris</i>	Koala prawn	Saanga (ಸಾಂಗಾ)	70L
20.	<i>Alpheidae affinis</i>	Large prawn	Saanga (ಸಾಂಗಾ)	90L

(Official Gazette Series II No. 41 dated 07/01/2021)

CATCH DATA OF MACKEREL AND SARDINES





Thank You

OMEGA FISHMEAL AND OIL PRIVATE LIMITED

PROJECT CO-ORDINATOR- INDIAN OIL SARDINE (GOA & MAHARASHTRA) FIP

(UNDER THE MARIN TRUST IMPROVER PROGRAMME)

FISHERY IMPROVEMENT PROJECT - WORKSHOP REPORT JUNE 2022

APPENDIX 10

“ FISHERIES REGULATION FOR PURSE SEINE FISHING IN MAHARASHTRA ”


FISHERIES REGULATION FOR PURSE SEINE FISHING IN MAHARASHTRA



**ASSISTANT COMMISSIONER OF FISHERIES,
DEPARTMENT OF FISHERIES,
RATNAGIRI**

INTRODUCTION

- Purse seines are one of the important gears operated along the west coast of India for harvesting shoaling pelagic fishes, mostly oil sardine and mackerel.
- In India purse seine was introduced on experimental basis in 1954
- In Maharashtra, fishers from the southern region (Ratnagiri and Sindhurg) adopted purse seine fishing in late eighties
- Mirkarwada emerged as a major base of operation for these purse seiners.
- In northern Maharashtra, fishers were mostly engaged in set bagnet (Dol nets) and trawl fishing
- The late 1990s when a few trawl fishers shifted to purse seine fishing expecting better economic prospects.

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- Before the introduction of purse seines, mostly smallscale exploitation of oil sardine and mackerel was done by artisanal fishers in coastal area using shore seines (rampani) and gillnets as well as small trawlers.
 - The number of purse seiners increased and boom in purse seine fishery led to migration of labourers to southern Maharashtra, mostly from Andhra Pradesh initially and later from Bihar, Uttar Pradesh and West Bengal

CONFLICTS

- Due to the promising economic returns purse seining technology was soon adopted in northern Maharashtra (Mumbai) and new purse seiners were introduced or trawl fishing boats were converted to purse seines
- The increase in purse seine fishing in nearshore waters lead to conflicts between trawl, Dol net and gill net fishers.
- This led to the notification on 13th October, 1999 under the state's Marine Fisheries Regulation Act (MFRA) whereby, the use of purse-seine gear by any mechanized fishing vessels within territorial waters of 12 nautical miles (Nm) of Greater Mumbai, Thane, Raigad, Ratnagiri and Sindhudurg districts were prohibited.
- Following the success of larger mechanized purse seining vessels, small scale fishers also made modifications in their wooden country crafts and purchased suitable small sized purse seine nets.

