CMFRI
bulletin 44
Part Two

MARCH 1990

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MANDAPAM CAMP
16-18 September 1987

Papers Presented
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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

Central Marine Fisheries Research Institute
40
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1947-1987

CMFRI

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Bulletins are issued periodically by Central Marine Fisheries Research Institute to interpret current knowledge in the various fields of research on marine fisheries and allied subjects in India.

Published by
Dr. P. S. B. R. JAMES
Director
Central Marine Fisheries Research Institute
E. R. G. Road
Cochin-682 031, India

Limited Circulation

Technical Session IV

FISHERIES TECHNOLOGY

Paper-59

ROLE OF FISHING TECHNOLOGY IN THE RESEARCH AND DEVELOPMENT OF MARINE FISHERIES IN INDIA

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ABSTRACT

Consequent to the declaration of Exclusive Economic Zone (EEZ) to 200 nautical miles, India has acquired right to explore, exploit, manage and conserve the resources of her seas. This provides, greater challenge by way of financial investment, provision of infrastructural facilities, introduction of different types of large deep sea vessels, modern fishing gear and use of modern technologies in fish handling, processing, storage and marketing.

Great strides have been made in increasing marine fish production of India from 0.53 million tonnes in 1951 to 1.81 million tonnes in 1984. This has been possible by application of various technologies including fishing technology. The introduction of bottom trawls, purse seines, high opening trawls in selected areas, double rig shrimp trawls from deep sea fleet, etc. has made significant impact on the marine fish production. Introduction of synthetic twines contributed to the increase of efficiency of gear like gill nets and trawls. Mechanisation of fishing vessels resulted in economical operations, expansion of fishing range and duration of fishing. Other aspects of fishing which helped the overall fisheries development include exploratory surveys for resources assessment, deck equipment to handle the gear, electronic instruments for finding fish and to navigate the vessels safely.

This paper deals with fishing methods in marine waters, types of vessels in operation, prospective development in fishing technology and recommendation regarding vessel and gear suitability for exploitation of deep sea resources.

INTRODUCTION

Consequent on the declaration of the Exclusive Economic Zone (EEZ) of 200 nautical miles through an act of parliament in 1976, India has acquired right to explore exploit, manage and conserve the resources of the EEZ. This provides greater challenge by way of financial investment, provisions of infrastructural facilities, introduction of different types of large deep vessels, application of modern technologies in fishing, fish processing, fish handling, storage and use new marketing strategies.

Of the total estimated potential of 4.5 m. tonnes, India is now harvesting about 1.8 m. tonnes of marine fish. The importance of harvesting all the resources at sustainable levels needs no special emphasis particularly to meet the animal protein requirements of the large Indian population. Fishing technology has a greater role in the marine fisheries development of India.

The fishing vessel, gear and operations represent in most instances a considerable share of the investment and operating costs of fishery development. Fishing and related shore services also account for a significant share of the employment opportunities. Any short comings or mistakes in planning and implementation of development programmes with respect to fishihg technology, therefore involve correspondingly high risks

of losses in time, funds and efforts. Unlike established fisheries disciplines such as fisheries biology, oceanography, statistics, fish processing, fish marketing and fishery economics, the development of fishing vessels, gear and operations have been taken for granted and left essentially to the fishermen, fishing companies with little or no government inputs. Thus fishing technology has been neglected so far. However in industrial fisheries, the trends have changed during the last few decades.

The following are some examples illustrating the role of fishing technology in the Research and Development of Marine Fisheries in India.

1) *Introduction of Synthetic material for fabrication of fishing gear.*

With the advent of synthetic fibres, fishing net manufacturing industry has made rapid strides. Synthetic fibres are superior to the natural fibres due to their rot proof nature, durability and catch efficiency. The use of synthetic materials for fishing gear fabrication is one of the major aspects of Fishing Technology which has revolutionised the fishing industry. Now there is a wide variety of synthetic materials with characteristic properties and hence sufficient choice to select suitable material to meet the requirements of individual fishing gear.

Indian fishermen especially those of Gujarat and Maharashtra have been able to increase their catch substantially with the use of nylon for gill nets. Just as hemp has almost been replaced by nylon in gill nets, cotton is replaced by nylon in Purse seines, and by H.D.P.E. in trawls.

