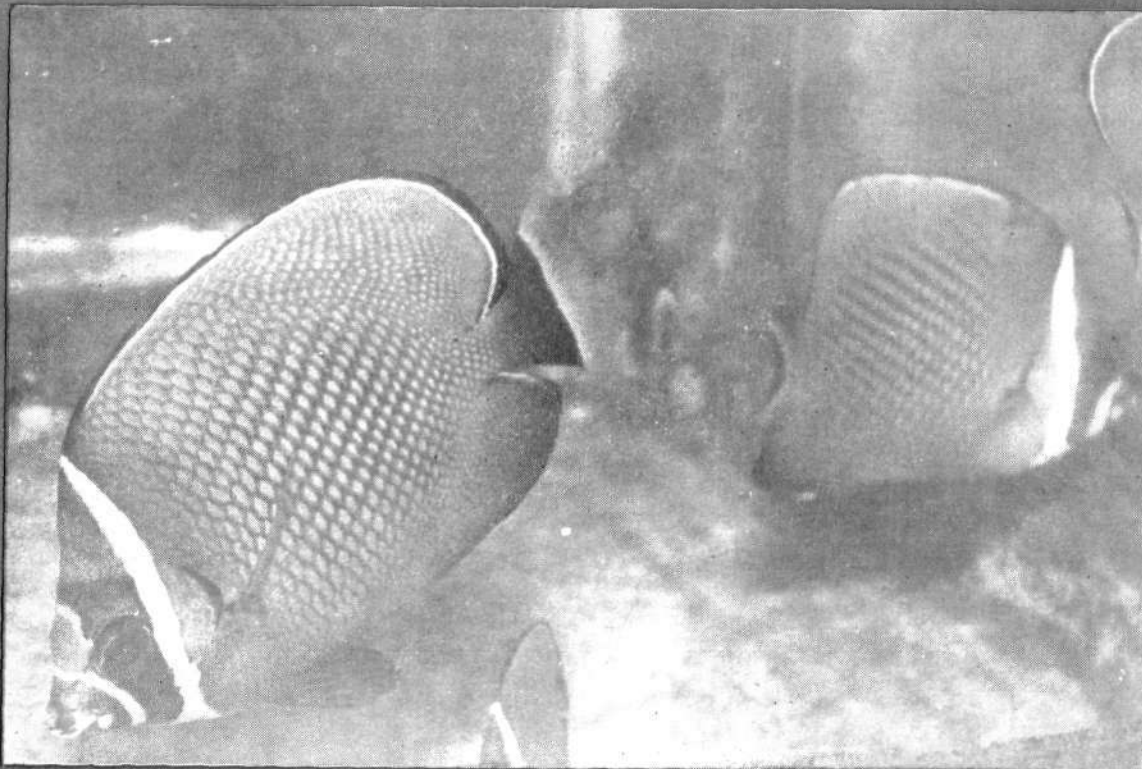




# समुद्री मात्स्यिकी सूचना सेवा MARINE FISHERIES INFORMATION SERVICE

No. 93

MARCH 1989



तकनीकी एवं विस्तार अंकावली TECHNICAL AND  
EXTENSION SERIES

केन्द्रीय समुद्री मात्स्यिकी अनुसंधान संस्थान  
CENTRAL MARINE FISHERIES  
RESEARCH INSTITUTE  
कोचिन, भारत COCHIN, INDIA

भारतीय कृषि अनुसंधान परिषद  
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

**समुद्री मात्स्यिकी सूचना सेवा :** समुद्री मात्स्यिकी पर आधारित अनुसंधान परिणामों को आयोजकों, मत्स्य उद्योगों और मत्स्य पालकों के बीच प्रसार करना और तकनीकी का प्रयोगशाला से श्रमशाला तक हस्तांतरित करना प्रस्तुत तकनीकी और विस्तार अंकावली का लक्ष्य है।

**THE MARINE FISHERIES INFORMATION SERVICE :** Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers and transfer of technology from laboratory to field.

Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.*, No. 93: 1989

## अंतर्वस्तु / CONTENTS

1. Proceedings of the Workshop on Fisheries Research and Development in Maharashtra held at Bombay on 25th and 26th May, 1988
2. Recommendations of the Workshop on Fisheries Research and Development in Maharashtra
3. Prawn fisheries of Maharashtra coast and problems of prawn culture in the state
4. General account on the problems of marine fisheries research and development in Maharashtra
5. Marine fisheries research in Maharashtra
6. Fishery oceanographic conditions off the coast of Maharashtra
7. List of participants

महाराष्ट्र में मात्स्यिकी अनुसंधान एवं विकास के बारे में तारापूर जलजीवालय में 25 और 26 मई, 1988 को संपन्न कार्यशाला की कार्यवाही

---

### मुख्य आवरण चित्र:

कीटोडोन कोल्लरिस: (वाइट कोल्लर्ड ऑर्नामेंटल मछली) सी. एम. एफ. आर. आइ. के मण्डपम क्षेत्रीय केन्द्र में अनुरक्षण की गयी एक प्रवाल मछली। मानार और पाक की खाड़ी में प्रचुर मात्रा में यह देखी जाती है।

### Front cover photo:

*Chaetodon collaris* (white collared coral fish) an ornamental coral fish found in plenty in the Palk Bay and Gulf of Mannar and being maintained at the Regional Centre of CMFRI at Mandapam.

### पृष्ठ आवरण चित्र:

ट्यूना (यूथिनस अफिनिस) की बंपर पकड़ और कारवार में ट्यूना संसाधन का एक अनन्य दृश्य।

### Back cover photo:

A bumper catch of tuna (*Euthynus affinis*) and an unique scene of tuna curing at Karwar.

**PROCEEDINGS OF THE WORKSHOP ON FISHERIES RESEARCH AND  
DEVELOPMENT IN MAHARASHTRA HELD AT BOMBAY  
ON 25TH AND 26TH MAY, 1988**

**Inauguration**

Mr. Satyabir Singh Dodd, Director of Fisheries, Maharashtra who inaugurated the workshop also welcomed the participants and expressed the wish that the deliberations during the two days would bring into focus the problems confronting the marine fisheries sector in the state. He thanked Dr. P.S.B.R. James, Director, CMFRI, Cochin for initiating this dialogue between the state government agencies and the central institutes.

Dr. P.S.B.R. James in his introductory address congratulated Mr. Dodd for being the first Director of Fisheries to convene such a workshop. He outlined the objectives of the Workshop as (1) to take stock of the available information on the status of the marine fisheries sector in the state, (2) to highlight the local problems which need immediate attention, (3) to explore the possibilities of increasing the marine fish production in the state, (4) to identify priority areas of research which should be tackled by the research institutions and (5) to develop greater co-operation between the state and central government agencies concerned with marine fisheries development. The CMFRI being the premier Institution which has been collecting data on marine fish production on all India basis for the past four decades had amassed a wealth of information. The Institute has developed a statistical model for estimating the marine fish production of the country based on a stratified random sampling system which has been highly recommended by the FAO for adoption by the developing countries. For evaluation of the fishery resources, continuous monitoring of the changes in fishing pattern, fishing areas, gear *etc.* have been done. On the occasion of the symposium held at Mandapam to celebrate the 40th anniversary of the CMFRI, the Institute has consolidated and analysed the data for the ten year period 1975-'84 and has brought out a series of publications on the appraisal of marine fish production and potentials for all maritime states of India. It was an occasion for stock taking and for visualising what should be done in the future. Copies of these

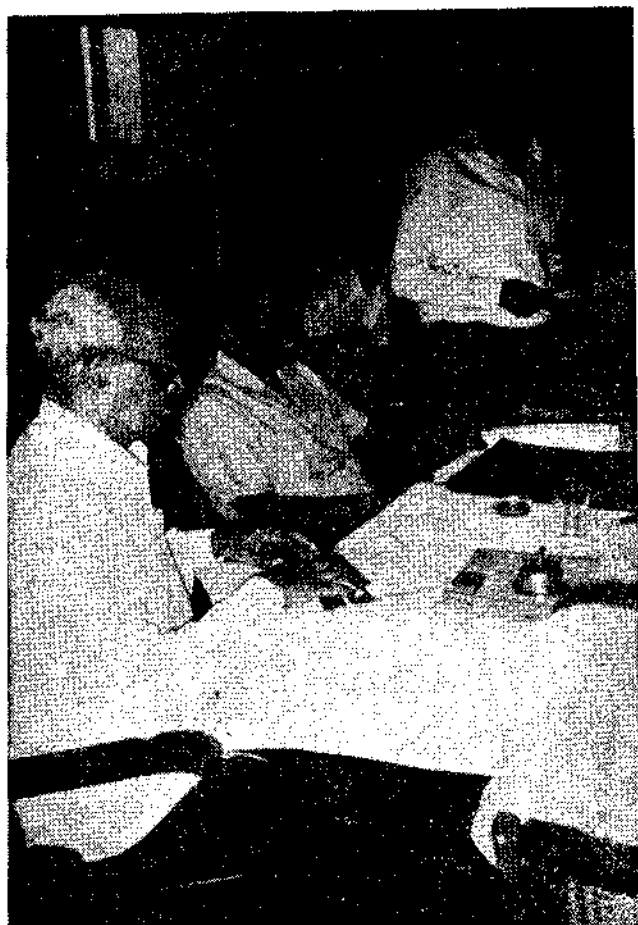
appraisals have been sent to the state fisheries departments for elucidating their comments so that the research programmes of the Institute could be reoriented to find answers to the local problems. As a follow-up measure the states were requested to organise workshops to discuss matters of importance to the state and to project ideas and suggestions which could be taken up by the concerned institutes for investigation. Dr. James expressed his happiness that Maharashtra State was the first to organise such a workshop in which all institutions and agencies connected with fisheries participated. Dr. James said that it was a landmark in the history of marine fisheries research and development which promised promotion of greater collaboration between the various fisheries institutions and organisations. Similar workshops are expected to be organised by all the other states in the coming months. These workshops will enable the CMFRI to formulate its research programmes based on the real problems of the maritime states. Constant evaluation of the programmes is an important and continuing exercise. It is proposed to conduct such workshops every five years in each state for this purpose.

**Status of marine fisheries in Maharashtra**

Dr. James then proceeded to review the status of marine fisheries in Maharashtra. The state of Maharashtra with its long coast line and wide continental shelf has ample fishery resources. It is second in marine fish production (about 3 lakh tonnes) in the country and so it is very important in the national scene. The state stands first in prawn production and is rich in resources of Bombay duck, 'ghol', 'dara', cat fish, ribbon fish and pomfret.