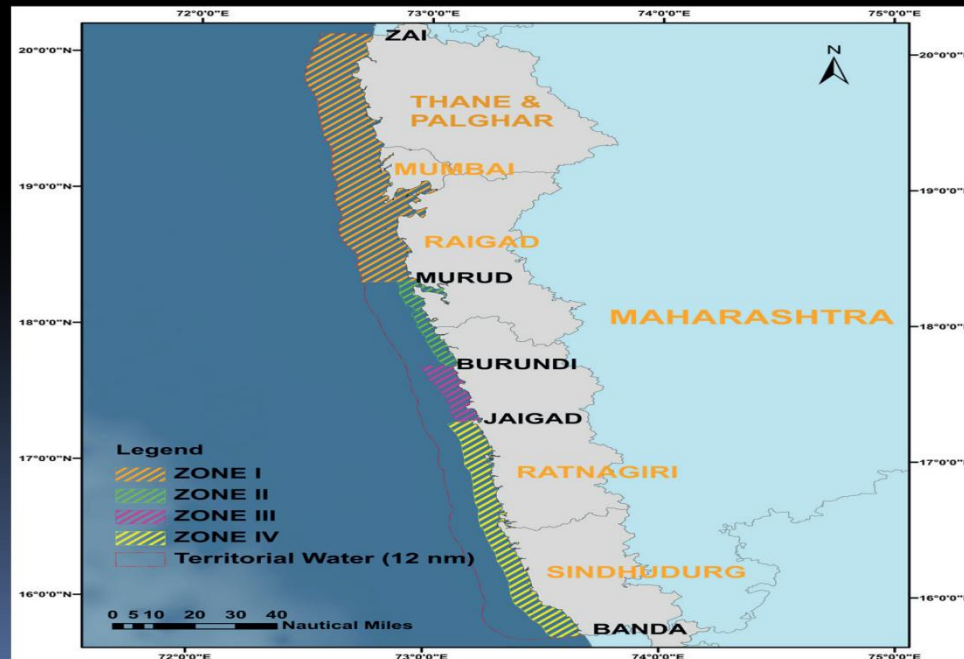
STATUS OF PURSE SEINE FISHING


- The number of FRP mini purse seines (9-13 m OAL) are increasing, especially in southern Maharashtra.
- During 2010 there were 435 purses seiners operating along the Maharashtra coast (Marine Fisheries Census, 2010) and their overall length (OAL) ranges from 14-18 m.
- The average marine pelagic fish landing in Maharashtra before introduction purse seine (1960-1990) was 76,000 tons while after introduction purse seine (1991 to 2016) it increased by about 66% to 115,000 tons
- The combined average landing of Indian mackerel and oil sardine in Maharashtra grew from 9% to 23% after introduction of purse seine.

- Important technology adoption by purse seine fishing in recent years is hydraulic power block for hauling the purse seine and Automatic Identification System (AIS) useful for navigation and tracking fishing boats.
- The increasing number of purse seines have coincided with the trend of low catches in small scale sectors and since there is overlapping area of operation among these sectors, it has lead to conflicts at sea.

FISHERIES REGULATION

- The committee appointed by Government of Maharashtra to study the status of purse seine fishing and its impact on the traditional fishing and ecology along the Maharashtra coast submitted its report in May 2012.
- Based on these recommendations Government of Maharashtra issued an order on 5th February 2016 to regulate purse seine fishing in Maharashtra to resolve conflicts among the traditional small scale fishers and purse seine fishers.
- The committee has demarcated the different zones for purse seine fishing in Maharashtra while reserving the rights of traditional fishers also. These zones are:





1. Zone (I)- Zai to Murud: Area from shore to 12 nautical miles (Nm) shall be reserved for traditional fishing. The purse seine, ring seine including mini purse seine fishing shall be prohibited in this Zone.

2. Zone (II) Murud to Burundi: Area up to 10 m (5 fathom) depth from shore shall be reserved for traditional fishing. The Purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 10 m (5 fathom) depth.

3. Zone (III) Burundi to Jaigad: Area upto 20 m (10 fathom) depth from shore shall be reserved for the traditional fishing. The purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 20 m (10 fathom) depth.

4. Zone IV Jaigad to Banda: Area upto 25m (12.5 fathom) depth from shore shall be reserved for traditional fishing. The purse seine, ring seine and mini purse seine fishing shall be permitted beyond the 25-meter (12.5 fathom) depth.

The number of existing and operational purse seine, ring seine and mini-purse seine fishing licenses shall be brought down gradually to 262 and finally to 182.

Also not issue new licenses for purse seine/ring seine (including mini-purse seine).

Purse seine, ring seine and mini-purse seine gear shall be operated during the period september to december only and within the specified zone.

To conserve the fish stock the use of hydraulic winch (boom) is also prohibited for purse seine/ring seine (including mini-purse seine) fishing operations.

In addition, gear specifications for purse seine/ ring seine (including mini-purse seine) that can be operated by any mechanized fishing vessel in the territorial waters of the state.

Specifications of Purse Seine/Ring Seine (including mini-purse seine)

	Nets Length (m)	Height (m)
1. Zai to Murud	Operation of purse seine, ring seine and mini purse seine nets are prohibited in this zone	
2. Murud to Burundi	125-500	10-40
3. Burundi to Jaigad	250-500	20-40
4. Jaigad to Banda	300-500	25-40

- The purse seine operation often creates sectoral conflicts and concerns in small scale fishers.
- Implementing the Maharashtra Marine Fishing Regulation Act, 1981 and Notification on Purse seine operation is tedious task unless monitoring mechanisms like Vessel Monitoring System (VMS) and AIS is present in all fishing vessels, along with onboard inspections at sea.
- As per the Jurisdiction of MMFRA, 1981 and 2021 state can enforce and regulate fishing in the territorial waters (12 Nm) such as,

Whoever contravenes an order under this Act relating to the regulation of purse seine or ring seine (including mini purse seine) or Trawl net including mesh size shall be liable for-

1. penalty of one lakh rupees for the first contravention;
2. penalty of two lakh rupees for the second contravention; and
3. penalty of five lakh rupees for the third or subsequent contraventions.



Thank you