In India Polyamide, Polyethylene and Polyprophylene are manufactured for fishing gear at present. Polypropylene in multifilament form shows great promise as a substitute for nylon because of its cheapness, strength and stretch properties.

2) *High opening bottom trawl*

The introduction of high opening bottom trawl in Indian waters has demonstrated its greater effectiveness in catching the off bottom fishes like pomfrets, carangids and catfishes besides other demersal fishes. The trials of high opening trawls from small mechanised boats by BOBP in selected places of Tamilnadu, Orissa and Gujarat have shown encouraging results. This effort has considerably improved the marine fish landings of these states. The possibilities of introducing high opening trawls in other places have to be explored.

3) *Aimed trawling*

Development of mid water trawls besides solving the problem of catching column fishes in Indian waters has been with a view to diversify the fishing effort. Two boat midwater trawling was first tried in India about a decade ago. Along the south west coast, two boat mid water trawling has proved to be highly successful during the monsoon months. This indirectly is a boon for the economic operation of small mechanised boats.

Large scale mid water trawling trials were carried out along the south west and north west coasts of India, the results of which proved the utility of the method for the exploitation of columnar fishes like horse mackerel, ribbonfish, pomfrets, catfish, carangids etc.

4) *Double rig shrimp trawling*

Double rig shrimp trawling has the advantage of producing more shrimp per unit of effort than a single large trawl. It is easier to tow and handle the gear too. All the deep sea shrimp trawlers of India have successfully adopted double rigging, contributing for the increased landings of shrimps.

In India, a scientific appraisal of double rig trawling was done on the north west coast during the mid seventies.

5) *Lobster traps*

Lobsters which are highly priced are exploited by trawls and traps mainly. The

traditional colachel traps used by fishermen of south west coast of India lack compactness and the strength to withstand rough sea conditions. Considerable efforts have been made to introduce more effective traps. Rectangular trap, Australian pot and ink well type of traps, made indigenously have been tried successfully along the south west coast. As a result of these gear, non trawlable fishing grounds can be exploited more effectively particularly in the deeper areas of the shelf for deep sea species that are less exploited at the moment.

6) *Kalava traps*

Good Kalava grounds are located in the continental shelf within a depth range of 70-100 m. There is significant potentiality for Rock Cod fishing off the south west coast of India. However trawling is not possible in the region due to bottom obstructions. The operation of hand lining gear for Kalava poses the problem of locating the exact position of the fishing ground and keeping the vessel at the same spot. To overcome these problems, Kalava traps have been operated successfully from small mechanised vessels of about 43' length. This has made it possible to fish in rough weather too.

7) *Squid jigging*

Squids, a resource which has high export value are only marginally exploited in India. They appear along with other fishes in the trawl catch. Squid jigging, a modern technique of fishing operated successfully in countries like Japan has been tried in Indian waters at a depth range of 30-380 m. Experimental squid jigging operated from an FSI vessel in 1981 did not meet with success probably due to lack of expertise. This perhaps has hampered the wide acceptance of the squid jigging in India.

8) *Diversification of fishing methods*

Several small sized shrimp trawlers and larger outrigger trawlers are operating along the Indian Coast. However, the prospects of inshore fishing for shrimps are not as lucrative as it was before. Fishing by other methods is a means to ensure better exploitation of all the marine resources. This calls for diversification of fishing methods. to operate more than one type of gear to offset the economic difficulties due to non-availability of shrimps and to fish for other resources.

Experimental fishing using diversified fishing gear like purse seine, bottom trawl, pelagic trawl, trap etc. have been demonstrated particularly in the southern maritime states of India.

There is an urgent need to carryout diversified fishing activities from small mechanised boats. Other fishing methods for diversification include long lining for sharks, Pole and line fishing for tunas.

9) *Fish Aggregation Devices (FAD)*

Fish Aggregation Devices adopted for luring fishes into a position facilitating easy capture have reduced the time expended for searching fish. FAD's are a boon particularly in the exploitation of pelagic fishes where considerable time and fuel are spent in scouting. The methods adopted for exploitation of fishes around FADs are trolling, pole and line, hand lining, gill netting and purse seining. Experiences of Lakshadweep fishermen in fishing around the floating objects is highly rewarding with the catch doubling with about 40% reduced cost.