The Bombay duck fishery is unique to Maharashtra and Gujarat. It exhibits wide fluctuations from year to year. About 90% of the Bombay duck fishery of the country is accounted for by these two states which seem to share the same general stock. The 'dol' nets are the chief gear operated to capture this fish. The 'dol' net fishery is important in these two states and

needs to be studied in greater detail as the juveniles of a number of quality fish such as pomfrets and prawns are also caught in abundance by this gear.



Shri Satyabir Singh Dodd, Director, Maharashtra Fisheries delivers the inaugural address.

Wide yearly fluctuations in abundance and species composition are also noticed in the landings of penaeid and non-penaeid prawns and croakers. Long range programmes to understand these variations which are most probably fishery independent should be taken up. An increasing trend in the landings of ribbon fish, pomfret and cat fish is noticed, while the non-penaeid prawn landings show a declining trend.

There has been a definite increase in the landings by mechanised boats and a corresponding decline in those by non-mechanised boats. This trend is common to the entire country. About 70-75% of the marine fish production is contributed by mechanised boats. Boats fitted with outboard motors are becoming more popular and important. How far can one allow this increase in mechanised boats and how many boats

can be sustained by the resources are matters to be thought of.

Among the four coastal districts of Maharashtra the two northern districts, Thane and Greater Bombay are more developed from the fishery point of view than the two southern districts. But there is scope to increase the production from the southern states. The potential marine catch from Maharashtra waters is estimated to be 3.7 lakh tonnes.

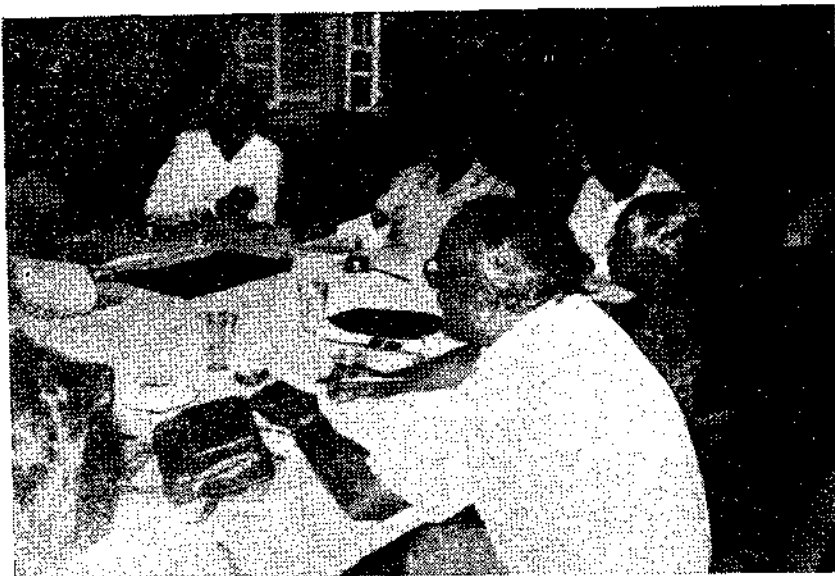
Already 3 lakh tonnes are being landed. The gap can be reduced by increasing the effort in the southern region in a phased manner.

Analysis of the data with the CMFRI shows that there is no further scope to increase production through 'dol' nets. But gill nets and trawl nets can be increased in a gradual manner, in the deeper areas of the presently exploited zone. Resources of the deeper areas and their commercial possibilities are not clearly known. The data from all sources including the FSI and the industry should be received by the National Marine Living Resources Data Centre of the CMFRI to make a proper estimate of the potential resources. Development of deep sea fishing depends on sound data base which is not available at present. The Indo-Polish Survey conducted in the N.W. region has revealed the existence of rich mid-water resources of pomfrets, horse mackerel, ribbon fishes cat fishes and eels.

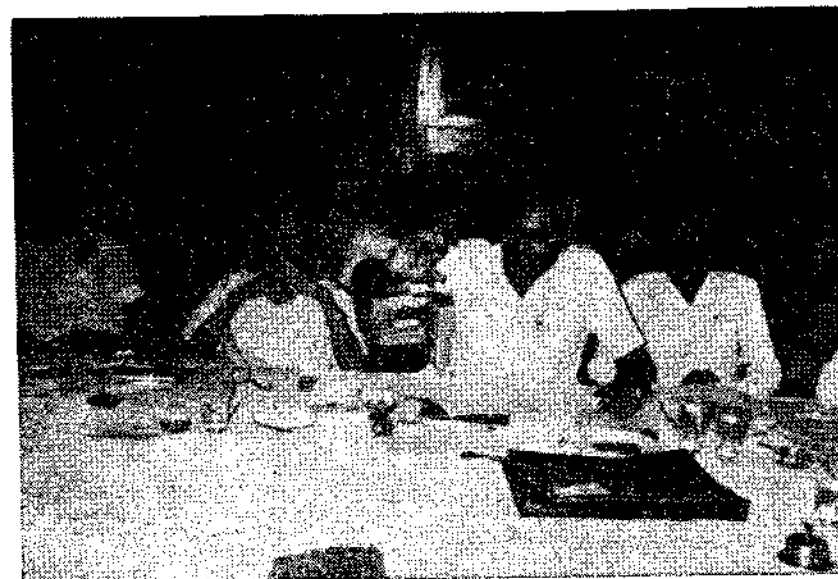
The poor fishing effort during the monsoon season due to rough weather is good for replenishment of the stocks of prawns. But we need more information on the biological aspects for conservation of prawn stocks. Some species of prawns are more available during night fishing than during day fishing. The ban on night fishing has to be reviewed in the light of this finding.

In view of the stagnation in prawn catches there is an urgent need to step up production through culture. The state should undertake detailed surveys to identify suitable areas for culture and formulate definite policies on land and water use so that prawn culture can develop in a big way in the state. Culturing of *Penaeus japonicus* and *Metapenaeus monoceros* should also be tried. The CMFRI has been helping the states of Kerala and Karnataka in setting up prawn hatcheries and is willing to extend technical assistance to the Maharashtra state also. Farms and hatcheries should be developed simultaneously.

Marine pollution is an important field which is assuming larger dimensions in recent years. Pollution



Dr. P.S.B.R. James, Director, CMFRI clarifies certain points raised by the participants. Seated on his right is Dr. C. V. Kulkarni and on his left is Dr. S. B. S. Dodd.



Dr. Y. L. Srikrishna of CIFE driving his point home. Seated on his right is Dr. A.G. Kalawar and on his left, is Dr. D.V. Bal.



Personnel from central and state fisheries and other organisations, universities and fishing industry and leading personalities associated with fisheries development of Maharashtra participated at the workshop.



Another view of the participants.

is dealt with by various Institutions. There is need to co-ordinate this work by identifying strategic locations and institutions which are capable of dealing with the local problems. A national grid of about six centres can be established. Not all reported cases of fish mortality are due to pollution. Mass fish mortality should be carefully monitored and the factors responsible should be carefully studied. But one should bear in mind that pollution of coastal waters could be one of the reasons for the stagnation in marine fish production.

For increasing production from the presently exploited zone slight increase in fishing effort is possible. But no large trawlers are needed for the purpose. Success of offshore fishing is linked with product development to popularise the fishes which at present do not have a ready market. Diversification of fishery products is essential. It is a healthy sign that processors in Maharashtra and Gujarat are interested in doing this. Waste products from the processing industry for prawns, cuttle fish and squids can be utilised as ingredients in prawn feeds. Mussel and clam flesh is also an excellent feed for growing prawns in culture systems. There is a very good demand for fish meal as poultry and cattle feed in Punjab. All these possibilities should be explored.

There is an urgent need to study the molluscan resources (oysters, mussels and clams) of the Maharashtra coast as it has a number of creeks and inlets which can harbour these resources.

Dr. James concluded by inviting all the concerned agencies to work together for the development of marine fisheries in the state.

#### **Problems faced by the fishery administration**

Mr. Sivaramakrishnan, Secretary, Government of Maharashtra, then spoke about the problems faced by the administrators. He pointed out the discrepancies in the estimates of fishery potential and actual production figures published by various organisations and stressed the need for standardizing the procedures and for reducing the areas of uncertainty. He wanted to know whether we have reached the maximum level of production as far as fish is concerned or whether there is scope to increase production from the sea. He stressed that the policies should benefit the fishermen. The conflict of interests between deep sea/off shore fishing and artisanal fishing should be tackled carefully. He wanted answers for the frequently asked question whether the trawler operations really affect the catch of traditional fishermen and whether the number of

mechanised boats can be increased further. He pointed out that income per boat is more important than catch per boat. When boats from other states are coming in every day, is there any justification in stopping mechanisation of boats in the state, he asked. Authentic and reliable information are not available for planning. The fishermen should be convinced by providing unimpeachable data. Interest of the different sectors of fishermen should be protected. In view of the fact that the prawn catch rate is more during the monsoon, should we prohibit fishing during the monsoon?

He stressed the need for gear development to make them more efficient. He pointed out that while OBMs are very popular in Gujarat, the Maharashtra fishermen want only inboard motors.

Mr. Dodd said that before regulatory measures are enforced the opinion of the scientists should be taken.

Responding to the questions raised by Mr. Sivaramakrishnan, Dr. Alagaraja said that CMFRI has been collecting fish landing data on an all India basis since 1947 and has over the years perfected a statistical system which has won the approval of the FAO and other International agencies. The discrepancies between the CMFRI data and the data collected by the states can be reconciled only by following a uniform method of assessing the landings. In fact, the CMFRI has been conducting training courses for the state government officials in the methods of collection and analysis of data for arriving at an estimate of marine fish production.

Mr. Muthu said that although the catch rate for prawns is higher during the monsoon the fishing effort is hardly 25% of the effort expended during the other months and hence the lull in fishing activity is likely to have a beneficial effect on the replenishment of the prawn stocks. Prof. Sreekrishna stressed the need for introducing mesh regulations to avoid capture of juveniles. He felt that a cod-end mesh size of 30 mm is optimum for the shrimp trawlers.

Dr. V.S. Somvanshi presented a summary of the results of the exploratory fishing conducted by the vessels of the FSI in Maharashtra waters for the period 1972-'87. A general trend of decline in the catch rate over the years was noticed. There was an indication that the low rainfall years were followed by poor catch rates. Dr. James suggested that the FSI may attempt commercial fishing in collaboration with other organisations to verify the commercial viability of fishing with large trawlers in deeper waters.