10) *Mechanisation*

Mechanisation of fishing craft initiated during the first five year plan, has assumed great importance over the years in the development of marine fisheries of India. It has enabled the fishermen to fish in deeper waters and for a longer period resulting increased productivity and income to the fishermen.

Mechanisation of fishing operations has played a very crucial role in improving the efficiency of all fishing methods. Introduction of several gear handling devices on board which facilitate easy, efficient, faster and safer handling of gear has helped the Indian

fishing industry to grow at a quicker pace. BOBP has successfully demonstrated the use of gantries on fishing trawlers.

With a view to enable hauling of large gear like purse seine, power blocks have been developed. This has made it possible to fish in rough weather too besides increasing manpower efficiency. Line haulers in long liners have increased the operational efficiency of gear by handling longer lines in short time with reduced manpower. Efforts in reducing human effort in fishing is reflected in winches used in trawlers and purse seiners for hauling the gear mechanically. Net drums installed on board fishing vessels provide more deck space, in addition. Smooth release of the catch on the deck made more effective by the use of Cod end clips. Split links help in connecting the riggings quickly effecting saving of time

11) *Deep sea fishing*

With the declaration of the EEZ, there have been several attempts for exploration of deep sea resources bayond 40 fathoms. Deep sea fishing involves high technology, high capital investment besides high risk. Exploratory surveys conducted so far have provided fairly good information regarding the deep sea resources of the Indian EEZ.

The potential areas for increased fish poduction are the upper coast especially for prawns and cephalopods, Laccadive and Andaman waters for Skipjack and other tunas, Wadge Bank for perches and the continental slope of the south west and south east coast for prawns and lobsters. However, deep sea fishing has not caught up in India due to varied reasons like non-availability of established markets, inadequate infrastructural facilities, lack of specific deep sea vessels and due to difficulties in securing the soft loans. Further more, Industrial surveys are needed to establish economic viability of ventures.

12) *Development of electronics*

Electronic Science has revolutionised the fishing industry. Electronic equipments including fish finding, navigation and communication devices have contributed to the increased production. The days of wandering in the sea and shooting the nets blindly have gone. The skipper can now see the fish below and around his vessel, estimate the density of the population, species composition if he is experienced with the use of echo ranging instruments like echo sounder and sonar.

Instruments working on the principle of hydro acoustic give the direct indication of fish availability, bottom configuration, movement of fishes etc. which are taken into account while planning fishing operations.

The use of Net Sonde in trawling gives information regarding the vertical opening of the trawl, fish behaviour in front of the net etc.

Fishing vessels can now navigate more safely and accurately than ever before using electronic instruments like Decca, Loran, Radar, Direction Finder, Satellite navigator etc. Radar increased the capability of inshore navigation and allowed greater safety for round the clock fishing operations. Satellite navigator has modernised the position finding accurately in few seconds. Fishing vessels while at sea can communicate with the shore and other vessels by means of the radio telephone and telegraphy. Till recently fishing vessels fitted with the electronic equipments were few. However, with the addition of large offshore and deep sea fleet, their use will be widespread.

Instruments for monitoring performance of craft and gear have been developed indigenously. The performance of gear under water is measured by instruments like under water tention meter, Tilt meter, Angle of atrack meter, mesh distorsion meter etc. Catch telemeter measures the catch in the net. Handling of several electronic instrumants on board poses problems. However, universal marine tele meter developed indigenously displays all the information one by one in a single meter.

Table 1. *Craft and Gear suggested for major deep sea resources of Indian seas.*

Resources	Depth of abundance (M)	Distribution	Appropriate type of gear	Suitable type of craft
1. Thread fin bream	50-300	All over Indian Coast, More on West Coast.	Bottom trawl, Mid water trawl.	Combination vessel/ Deep sea trawler
2. Bull's eye/ Big eye	50-200	All over Indian Coast.	Bottom trawl.	Deep sea trawler.
3. Black ruff	200-500	Goa, Karnataka, Kerala, A. P., Coromandal Coast.	,,	,,
4. Drift fish	100-500	Goa to Orissa.	,,	,,
5. Scad	100-500	Goa to Orissa.	,,	,,
6. Green eye	200-600	Karnataka, Kerala.	,,	,,
7. Horse Mackerel	40-100	Gujarat, Orissa, W. B.	Mid water trawl, Purse seine.	Combination vessel.
8. Mackerel	50-200	Orissa, W. B.	High opening trawl, purse seine.	Combination / Purse Vessel. seiner.
9. Ribbon fish	20-150	Maharashtra	Bottom trawl.	,, / Deep sea trawler.
10. Lizard fish	100-500	Maharashtra, Goa, Karnataka, Kerala	Trawl	Deep Sea Trawler.
11. Squid and cuttle fish	20-500	All over Indian Coast	Trawl, Squid jigging.	Combination / Squid vessel Jigger.
12. Deep sea lobster	200-500	Karnataka, Kerala, Wadge Bank, Gulf of Mannar, T. N., A. P., Orissa.	Trawl, Traps.	Combination / Trap vessel vessel
13. Deep sea prawn	100-500	Karnataka, Kerala, T.N.	Shrimp trawl.	Deep sea trawler.
14. Deep sea shark	200-600	Kerala, T. N.	Lines.	Long liner.
15. Crabs	100-200	Wadge Bank, Gulf of Mannar.	Pot	Combination / Pot vessel. vessel.
16. Cat fishes	50-150	Karnataka, Kerala, Lower and upper east coast.	Mid water Trawl, high opening trawl	Deep Sea / Combination Trawler. Vessel.

Electronic instruments for testing and standardisation of fishing craft measure different parameters of fishing craft. Development of Bollard pull monitor and speed and distance log has made it possible to measure the bollard pull and to know the speed and distance travelled by the vessel.

Craft and gear suggested for major deep sea resources of Indian Seas

There is a good possibility of increasing the marine fish production through exploitation of deep sea resources of the Indian seas. Deep sea resources are at present least exploited due to varied reasons and constraints. Major deep sea resources, their depth of abundance, distribution, suitable gear and craft are given in table 1.

Thread fin bream fishery offers good scope for increased production from the west coast especially Kerala – Karnataka and South Maharashtra areas between 50-200 m depth. Carangid fishery is under exploited at the moment. Catfishes appear in appreciable quantities all along the west coast and to a lesser extent on the east coast. There is possibility of increasing the production of squids on the west coast. Deep sea lobsters are found in abundance at a depth range of 200–500 m. along Karnataka, Kerala, Wadge Bank, Gulf of Mannar, Tamilnadu, Andhra Pradesh and Orissa.

Single type of gear is suggested for resources found in abundance almost throughout the year. The main gear suggested for the exploitation of deep sea resources of Indian seas are bottom trawl, midwater trawl, high opening trawl, purse seine, traps, pots and lines. Bottom trawls are suggested for resources like Thread fin bream, Big eye, Black ruff, Drift fish, Scad, Geen eye, Ribbon fish, Lizard fish, Squids, Cuttlefish, Deep sea lobster etc. Some of these resources are exploited by more than one type of gear. Midwater trawl is an appropriate gear for exploitation of Horse mackerel, Thread fin bream and catfishes. High opening bottom trawl could be efficiently used for catching Mackerel and catfishes. Though squids appear in bottom trawl, squid jigging is the most appropriate method for commercial exploitation. Purse seiners can be used for Mackerel and Horse mackerel. Lines are most suitable gear for deep sea sharks occuring at a depth range of 200-600 m. Traps and pots are efficient gear for deep sea lobsters and crabs respectively besides trawls. Shrimp trawls are best suited for deep sea prawns.

As regards the vessel, multipurpose vessel of 20 meters and above with layout of wheel house forward appears to be more appropriate for the exploitation of multispecies fisheries of deep sea. Bottom trawling, midwater trawling, purse seining, trapping, jigging would be combined in the multipurpose vessel depending on the requirement. Single purpose vessel is not justified unless the fishery extends for long seasons or throughout the year. Combination trawl and purse seine, trawl and pot, trawl and squid jigging are also relevant for the exploitation of few commercial species as listed in the table. The actual size of vessel depends on the distance of fishing grounds from the harbour, depth of operation, weather conditions and economic feasibility.

CONCLUSION

The Fishing technology has an important role in any well balanced over all fisheries development. So far it has been taken for granted and left to the fishermen and industry. However a begining was made in India in 1950's with the initiation of mechanization to apply the fishing technologies developed by research. The examples listed above have contributed to the increase of marine fish production of India. The research on fishing technology needs strengthening not only for consolidating the gains achieved but also to harvest all the available resources.