Dr. P.V. Kagwade reviewed the trends in the major fisheries of Maharashtra during the last three decades. The very lucrative fisheries for 'dara', 'ghol' and 'karkara' during the sixties have declined in the seventies and eighties. After the introduction of shrimp trawlers, a number of species of penaeid prawns contribute to the lucrative prawn fishery.

Dr. Vijayalakshmi Nair presented a review of the work on pollution undertaken by the NIO. Mercury pollution is very high in Thane creek due to industries. Mahim creek is practically dead with very high BOD levels. While polychaetes dominate in sewage polluted areas, foraminiferans are common in industrially polluted creeks. The high primary productivity in polluted areas does not lead to increase in fishery resources, due to damage of the environment. Growth of oysters in the highly polluted Bandra shore is less compared to their growth in the less polluted Mudh area. Mr. Dodd said that since most of the areas identified as suitable for culture are situated adjacent to the creeks, the possible effects of pollutants on the cultured organisms should be assessed. Dr. James suggested that existing information on marine pollution in Indian waters may be collected and presented as pollution status maps by the Pollution Control Board.

Dr. M. Devaraj, then presented his paper on the population dynamics of the marine fishery resources of Bombay based on the catch and effort data published by the CMFRI. He emphasised the need to collect reliable data on effort for each type of fishing gear. The importance of speeding up the calculations using computers was stressed by Shri K.K. Ghosh. The drawbacks of the surplus production model used by Dr. Devaraj were pointed out by Dr. Alagaraja.

Dr. Arul James spoke about the low cost products developed by the CIFT utilising the prawn and fish caught by the 'dol' nets. Dr. James stressed the need to develop value added products from the non-conventional deep sea fish. He also added that the technologies evolved by the CIFT should be taken to the people through extension programmes. Dr. Kalawar said that people want fish as fish and not as wafers, pickles, etc. This preference should be borne in mind while developing new fishery products. Mr. K.K. Ghosh pointed out the need to do market research for fisheries products. The importance of popularising hygienic methods of drying fish was stressed by Dr. James.

Prof. Sreekrishna reviewed the recent advances in craft and gear technology in detail. Use of high opening trawl nets, matching mesh size to engine power,

two-boat mid-water trawling, rigging to increase the sweep of the trawl nets, changing the design of the existing boats to make them less heavy, use of fuel saving devices such as Kort nozzles are some of the suggestions put forward by Prof. Sreekrishna to improve the fishing efficiency of the fleet. Dr. James suggested that a small group in the state can take up the work of testing these new technologies. He also suggested that the state government should put artificial reefs for the benefit of the fishermen. The CMFRI could give technical support in this work. Lack of adequate information on purse seine operations in the southern part of Maharashtra was highlighted, during the discussions. Dr. James said that CMFRI will take steps to fill this lacuna.

Mr. Dodd spoke on the problems encountered in implementation of the Maharashtra Maritime Fisheries Regulation Act. Dr. Kalawar elaborated the provisions of the Act and suggested practical ways of solving some of the problems. Mr. Joshi, Deputy Director of Fisheries, stressed the need to include the District Fishery Officer in enforcing the Act.

Dr. Kulkarni spoke about the need to expand the physical facilities at the Taraporevala Aquarium in view of its mounting popularity. Steps to show video films on marine life for the visitors to the aquarium was also suggested. The possibility of establishing a dolphinarium should also be explored, he said.

#### **Concluding remarks of Dr. James**

Summarising the deliberations of the two-days workshop, Dr. James listed out the salient points that emerged during the discussions.

The CMFRI would like to continue publishing the data on all India marine fish production after hearing the opinion of the maritime states also. The Institute is ready to train the officials from the state fisheries departments in the statistical methods evolved by the CMFRI.

*Marine Fisheries Regulation Acts* should be formulated on a national basis after examining all the issues involved. Self regulatory measures adopted by the fishermen themselves to avoid conflicts at sea should be encouraged. The scientific basis for regulations needs urgent attention.

While formulating the policy on introduction of more trawlers, the effect of such a step on the small scale sector should be carefully considered.



There are no solutions yet to problems created by inter-state migration of fishing boats during the fishing seasons. Such larger issues should be taken up at the higher levels.

Problems of the fishermen community engaged in 'dol' net fishery, 'dara' fishery and other traditional fisheries viz-a-viz the introduction of purse seining, deepwater/offshore fishing should be examined in greater detail.

The effects of bottom trawling on the seabed and the benthic organisms and their repercussions on the fishery of the region should be studied.

The optimum number and type of fishing boats for each state/region is to be determined. Collection of reliable statistics on existing boats is vital for this work.

Special efforts are to be made to study the monsoon fishery for prawns along the entire west coast to answer questions regarding banning fishing during the monsoon period.

An all India project to study the effects of the introduction of OBMs in all the states may be proposed with proper funding.

The effect of drought conditions on the marine fisheries should be examined. The relationship between a good monsoon and spawning success of fishes needs to be understood.

The existing information on the status of marine pollution in the country may be collected and brought out in the form of pollution status maps.

The FSI may take up commercial fishing in deeper areas with larger vessels to work out the economic viability of such ventures.

The CMFRI may critically examine the changes that have taken place in the fishery for 'ghol', 'dara' and 'karkara' in the Maharashtra state over the years.

New prawn resources have been discovered in Maharashtra waters. The CMFRI would study these resources in greater detail.

Brackishwater fish farming can increase fish production in the state. Microlevel surveys to locate suitable sites may be taken up by the state govt./MPEDA. The possible effects of pollution on brackishwater farming

should be assessed. Development of hatcheries and farms should go hand in hand.

Suitable mathematical models should be developed to study the population dynamics of the multispecies fisheries of the Indian seas. The models developed in the temperate waters for slow growing, long lived species with well defined spawning periods are not applicable to the tropical fish with short life span, fast growth rate and year round spawning.

CMFRI has developed suitable proformae for collection of basic data on catch and effort. A simplified proforma for large vessels has been prepared and given to the Chairman, MPEDA for distribution to the large vessels. It is essential that the basic data are supplied by these vessels to the CMFRI for proper monitoring of stocks.

There is an urgent need to assess the untapped fishery resources of each state and work out ways and means of increasing the catch. The fixing of production targets for the 8th plan period should be realistic in relation to the resource potential.

The non-conventional fish which are caught in the deeper regions should be the target of research on the processing side by the CIFT, IFP and CIFE. Extension work to popularize the technologies and products developed should be intensified.

All available fishing technologies to be prioritized and the relevant ones chosen for implementation by the various maritime states in a phased manner, according to local requirements.

The CMFRI would devote special attention to the study of monsoon fishery on the west coast, the purse seine fishery in southern Maharashtra and the breeding biology of prawns from the point of view of conservation of the resources.

Trade in ornamental marine fishes is a neglected field. Rich resources of ornamental fish are available in the Lakshadweep and Andaman groups of islands and also in the islands in the Gulf of Mannar region. In this connection the Taraporevala Aquarium which is the most popular marine aquarium in the country can take a lead in doing research and extension work in this new field. The CMFRI has identified about 60 species of ornamental fishes in the Lakshadweep islands and has initiated work in studying them.



## RECOMMENDATIONS OF THE WORKSHOP ON MARINE FISHERIES RESEARCH AND DEVELOPMENT IN MAHARASHTRA

1. The workshop discussed the present status of collection of marine fish catch statistics in the country and the problems involved in the same. It noted that the CMFRI had discontinued publication of marine fish catch statistics from the year 1986-'87 and the responsibility has been given to the maritime states for publication of the catch statistics for each of the States. However, the workshop felt that the CMFRI should continue to reconcile the figures obtained by the states and publish the same. (Action: CMFRI and S.F.D., Maharashtra).
2. The present methods of collection of fish catch statistics and documentation have been discussed at the workshop. Attention of the participants is drawn to the workshop held by CMFRI on "Acquisition and Dissemination of Data on Marine Living Resources of Indian Seas" at Cochin during which as a result of discussions certain proforma were prepared by CMFRI and published in Marine Fisheries Information Service, No. 46 for the use of various organizations. The workshop felt that in addition to these schedules there is a need to develop suitable schedules for incorporating data on socio-economic conditions in marine fisheries. In order to develop such schedules, a working group consisting of representatives of CMFRI, FSI and CIFE has been proposed to be constituted. CMFRI may convene the meeting for this purpose. (Action: CMFRI).
3. The workshop felt that catch and effort data for various commercial fisheries are vital for stock assessment. Therefore it is suggested that suitable models may be used in such studies and also attempts made to determine which model helps to understand the situation better. (Action: CMFRI, CIFE and FSI).
4. The workshop discussed the nature of presently exploited resources and the resources that can be exploited to increase fish production in the state. A critical analysis of this situation by CMFRI indicated that while there should be no further increase in intensity on fishing by the 'dol' nets, the effort by gill nets and trawl nets can be marginally increased so as to obtain an additional production of about 60,000 tonnes. For fixing the target for marine fish production from the presently exploited region in the state, this aspect should be taken into consideration. Any additional target that may be suggested for the state is naturally linked with the untapped resources, the infrastructure needed and the economics involved in exploitation of such resources. Therefore, while fixing of targets the gap that exists between the potential resources and the presently exploited resources should be taken into consideration. Any arbitrary fixation of target for marine fish production is likely to be met with difficulties. (Action: SFD, Maharashtra, CMFRI and Min. Agri., Government of India).
5. It was brought to the notice of the workshop that in southern Maharashtra there are about 60 purse-seiners operating. But the effects of purse-seine operation in this region on the traditional methods of fishing are not clearly known. The workshop therefore, recommends that the CMFRI may make a detailed study on the effect of purse-seine fishing both on the resources as well as the traditional methods of fishing. (Action: CMFRI).
6. It was brought to the notice of the workshop that the classical resources like 'ghol', 'dara', 'koth' and 'wam' are now not seen in such abundance as seen some years ago. Different reasons have been attributed to explain the situation like emphasis on and diversion of fishing activity for shrimp, probable decline in the stocks and changing methods of fishing. However, the CMFRI may examine the situation by making a critical review on the basis of data collected over the past 10 years for indicating the reasons. (Action: CMFRI).
7. The workshop discussed the problem of conservation of shrimp resources during the monsoon season and felt that adequate scientific basis for regulation of the fishery is at present not available. Therefore, it is suggested that the CMFRI should undertake a detailed study of the monsoon fishery along the west coast and provide the scientific basis for the economics of such fishing and conservation of resources. (Action: CMFRI).
8. The Maharashtra Government would like to know the commercial feasibility of exploiting marine fisheries resources beyond the 40 fathoms depth

along the coast. In order to meet this requirement, it is suggested that a pilot project be immediately initiated by FSI through deployment of their boats to assess the resources of the region and commercial feasibility of exploitation of such resources with the help of other Institutions. (Action: FSI).

9. The workshop discussed the present status of operation of 'dol' nets in Maharashtra especially the species composition, the size of various species and the mesh size of the 'dol' nets. Since this is one of the important methods of fishing in the state, a detailed study on the possible effects of operation of 'dol' nets on fish populations in the region is needed in both Maharashtra and Gujarat. CMFRI may conduct special studies on the subject. (Action: CMFRI).
10. The workshop discussed the potential of non-conventional fishery resources of Maharashtra state that has emerged from the data collected by FSI. Since some of these resources are recognized as fairly abundant, it is essential that attempts be made to sort out the promising resources and develop suitable methods for processing product development and marketing on priority basis. This should take into consideration the consumer acceptance for such products. (Action: CIFT, CIFE and SFD, Maharashtra).
11. CMFRI has mentioned about the availability of resources of some species of prawns hitherto not exploited from the Maharashtra region. The magnitude of these resources must be further studied for commercial exploitation (Action: CMFRI).
12. The workshop noted that solar drying can be adopted for drying fish. But this method has not been adopted by the fishermen so far. Several reasons have been attributed for the same, especially the requirement of space for this method as against the traditional methods of drying fish on scaffolds along the Maharashtra coast. The applicability of solar drying, therefore, needs further examination by concerned authorities. (Action: SFD, Maharashtra and CIFT).
13. The various technologies available on fishing craft and gear have been brought to the notice of the workshop which might help in the economics of operation, saving of fuel, maintenance of craft and gear *etc.* However, the workshop felt that the technologies which are suitable for the state may be critically examined and necessary experimental work or pilot studies be conducted. (Action: CIFE and CIFT).
14. The workshop discussed the high variability in mesh size of cod end of trawl nets in different states and the need for regulating the same with special reference to conservation of shrimp. It was generally agreed after taking into consideration the information available from various states, that the mesh size should not be less than 35 mm. Therefore, efforts should be made to regulate the cod end mesh size of trawl nets for conserving the shrimp resources. (Action: SFD, Maharashtra).
15. In view of the changing environmental conditions and the changing fishing patterns the workshop felt the need for collection of environmental data in relation to the fish resources for better understanding of their availability pattern. (Action: CMFRI, CIFE, NIO and FSI).
16. In view of the interest of the state to intensify brackishwater fish and prawn culture, it was found necessary to assess the exact area suitable for brackish water culture, extend of shrimp culture to such areas and also determine the levels of pollution in the creeks and adjacent areas to safeguard the interests of brackishwater culture. (Action: SFD, Maharashtra, Pollution Control Board, Maharashtra and NIO).
17. The workshop discussed the work being done on pollution in Maharashtra, especially the programme of work of the DOD supported research project on pollution. It was felt that the existing information on different types of marine pollution in Maharashtra may first be documented giving details as to how pollution has been affecting the marine resources. Based on this information, further work on marine pollution is suggested. A map showing the present condition of pollution in brackishwater areas may also be prepared which would be useful in connection with the proposed intensification of brackishwater shrimp culture in the State. (Action: NIO, Pollution Control Board, Maharashtra).
18. In view of the conflicts that are arising between the traditional and mechanised sectors in marine fishing, it is suggested that the question of further mechanisation of the fishing craft in the state be examined carefully and necessary education and extension programmes undertaken for the fisher-

men to bring out a proper amicability between the two sectors to avoid conflicts. (Action: SFD, Maharashtra).

19. The existing marine fishing regulations in the state have been discussed at the workshop. Several difficulties have been expressed in matters like registration and licencing of boats, delimitation of the fishing zones, implementation of the regulations, powers given to different authorities and departments *etc.* However, some of these issues might be resolved based on the scientific information regarding the nature and exploitation of the resources. To that extent the workshop felt that the necessary scientific basis could be developed in course of time. The workshop also recommends that there should be an inter-state understanding as far as these matters are concerned to ultimately develop a national policy. The scientific background for resolving such issues should also be

developed. (Action: SFD, Maharashtra, CMFRI and Ministry of Agriculture, Government of India).

20. The Workshop discussed the short term and long term development of the Taraporevala Aquarium in Bombay and suggested that improvements to the aquarium need support at state and national level as this is the most important marine aquarium in the country serving the twin purpose of recreation and education. Immediate requirements include necessary repairs in the existing system and replenishment of the ornamental fish. The long term development includes provision of additional space for expansion, modernisation and inclusion of oceanarium for larger animals such as dolphins *etc.* It is suggested that a committee should be formed to look into various aspects to make it more attractive and also serve the purpose of education and training in such specialised areas. (Action: SFD, Maharashtra).



## PRAWN FISHERIES OF MAHARASHTRA COAST AND PROBLEMS OF PRAWN CULTURE IN THE STATE\*

Maharashtra is the leading prawn producing state in India, accounting for 75% of the non-penaeid and 34.3% of the penaeid prawn landings in the country. The marine prawn catch in the state during the five years 1982-'86 is given below (in tonnes).

Year	Penaeid prawns	Non-penaeid prawns	Total
1982	33,914	40,809	74,723
1983	36,027	32,134	68,161
1984	43,934	39,230	83,164
1985	51,793	55,180	1,06,973
1986	46,341	57,387	1,03,728

There has been a steady increase in penaeid prawn landings from 33,914 tonnes in 1982 to 51,793 tonnes in 1985 followed by a decline to 46,341 tonnes in 1986.

The non-penaeid landings declined from 40,809 tonnes in 1982 to 32,134 tonnes in 1983 and then showed a steady increase reaching a high value of 57,387 tonnes in 1986.

While almost the entire penaeid landings are made by small mechanised trawlers (9 - 14m OAL) operating in 20-70 m depth the non-penaeid landings are accounted for mainly by the 'dol' nets operated in 20-40m depth. The strong tidal currents in the region enable the fixed 'dol' nets to be used with advantage.

The species composition of prawns in these two methods of fishing are markedly different. The trawlers catch the larger sized exportable penaeids such as *Metapenaeus affinis*, *M. monoceros*, *M. kutchensis*, *Parapenaeopsis stylifera*, *P. hardwickii*, *Solenocera crassicornis* and *Penaeus penicillatus*. After 1982 the trawlers which remain out in the sea for 2-3 days started fishing in deeper waters (40-70 m) and discovered in south of Bombay, new resources of penaeid prawns such as *Trachypenaeus curvirostris*, *Metapenaeopsis stridulans*, *Parapenaeus longipes* and *Penaeus japonicus*.

\* Presented by M. S. Muthu, Madras Research Centre of CMFRI, Madras.

In the 'dol' net catches the dominating species of small sized non-exportable non-penaeids are *Acetes indicus*, *A. johni*, *Parapenaeopsis sibogae*, *Exhippolysmata ensirostris*, *Exopalaemon stylifera* and *Nemato-palaemon tenuipes*. It is immediately apparent that the prawn fishery of Maharashtra is multispecies with different species fluctuating widely in abundance from year to year. However, there has been a general increase in prawn catch during the past five years.

The standing stock of penaeid prawns in the 25,000 km<sup>2</sup> area of Bombay between Lat. 17° and 21° N and Long. 71° and 73° E has been estimated by Dr. Ramamurthy as 13,000 tonnes. Generally 60% of the standing stock is taken as the exploitable yield, which is 7,800 tonnes. The present annual yield from this region is around 9,000 tonnes. Hence there is no scope for increasing the fishing effort.

These areas are well within the fishing range of the existing small mechanised boats and hence there is no need to introduce large trawlers in this region. The existing boats which are staying out at sea for 2-3 days can fish during night time also when larger catches of *M. monoceros* and *P. japonicus* are obtained due to their habit of lying buried in the substratum during day time.

Dr. Ramamurthy's studies have also revealed that there has been no decrease in size of the prawns over the years. In fact, he has found an inverse relationship between size and abundance. In other words during years of good abundance the mean size is small indicating strong recruitment rather than decline in size due to overfishing.

He also found that the prawns breed almost throughout the year and that the prawns caught are well above the size at first maturity which means that the prawns have had a chance to breed before they are caught. The monsoon season, June to August, which

is a lean period for fishing due to inclement weather, affords natural respite from fishing pressure for about three months. All these factors are natural safe-guards against depletion of stocks.

Hence the prawn fishery along the Maharashtra coast appears to be in fairly good shape but has to be closely monitored to see whether the present yield can be maintained without being detrimental to the prawn stocks.

#### *Scope for prawn culture*

Maharashtra coast is endowed with good brackish-water resources which are potentially suitable for establishing prawn culture farms. But no proper survey has been made to assess the extent of these areas. Nor has the land and water use policy been clearly defined by the state till recently. But it is now understood that the state is allotting lands to entrepreneurs to start prawn farms in the state.

The natural seed resources of the state have not been assessed and except for the newly established prawn hatchery of Bada Pokaran, no commercial hatcheries are there in the state.

Prawn farm and prawn hatcheries should be developed simultaneously if prawn culture is to develop in a profitable manner. The areas bordering brackish-water creeks and the salt pan areas are prospective sites for establishment of prawn farms. But care should be taken to see whether these creeks are free of industrial or domestic sewage pollution.

There is good scope for developing pump fed farms in the elevated areas on either side of the creeks. However, microlevel surveys are urgently needed for this purpose. The MPEDA could be of help in conducting these surveys as they have recently recruited qualified engineers for such work.



## GENERAL ACCOUNT ON THE PROBLEMS OF MARINE FISHERIES RESEARCH AND DEVELOPMENT IN MAHARASHTRA\*

Maharashtra with a coastline of 720 km has a shelf area of about 90,000 sq.km. The EEZ confers an additional 20,000 sq.km approximately for exploitation. At present only 30% of the shelf area upto a depth of about 50 m is intensively exploited. The estimated annual catch from this area in recent years is about three lakh tonnes (compared to two lakh tonnes in early seventies) whereas the potential has been estimated to be 3.7 to 4.0 lakh tonnes (CMFRI & FSI). There is thus scope to increase production in this limited area to a moderate extent which can be done by increase of effort in a phased manner.

It is also to be assessed what is Maharashtra's contribution to the present production of three lakh tonnes since the landings include fish caught from Gujarat waters also. Further, the fishing effort in terms of actual trawling hours appears to be highly variable from season to season and also year to year and there is no reliable data on this aspect. An accurate or a near accurate estimate of catch and effort is a prerequisite for the development and rational exploitation of fisheries of a maritime state. To this end it would be better, if a suitable system could be developed to introduce simple log sheets to indicate area, depth of fishing, number of hauls and duration of each haul, catch details etc. on the lines as recommended in the "Workshop on Acquisition and Dissemination of Data on Marine Living Resources" held in 1982 at CMFRI. At least a few selected boats from major landing centres such as New Ferry Wharf and Sassoon Dock could be brought into this system to get an approximate picture of Maharashtra's share in fish production by trawlers.

A survey was conducted by M.T. Muraena in 1977 under the Indo-Polish agreement in the N.W. coast of India. Fishing with bottom and pelagic trawls was conducted between 15° & 24°N in the depth range of 90-360 m to assess the industrial fisheries potential of the area. The survey proved that pelagic mid water trawling was most productive in areas 19°-22°N and 67° - 69°E off Dwaraka and Bombay regions. The catch rate worked out to 1,838 and 1,137 kg/hr respectively, the main categories being horse mackerel and

pomfrets from 54-130 m depth. Catches upto 12 tonnes horse mackerel and 6 tonnes of black pomfret were recorded from these areas during February/March. Other resources that can be economically exploited were ribbon fish, eel and cat fish. Bottom trawling conducted in 90-130 m depth has not proved encouraging in the Maharashtra region. However, squids which are gaining importance due to export value were caught in considerable quantities in areas south of Bombay. It has also been observed at NFW that the commercial trawlers at times brought exclusively cephalopods or coastal tunas thus indicating abundance of these shoals according to season. Though large fishing vessels may not be necessary to tap those various resources occurring beyond 50 m depth area, introduction of medium sized vessels that can sustain absence from the port for about a week will be a feasible attempt.

Though the Marine Fishing Regulation Act has come into force in Maharashtra, it is to be reviewed how far this Act is being enforced. Effective regulations can promote amity between the mechanised and non-mechanised fishing sectors. Self imposed regulations as practised in some of the fishing villages in Tamil Nadu can also be tested through education to avoid confrontation.

The Bombay duck is of commercial importance in Maharashtra and Gujarat. The size class analysis of the fishery showed that smaller sizes dominate in Gujarat waters compared to Maharashtra. It needs to be elucidated how far the stocks occurring in the two states are interdependent and also the migratory habits of the species. There is no information available on the total annual stock in the fishing grounds. The annual yield is, however, found to be highly fluctuating over the years.

Penaeid prawn landings in Maharashtra are on the increase in recent years. A standing stock of 13,000 tonnes per annum has been indicated in the fishing grounds currently exploited from New Ferry Wharf base, the average annual catch being 8,300 tonnes which appears to be within the safe level of exploitation. However, there appears to be scope to increase the catch since prawns are short lived forms and will be lost to the fishery if not harvested. The standing stock in the month of September has been indicated to be very high which suggests that more exploitation can be

\* Presented by S. Ramamurthy, Madras Research Centre of CMFRI, Madras.



undertaken during this month in particular. The present mesh size and age at capture appear to be optimum. However, the stocks are to be continuously monitored to take safeguard measures, if warranted. In the offshore regions off Ratnagiri, between 200-500 m depth the FSI has located grounds for deep sea prawns, the potential of which is to be assessed.

Other resources like seer fish caught mainly by drift gill nets hold immense prospects for development in the Maharashtra coast. Multiple trolling using artificial jigs will be worth attempting to tap this resource. The resource of threadfin breams seems to be currently exploited at the optimum level. Any increase in effort may adversely affect the stock. To get sustained yield from the present fishing grounds there is need to increase the cod end mesh size of trawl nets.

There is no information on the molluscan (bivalves and gastropods) resources of the Maharashtra coast. The fishery at present is mostly of a sustenance nature. A regular survey needs to be undertaken to assess the potential resources for proper exploitation.

Capture fisheries has its own limitations in regard to production. In this context aquaculture affords

immense scope to augment production. Maharashtra has a brackishwater area of about 81,000 ha of which 1,800 ha is reported to be utilised for fish cultivation. The state has to identify suitable areas for farming. Fish cum prawn seed resources survey also has to be undertaken. The state is bestowed with large sized penaeid prawns such as *Penaeus japonicus* and *P. penicillatus* which offer ample scope for cultivation in controlled conditions. Even on a modest scale, if 30% of the brackishwater area is brought under cultivation a production of 15 to 20,000 tonnes of prawns can be achieved. Further, Maharashtra has a number of sheltered bays where culture of organisms like mussels, oysters in rafts and cages and net cage culture of fin fishes could be undertaken.

To sum up, the strategy to boost marine fish production in Maharashtra will be to increase production from the currently exploited grounds through increased effort in a phased manner, effective utilisation of the EEZ resources through offshore fishing, improvement of infrastructure facilities such as berthing, cold storage, etc., introduction of new fish products which will have consumer acceptance in the domestic market, popularise the non conventional resources and proper utilisation of the brackishwater areas and near shore sheltered waters through suitable culture techniques.



## MARINE FISHERIES RESEARCH IN MAHARASHTRA\*

I am presenting some of the observations made during the course of last 30 years on marine fisheries in Maharashtra.

In the fifties when otter trawling was introduced on commercial scale by the Japanese vessel 'Taijo-Maru' bull trawling was started first by the Government of India exploratory vessels M.T. *Ashok* and M.T. *Pratap* and later by the three sets of commercial trawlers 'Satpati'-*Pilotan*, 'Arnala'-*Paj* and 'Akashi-Maru'-No. 23 and 25 of New India Fisheries company and large quantities of quality fishes were exploited from the Bombay-Saurashtra waters. Though this workshop is on the

fisheries of Maharashtra, one cannot ignore Gujarat and take Maharashtra in isolation because of the common fish and fisheries occurring in these two states.

The quality fishes of great commercial importance in the beginning were 'dara', 'ghol', 'koth', 'wam', 'karkara', 'doma', 'cat fish', 'sharks' and 'rays'. Later on commercially less important fishes like 'shende', flat fish and clupeids were also included. The Bombay-Saurashtra region and also the Kutch region were exploited continuously for nearly two decades and fisheries of many species started declining in the late sixties. In the seventies due to export demand, the fishing interest was switched over to prawn resulting in the introduction of shrimp trawls.

---

\* Presented by P. V. Kagwade, Bombay Research Centre of CMFRI, Bombay.

The switching over to prawn fishing should have given enough time for the revival of fisheries of 'dara', 'ghol', 'koth', etc. which had declined. The present status of these fisheries is discussed here.

In the case of 'dara', the inshore fishery by gill net has remained more or less steady at 2.3 to 2.5 thousand tonnes in Gujarat and 1.4 to 1.7 thousand tonnes in Maharashtra on an annual average in the last two decades. This might be because there is no report of fishing for juveniles of 'dara' called 'chelua' by the trawlers which might have indirectly acted as a measure of conservation.

Another point to be mentioned here is that 'dara' net locally called 'waghra' jal is a highly selective gear with the mesh size of 81 to 105 cm. Fishes caught in this net measure between 81 to 105 cm. 'Dara' matures at about 80 cm in standard length in its 4th year. Hence, it is required to live to a size much longer than this. There are also reports of capture of large 'dara' of 142 to 170 cms in size by the 'dol' nets. In view of this it is suggested that if the mesh of some of the 'waghra jals' and not all, is increased by another few centimetres, there is a possibility of getting some specimens measuring larger than 105 cm in the catch.

Catches of 'ghol' have come down very much but since it is clubbed with sciaenids, it is not possible to assess the extent to which the fishery is affected.

'Koth' right from the beginning had a fishery of very small magnitude and it has dwindled greatly.

'Karkara' has almost disappeared from the fishery. Earlier trawl fishery of this species was comprised chiefly of the size 45-55 cm, all adults, the maturity size being at 41 cm. Juveniles upto 18 cm are available sometimes in small quantities in the inshore catch. Since only a small portion of the stock was harvested at that time, it is felt that its fishery should have revived rather than disappeared by now. The survey conducted by the vessel M.T. 'Muraena' for a year during 1977 had shown that 'karkara' formed good fishery at 55-90 m depth range. The catch came by both bottom and pelagic trawls and together formed 4.7 tonnes for the year. This suggests that 'karkara' fishery is in sound state and can be resumed once again.

Eel fishery does not seem to have been affected much. Its catch is more or less steady at about 3,400 tonnes per year.

Among the other varieties, *Polynemus heptadactylus*, *Psettodes erumei*, *Ilisha elongata* and *I. filigera* have also declined and appeared only occasionally in the catch. Some of the new entrants to the trawl fishery are nemipterids, *Saurida*, crabs, lobsters, squids and cuttle fish.

With the replacement of shrimp trawl a number of penaeid prawn species have appeared to contribute to the prawn fishery. Any decline in the catch of one species is not generally felt because it is compensated by others. There are about a dozen species of penaeid prawns contributing to the trawl fishery. This has resulted in the increasing trend in the catch of penaeid prawns in Greater Bombay.

Bombay duck is the major fishery of Maharashtra. It is harvested by the indigenous gear 'dol.' Its fishery was steady at 30,000 tonnes in sixties. The catch started improving after 1975 and reached the highest of 82,000 tonnes in 1981. The second highest of 58,000 tonnes was in 1984. This indicates that Bombay duck fishery is a promising one for some more time to come. This is because the fishery is supported mainly by the juveniles, the adults being far out in the sea. Not much of spawners are caught in the inshore waters.

Pomfrets are mostly coastal species, fished by gill nets and also 'dol'. Though the juveniles have been caught by the 'dol' nets in large quantities, the catches have been more or less steady at about 16,000 tonnes per year.

In the 'dol' net fishery the non-penaeid prawns are represented by a small number of species, the same being exploited for the past so many years. New entrants to the fishery as in the case of penaeid prawns are not observed. This has resulted in the decline in its catch in Thana, the district best known for this group of prawns.

It is time now to ascertain whether the fishery of some of the species like 'ghol' and 'shende' which once were prominent are unable to recover due to heavy pressure of exploitation at that time or whether they have changed their habitat giving room to the new entrants. Fishing for 'karkara' also should be attempted.



## FISHERY OCEANOGRAPHIC CONDITIONS OFF THE COAST OF MAHARASHTRA\*

The fishery of Maharashtra, as elsewhere in the world is influenced by abiotic oceanographic factors such as temperature, salinity, currents, monsoons, storms, light, dissolved oxygen content, inorganic nutrients like phosphates, nitrates, silicates and biotic factors like phytoplankton, zooplankton and benthos.

In the waters off Maharashtra in the summer months of May-June the surface temperature is high, around 30°C and drops by nearly 10°C in the winter months of December-January, when it averages 20°C. The temperature at the depth of 100 m is 20-22°C. Normally within a given season, the variations in temperature are not wide but during the southwest monsoon season (June-August) off Maharashtra the variations are as wide as 7°C at the surface. The variation at 500 m depth during the monsoon season is 6°C whereas during the premonsoon and post monsoon season, it is barely 1°C.

The waters in the upper 50 m are well mixed and nearly isothermal. The temperature starts to fall down sharply below 50 m.

Off Maharashtra, surface salinity varies from 35.4 to 36.6‰. It decreases from north to south. There are no marked variations due to seasons except in the close shore waters due to runoff during south west monsoon. The salinity at 500 m decreases slightly to 35.08-35.54‰.

The northeast monsoon (November-January) off the west coast is generally weak. The precipitation is also negligible. During this season and upto March, the surface currents are weak and flow from north to south. April is a transitory month. By late May, the strong moisture-laden southwest monsoon winds reach Maharashtra and prevail upto September. Heavy precipitation occurs during June-September. The strong Somali current (south equatorial current) which originates from Africa, forms part of the anticyclonic circulation in the Arabian Sea and reaches Maharashtra coast by May. The surface currents flow from south to north along the coast during May-September. October is a transitory month again.

Localized eddies and meanders are quite common affecting the circulation patterns. The tidal currents are stronger along the northern coast than the southern.

Storms and surge-causing tropical cyclones occur predominantly during the premonsoon (March-May) and postmonsoon (October-December) periods, and are rare during the southwest monsoon. During cyclones wave heights of 2 to 4.5 m are not uncommon.

Along the coast of Maharashtra, oxygen often becomes supersaturated in the mixed layer (upto 50 m). The annual average is in the range of 4.0 to 5.2 ml/l. In deeper layers, around 1000 m depth wide seasonal fluctuations are encountered. The oxygen values near the surface show a decrease during the upwelling period of August-September on account of the upward movement of oxygen low waters from deeper layers.

The vertical distribution of oxygen in the water column is not uniform. Two oxygen minima, one between 100 and 400 m and the other between 800 and 1500 m occur, with maxima at the intermediate depths. The shallow minimum is due to limited mixing and near stagnant conditions, high organic production and sinking and decomposition of large amounts of organic matter.

Inorganic nutrients such as phosphates, nitrates and silicates play a very important role in the fertility of any ecosystem. Silicates, by an large, are in abundant supply and are rarely a limiting factor in marine productivity.

Phosphates in the surface waters off Maharashtra are generally low and are in the range of 0.5-0.75 µg at/l at the surface and 1.0-1.25 µg at/l at 100 m. Higher values of 3.0-3.5 µg at/l are recorded at deeper layers of 1000 m. Surface values are higher during the premonsoon than the rest of the year, whereas 100m values are low during this period.

Nitrates are also generally low. At the surface they are 2.0-2.5, at 100 m 2.5, at 500 m 5-15 and at 1000 m 7.5-15 µg at/l. High concentrations occur at the surface and 100m during the southwest monsoon.

Sunlight is an important factor for plant production or primary productivity in the sea. It is generally

\* Prepared by K. Radhakrishna, Visakhapatnam Research Centre of CMFRI, Visakhapatnam.

agreed that at the depth where 1% of the incident surface sunlight penetrates, production and consumption balance each other with no net gain. The productive zone above this 1% depth is known as the euphotic zone.

In the inshore waters off Maharashtra, the euphotic zone extends to 25–30 m and increases to 40–60 m further offshore. The waters close to the shore are turbid with high suspended matter load (4 mg/l) due to land influence. In the offshore, the turbidity levels are around 2 mg/l.

The fertility of any sea is easily judged by the amount of plants (microscopic algae) produced there. This plant production is also known as primary production and is estimated per unit time and unit volume/area.

Primary production at the surface is high ranging from 50–100 gC/m<sup>3</sup>/day in waters upto 50 m depth. It decreases in the offshore as the depth increases (25–50 mgC in 50–100 m deep waters and 10–25 mgC in waters beyond 100 m depth.)

The production in the water column is also high (876 mgC/m<sup>3</sup>/day) upto 50 m depth and 607 mgC in waters beyond. The average works out to 700 mgC/m<sup>3</sup>/day for the continental shelf areas.

Primary production is high during the postmonsoon months extending upto March–April, and low in the following southwest monsoon months. Wide fluctuations are encountered in primary production depending on climatic conditions like cloud cover, rain and sea state.

Primary production or synthesis of fresh organic matter in the presence of sunlight occurs primarily through the action of pigments present in the phytoplankton. Among the various pigments, chlorophylls are the most important. The concentration of chlorophylls is, thus a direct index of the primary productivity potential or in other words, the fertility of the sea. Among the chlorophylls, chlorophyll *a*, by and large, is the most important in the marine ecosystem. In the coastal waters off northern Maharashtra, chlorophyll *a* at the surface is in the range of 1.0–2.0 mg/m<sup>3</sup> whereas down south and in the offshore waters the concentrations are low; 0.5–1.0 mg/m<sup>3</sup>.

In the euphotic column (upto 50 m) the integrated concentration of chlorophyll *a* is in the range of 10–20 mg/m<sup>2</sup> close to and a little south of Bombay and less than 10 mg/m<sup>2</sup> in the area in general.

Zooplankton, is an important link between the primary producers viz. the phytoplankton and the consumers viz. fishes, squids, shrimps etc. Zooplankton

abundance is a direct index of the fishery wealth of the sea.

Zooplankton biomass in the nearshore waters north of Bombay and off Ratnagiri is quite high (over 0.5 ml/m<sup>3</sup>). The shelf waters also support biomass of 0.4–0.5 ml/m<sup>3</sup> and the offshore waters support 0.3–0.4 ml/m<sup>3</sup>. Ostracods, copepods and salps dominate the zooplankton. Zooplankton, below 200 m, i.e. in the mesopelagic region is very low probably because of the oxygen minimum layer.

Benthos, i.e. the organisms that live on or near the sea bottom are important as food of bottom living, or, demersal fishes. The larger animals like polychaete worms, shellfish like gastropods and bivalves, and crustaceans like stomatopods and small prawns, compose the macrobenthos. Smaller animals like, amphipods, cumacians, small polychaetes, nematodes and foraminiferans constitute the meiobenthos.

The biomass of macrobenthos varies widely (0.15–153.2 g/m<sup>2</sup>) with an average of 6.75 g/m<sup>2</sup> along the Maharashtra coast. The region between 16–20°N is very rich. Meiobenthos average 12.65 in the range of 0.92–14.74 g/m<sup>2</sup>. In the offshore waters benthic biomass is low on account of greater depths, low oxygen concentrations and sandy and rocky nature of sea bottom.

The waters of Maharashtra are fertile and support high plankton production. The postmonsoon peak of plankton production (October–December) coincides with the peak fish landings during that period. The secondary peak of plankton in March is associated with good fish landings in May.


During October–November, the shoreward migration of demersal fishes from the deeper layers is a result of shoreward uplift of the oxygen minimum layer.

The processes of upwelling and the shoreward uplift of the oxygen minimum layer generally influence the fisheries of Maharashtra.

The primary productivity of EEZ off Maharashtra amounts to about 60 million tonnes of carbon. The present exploitation of fish from this area is around 0.36 million tonnes only i.e. out of every 167 units of phytoplankton, only one unit is being harvested as fish. This clearly is severe under exploitation. The major fishery resources of Maharashtra being constituted by the primary and secondary carnivores such as Bombay duck, prawns, croakers, pomfrets, ribbon fish, catfish etc., it should be possible to realise nearly twice the present fish catch from the sea off Maharashtra.



## LIST OF PARTICIPANTS

1. ALAGARAJA, K.	Scientist S-3 & Head, FRA Division, CMFR Institute, Cochin.	14. DHAPRE, C. G.	Regional Dy. Director, Fisheries, Nasik.
2. ALEXANDER, K. KURIAN	Scientist S-2, B.R.C. of CMFR Institute, Bombay.	15. DODD, S. B. S.	Director of Fisheries of Maharashtra, Bombay.
3. ARAVINDAKSHAN, M.	Scientist S-1, B.R.C. of CMFR Institute, Bombay.	16. GHOSH, K. K.	Prof. & Head, Planning Evaluation, CIFE, Bombay.
4. ARUL JAMES, M.	Scientist S-3 &  Scientist-in-Charge, CIFT, Bombay.	17. JAMES, P. S. B. R.	Director, CMFR Institute, Cochin.
5. ASHOK NAIDU	Dy. Director, MPEDA, Bombay.	18. JOSHI, L. M.	Asst. Director of Fisheries, Bombay.
6. BACHANSINGH	Asst. Director of Fisheries, Sindhudurga.	19. KAGWADE, P. V.	Scientist S-3 & Officer-in-Charge, B.R.C. of CMFR Institute, Bombay.
7. BAL, D. V.	Former Director of the Institute of Science, CIFE, Bombay.	20. KARBHARI, J. P.	Field Officer, B.R.C. of CMFR Institute, Bombay.
8. BHATT, B. B.	Dy. Registrar, Fisheries, Bombay.	21. KALAWAR, A. G.	Director of Fisheries of Maharashtra (Retd.) Bombay.
9. BHIDE, A. P.	Asst. Director of Fisheries (BWS), Bombay.	22. KHAN, M. Z.	Scientist S-1, B.R.C. of CMFR Institute, Bombay.
10. CHAKRABORTY, S. K.	Scientist S-1, B.R.C. of CMFR Institute, Bombay.	23. KUBER VIDYASAGAR	Scientist S-2, B.R.C. of CMFR Institute, Bombay.
11. DESHMUKH, V. D.	Scientist S-1, B.R.C. of CMFR Institute, Bombay.	24. KULKARNI, C. V.	Former Director of Fisheries, Maharashtra Bombay.
12. DESHMUKH, V. M.	Scientist S-2, B.R.C. of CMFR Institute, Bombay.	25. MADHUSUDANA RAO, K.	Prof. of Fisheries Extension, CIFE, Bombay.
13. DEVARAJ, M.	Prof. & Head, Fishery Biology Div., CIFE, Bombay.	26. MARDE, M. G.	Asst. Director of Fisheries, Sindudurga.
		27. MHAISKAR, J. D.	Dy. Director of Fisheries (Statistics), Bombay.

- |                       |  |                          |  |
|-----------------------|--|--------------------------|--|
| 28. MUTHU, M. S.      | Scientist S-3 & Head,<br>Crustacean Division,<br>M.R.C. of CMFR<br>Institute, Madras.                      | 35. SHETTY, G. H.        | Curator, Taraporevala<br>Aquarium, Bombay.   |
| 29. NANDUSEKAR, P. P. | Sr. Scientific Officer,<br>Maharashtra Pollution<br>Control Board,<br>Bombay.                              | 36. SHIRGUR, G. A.       | Research Officer,<br>Prof. & Head,<br>Taraporevala Marine<br>Biological RS,<br>Bombay. |
| 30. PANDE, J. N.      | Dy. Director of<br>Fisheries, Bombay.  | 37. SINGH, V. V.         | Scientist S-1,<br>B.R.C. of CMFR<br>Institute, Bombay.                                 |
| 31. RADHAKRISHNA, K.  | Scientist S-3 & Head,<br>Fishery Environment<br>Management Division,<br>V.R.C. of CMFRI,<br>Visakhapatnam. | 38. SIVARAMAKRISHNAN, K. | Secretary (ADF)<br>Government of<br>Maharashtra.                                       |
| 32. RAJE, S. G.       | Scientist S-1,<br>B.R.C. of CMFR<br>Institute, Bombay.   | 39. SOMVANSI, V. S.      | Sr. Fisheries Scientist,<br>F.S.I., Bombay.  |
| 33. RANGNEKAR, S. W.  | Ret. Dy. Director of<br>Fisheries of Maha-<br>rashtra, Bombay.   | 40. SREEKRISHNA, Y.      | Director, CIFE,<br>Bombay.   |
| 34. SANKOLLI, K. N.   | Dean (KKV), Fisheries<br>Faculty, College of<br>Fisheries, Ratnagiri.                                      | 41. VIJAYALAXMI, R. NAIR | Scientist, NIO,<br>Regional Centre,<br>Versova, Bombay.                                |
|                       |  | 42. WAGHMODE, V. B.      | Dy. Director of<br>Fisheries of Mahara-<br>shtra, Bombay.                              |





## महाराष्ट्र में मात्स्यकी अनुसंधान एवं विकास के बारे में तारापूर जलजीवालय में 25 और 26 मई 1988 को संपन्न कार्यशाला की कार्यवाही

### उद्घाटन

कार्यशाला का उद्घाटन महाराष्ट्र के मात्स्यकी निदेशक श्री. सत्यबीर सिंह ने किया। उन्होंने भागीदारों का स्वागत किया और आशा प्रकट की कि इन दो दिनों की चर्चाएँ राज्य के समुद्री मात्स्यकी संबन्धी समस्याओं पर विशेष ध्यान देने में सहायक सिद्ध होगी। उन्होंने राज्य सरकार अभिकरणों और केन्द्रीय संस्थानों के बीच इस प्रकार की एक चर्चा आयोजित करनेवाले डा. पी. एस. बी. आर. जेम्स, निदेशक, सी. एम. एफ. आर. आइ. को अपना धन्यवाद प्रकट किया।

डा. पी. एस. बी. आर. जेम्स ने अपने भाषण में ऐसी एक कार्यशाला का आयोजन करने वाले पहले निदेशक श्री. डोड को, साधुवाद दिया। उन्होंने कहा कि इस कार्यशाला का उद्देश्य, राज्य के समुद्री मात्स्यकी

सेक्टर की स्थिति की सूचनाओं का सटक लेना, अत्यावश्यक स्थानीय समस्याओं पर प्रकाश डालना, राज्य के समुद्री मात्स्यकी उत्पादन को बढ़ाने की शक्यता की खोज करना, अनुसंधान के मुख्य क्षेत्रों को पहचानकर अनुसंधान संस्थानों द्वारा उनको सुलझना और समुद्री मात्स्यकी विकास से संबन्धित राज्य सरकार एवं केन्द्रीय सरकार अभिकरणों के बीच सहयोग बढ़ाना, आदि है।

अखिल भारतीय स्तर पर समुद्री मात्स्यकी सूचना संपदा का संचय करते हुये पिछले 4 दशकों से देश में कार्यरत सी. एम. एफ. आर. आइ. इस क्षेत्र का सब से प्रमुख संस्थान है। संस्थान ने देश के समुद्री मत्स्य उत्पादन के प्राक्कलन के लिए एक सांख्यिकीय मॉडल का विकास किया है जिसकी एक. ए. ओ. ने भी सिफारिश की है। मात्स्यकी संपदाओं के मूल्यांकन के लिए संस्थान ने मत्स्य रीति, मत्स्य क्षेत्रों

एवं मत्स्यन सामग्री आदि में होने वाले व्यतियान का निरन्तर मॉनिटर किया। सी. एम. एफ. आर. आई के चालीसवीं साल के समारोह के अवसर पर मण्डपम कैम्प में चलायी गयी संगोष्ठी में संस्थान ने 1975 से 1984 तक के दस वर्ष के डेटाओं का विश्लेषण और संकलन करके एक पत्रमाला का प्रकाशन किया गया जिस में भारत के समुद्रवर्ती राज्यों के समुद्री मत्स्य उत्पादन और उत्पादन की संभावनाओं का मूल्यांकन है। इस की प्रतियाँ राज्य मात्स्यकी विभागों को उनकी टिप्पणी के लिए भेज दी गयीं ताकि संस्थान स्थानीय समस्याओं का समाधान ढूँढ सकें। एक अनुवर्ती कार्रवाई के रूप में राज्यों से कार्यशालाओं का आयोजन करने के लिए अनुरोध किया गया है। डा. जेम्स ने फिर से कहा कि महाराष्ट्र सरकार का यह प्रयास समुद्री मात्स्यकी अनुसंधान एवं विकास के इतिहास में एक मीलपत्थर है जो विविध मात्स्यकी संस्थानों एवं संस्थाओं के बीच सहयोग का बचन देता है। इन कार्यशालाओं से सी. एम. एफ. आर. आई. समुद्रवर्ती राज्यों की वास्तविक समस्याओं के आधार पर अनुसंधान कार्यक्रम व्यवस्थित कर सकता है।

### महाराष्ट्र में समुद्री मात्स्यकी की स्थिति

लंबी तटीय क्षेत्र एवं विस्तृत महाद्वीपीय तल से युक्त महाराष्ट्र राज्य की मात्स्यकी - संपदा विपुल है। सारे देश के समुद्री मत्स्य उत्पादन में महाराष्ट्र का द्वितीय स्थान है। (लगभग 3 लाख टन) झींगे-उत्पादन में इसका स्थान प्रथम है और बम्बिल, गोल, दारा, शिंगडी, फीता मीन, पॉम्फ्रेट, आदि की भी प्रचुरता है।

बम्बिल मछली का 90% महाराष्ट्र और गुजरात से प्राप्त होता है। दोनों राज्यों में डोल नेट का प्रयोग करके इसे पकड़ा जाता है। डोल नेट के उपयोग से पॉम्फ्रेट, झींगे आदि मछलियों के किशोरों का नाश होता है। इसलिए इसके बारे में विस्तार से अध्ययन करना आवश्यक है।

पेनीआइड और नॉन-पेनीआइड झींगे और क्रोकेस आदि के स्थलन में प्रचुरता एवं जाति संघटन में वार्षिक उतार चढ़ाव दिखायी पड़ी। इस विविधता को समझने के लिए लंबी-मार्ग कार्यक्रम की शुरुआत करनी है।

यांत्रिक नौका द्वारा स्थलन में बढ़ती और अयांत्रिक यानों द्वारा स्थलन में घटती दिखायी पड़ी। सारे देश के 70-75% मत्स्य उत्पादन यांत्रिक नौका के ज़रिए प्राप्त है। यांत्रिक नौकाओं का बढ़ता उपयोग मत्स्य संपदाओं को किस प्रकार प्रभावित करेगा, इस विषय के बारे में सोचना होगा।

महाराष्ट्र के चार तटीय जिलों में मात्स्यकी के उत्पादन में उत्तर के दो प्रान्त, दक्षिण के दो प्रान्तों से आगे हैं। यहाँ की शक्य समुद्री पकड़ 3.7 टन है।

डाटा विश्लेषण से यह सूचना प्राप्त होती है कि "डोल-नेट" से उत्पादन बढ़ाने की कोई गुंजाइश नहीं है। लेकिन अपवाही जाल और टूल जाल का प्रयोग समुपयोजित वर्तमान गहरे समुद्र में करते हुए उपज बढ़ायी जा सकती है। गहरे क्षेत्रों की संपदायें और उनकी बाणिज्य-संभाव्यता के बारे में व्यक्ति ज्ञान नहीं है। विभव संपदा के ठीक प्राकलन

के लिए एफ. एस. आई सहित सभी स्रोतों से सी. एम. एफ. आर. आई. के राष्ट्रीय समुद्री संपदा डाटा केन्द्र द्वारा डाटा प्राप्त करना है। गंभीर सागर मत्स्यन का विकास सही डाटा पर आधारित है जो अब उपलब्ध नहीं है। उत्तर-पश्चिमी तट क्षेत्र में संचालित इन्डो-पोलिश सर्वेक्षण से पॉम्फ्रेट, काट-बाँगडा, फीतामीन, शिंगडी और सर्पमीन जैसे मध्य-जल संपदाओं की उपस्थिति सहसृत हुई।

मनसून में प्रक्षुब्ध मौसम के कारण पकड़-श्रम में जो कमी होती है झींगों के पुर्नपुति के लिए सहायक हो जाती हैं। रात के समय झींगे की कुछ स्वीशीज़ दिन के समय से ज्यादा मिलती हैं। इसलिए रात के मत्स्यन में जो रोक है, इस पर पुनरीक्षण करना आवश्यक है।

झींगे की पकड़ में पड़ी कमी के कारण संवर्धन के ज़रिए इसका उत्पादन बढ़ाना आवश्यक है। सी. एम. एफ. आर. आई. अब फेरल और कनटिक में झींगे हैचरियों के निर्माण के लिए सहायता दे रहा है। महाराष्ट्र को भी तकनीकी सहायता देने के लिए तैयार है।

समुद्री प्रदूषण आजकल मत्स्य नश्वरता का एक प्रमुख कारण है। लेकिन मत्स्य नश्वरता का कारण सिर्फ प्रदूषण ही नहीं, इसके कारणों पर अध्ययन करना बहुत आवश्यक है।

आजकल के समुपयोजित क्षेत्रों से उत्पादन बढ़ाने के लिए मत्स्यन श्रम बढ़ाया जा सकता है। इसके लिए बड़े टूलर्स की आवश्यकता नहीं है। अपतट मत्स्यन से प्राप्त होनेवाली, बाजार में कम दाम मिलनेवाली, मछलियों को लोकप्रिय बनाने के लिये उत्पाद विविधीकरण का विकास करना आवश्यक है। सन्तोषजनक बात यह है कि महाराष्ट्र और गुजरात इस में रुचि रखते हैं। झींगे, फटल फिश, स्क्रिब आदि के संसाधन-उद्योग में होने वाला उत्सर्ग झींगे भोज्य में संघटक के रूप में उपयोग कर सकते हैं। मसल एवं सीपी भी झींगों के लिए अच्छा भोज्य है।

महाराष्ट्र तट के मलस्क संपदाओं के बारे में अध्ययन करना अत्यन्त आवश्यक है क्योंकि वहाँ इन संपदाओं को आश्रय देने के लिए असंख्य निवेशिकायें और अन्तर्गम सरितायें हैं।

राज्य के संबन्धित अभिकरणों को, समुद्री मात्स्यकी के विकास के लिए एक साथ मिलकर काम करने का निमंत्रण देते हुए डा. जेम्स ने अपना भाषण समाप्त किया।

### मात्स्यकी प्रशाशकों की समस्यायें

श्री. शिवरामकृष्णन, सचिव, महाराष्ट्र सरकार ने प्रशाशकों की समस्याओं के बारे में बताया। उन्होंने मत्स्य विभव के प्राकलन और वास्तविक उत्पादन की भिन्नता की और संकेत किया और इसके मान-नीकरण की आवश्यकता पर जोर दिया। उन्होंने फिर कहा कि जो नीति मात्स्यकी उत्पादन की बढ़ती के लिए प्रयोग में लायी गई है, उसका गुण धीवरों को भी मिलना चाहिए। उनकी राय में प्रति नौका की पकड़ की अपेक्षा प्रति नौका की आय मुख्य है। उन्होंने इन प्रश्नों का निवारण हेतु पूछा कि क्या परंपरागत मत्स्यन पर टूलर आपरेशन कोई हानि पहुँचायेगा या नहीं और यांत्रिक नौकाओं का उपयोग बढ़ाना

चाहिए या नहीं। इस विषय पर प्राधिकृत और विश्वासयोग्य सूचनाएँ देना अत्यन्त आवश्यक है। उन्होंने फिर धीवरों के कार्यभार बढ़ाने के लिए मत्स्य यंत्रों के विकास की आवश्यकता पर जोर डाला।

श्री. शिवरामकृष्ण के प्रश्नों का उत्तर देते हुए डा. अलगराजा ने कहा कि सन् 1947 से सी. एम. एफ. आर. आइ. अखिल भारतीय स्तर पर मत्स्य स्थलन डाटा का संग्रहण करता आया है और इस सांख्यिकीय प्रणाली ने एफ. ए. ओ और अन्य अन्तराष्ट्रीय अभिकरणों द्वारा अनुमोदन प्राप्त किया है। अब, सी. एम. एफ. आर. आइ और अन्य राज्यों के बीच के डाटा संकलन में जो कमी पड़ी है उसका सुधार, निर्धारण रीति अपनाने से, संभव है।

श्री. बी. एस. सोमवानशी ने महाराष्ट्र में एफ. एस. आइ के पोतों द्वारा 1972-87 की अवधि में परिचालित समन्वेषी मत्स्यन की परिणति का एक संक्षिप्त अंश प्रस्तुत किया।

डा. श्रीमती पी. बी. कगवाडे ने पिछले तीन दशकों के महाराष्ट्र के मुख्य समुद्री मात्स्यकी का पुनरीक्षण प्रस्तुत किया। डा. विजयलक्ष्मी नायर ने एन. आइ. ओ के प्रदूषण पर किये गये कार्य का पुनरीक्षण प्रस्तुत किया। डा. देवराज ने समुद्री मात्स्यकी संपदाओं की जनसंख्या गतिकी के बारे में अपना प्रबन्ध प्रस्तुत किया।

डा. अरुल जेम्स ने सी. आइ. एफ. टी. के “डोल” नेट से प्राप्त झींगे और मछलियों से विकसित कम दाम के उत्पन्नों के बारे में भाषण दिया। डा. कालवार ने कहा कि लोगों को मत्स्य के स्थान पर मत्स्य ही चाहिए न कि मत्स्य उत्पन्न। श्री. के. के. घोष ने मात्स्यकी उत्पन्नों के बाज़ार - अनुसंधान की आवश्यकता पर जोर डाला। मछली सुखाने के लिए स्वास्थ्यकर रीतियों को स्वीकार करने की आवश्यकता पर डा. जेम्स ने जोर डाला।

श्री मुत्तू ने कहा कि मानसून में झींगे का पकड़-दर उच्च है लेकिन पकड़-अम अन्य मछीनों की अपेक्षा बहुत कम होता है। किशोरों को पकड़ रोकने के लिए प्रो. श्रीकृष्ण ने जाली विनियमन प्रस्तु करने की आवश्यकता पर जोर डाला।

हाल ही में यान और गिअर तकनालजी में जो प्रगति हुई उसका विस्तार से प्रो. श्रीकृष्ण ने पुनरीक्षण प्रस्तुत किया। धीवरों की मत्स्यन-प्रवीणता को बढ़ाने के लिए उन्होंने अनेक सुझाव दिए। श्री. डोड ने महाराष्ट्र समुद्रवर्ती मात्स्यकी विनियम अधिनियम के कार्यान्वयन में जो समस्याएँ हैं उनके बारे में भाषण दिया। डा. कालवार ने अधिनियम की शर्तों के बारे में विस्तार से विवरण दिया और उन्हें सुलझाने के लिए कुछ प्रयोगात्मक रीतियाँ भी प्रस्तुत की। मात्स्यकी के उप निदेशक श्री. जोशी ने जिला मत्स्य-क्षेत्र अधिकारी को भी अधिनियम लागू कराने के लिए शामिल कराने की आवश्यकता पर जोर डाला।

डा. कुलकरनी ने तारापूर जलजीवालय की बढ़ती लोकप्रियता को देखकर इसकी सुविधायें बढ़ाने की माँग की। जलशाला के सन्दर्शकों को समुद्री जीवियों पर बीडियो-फिल्म दिखाने का भी सुझाव दिया।

## डा. जेम्स की समापन-टिप्पणी

डा. जेम्स ने कार्यशाला की मूल बातों का संक्षेप इस प्रकार किया।

समुद्रवर्ती राज्यों से भी राय प्राप्त कर सी. एम. एफ. आर. आइ. समुद्री उत्पादन का अखिल भारतीय डाटा का प्रकाशन जारी कर सकते हैं। राज्य मात्स्यकी विभाग के कर्मचारियों को संस्थान द्वारा विकसित सांख्यिकीय प्रणाली में प्रशिक्षण देने के लिए तैयार है। समुद्री मात्स्यकी विनियम अधिनियम की अखिल भारतीय रूप-कल्पना, समुद्र में संघर्ष दूर करने के लिए धीवरों द्वारा स्वीकृत स्वयं नियंत्रण मार्गों का प्रोत्साहन, लघुमान यानों पर टूलरों का प्रभाव, यानों का अन्तर्राष्ट्रीय मत्स्यन, परंपरागत मत्स्यन के स्थान पर कोष-संपादों का उपयोग, समुद्र तल एवं नितलस्थ जीवों में तलीय टूलिंग का प्रभाव और इस से इस क्षेत्र के मात्स्यकी पर पड़ा असर, हर एक राज्य/क्षेत्र के लिये आवश्यक एवं उचित प्रकार की मत्स्यन नौकाओं का निर्धारण आदि विषयों पर अध्ययन चलाने की सिफारिश उन्होंने की। मानसून में झींगे मत्स्यन में की गई रोक, समुद्री मात्स्यकी पर अनावृष्टि का प्रभाव अच्छा मानसून एवं मछलियों के अंडजनन के बीच का संबंध जैसे विषयों को वे अध्ययन के लिए आवश्यक समझता है। देश के समुद्री प्रदूषण की स्थिति का संग्रहण करके उसे एक प्रदूषण नक्शा के रूप में प्रस्तुतीकरण, महाराष्ट्र में “गोल” “दारा” और “कारकारा” मात्स्यकी में पड़े अन्तर की जाँच और हाल ही में वहाँ पता लगायी गई झींगे संपदाओं पर शोध, नुनबंदे जल में मत्स्य पालन करके मत्स्य उत्पादन बढ़ाने के तरीके राज्य सरकार और एम. पी. ई. डी. ए. द्वारा बूँड निकालना, भारतीय समुद्रों के बहु स्पर्शीयों की जन संख्या गतिकी के अध्ययन करने के लिए अनुयोज्य गणित प्रणाली का विकास करना आदि भी उनकी सिफारिशें थीं।

गहरे समुद्र से पकड़े गये अपरंपरागत मत्स्य, सी. आइ. एफ. टी. आइ. एफ. पी. और सी. आइ. एफ. ई के संसाधन प्रभागों के अनुसंधान का विषय बनाना, विकसित तकनालजी से उत्पादन को लोकप्रिय बनाने का विस्तार काम प्रबल करना और स्थानीय आवश्यकता के अनुसार सभी मत्स्यन तकनालजियों को अप्रुता देना और संबंध तकनालजियों को विविध समुद्रवर्ती राज्यों द्वारा क्रमबद्ध रूप से कार्यान्वयन के लिए चुनने की सिफारिशें भी डा. जेम्स ने दीं।

## महाराष्ट्र में समुद्री मात्स्यकी अनुसंधान एवं विकास के बारे में बंबई में 25 और 26 मई 1988 को संपन्न कार्यशाला की सिफारिशें

1. कार्यशाला में देश के समुद्री मत्स्य अभिग्रहण की सांख्यिकी और उसके प्रश्नों पर चर्चा हुई। समुद्र मात्स्यकी के सांख्यिकी का प्रकाशन जो सी. एम. एफ. आर. आइ. करता था, 1986-87 वर्ष से समुद्रवर्ती राज्यों कर रहे हैं। कार्यशाला की सिफारिश थी कि राज्यों के प्राप्त आँकड़ों का समन्वय करके प्रकाशन का काम सी. एम. एफ. आर. आइ. द्वारा किये जायें (कार्रवाई: सी. एम. एफ. आर. आइ. और एस. एफ. डी. महाराष्ट्र)
2. कार्यशाला में मत्स्य संग्रहण की वर्तमान रीति एवं प्रलेखन पर चर्चा हुई। डाटा संकलन के लिये सी. एम. एफ. आर. आइ. द्वारा कोचिन में “भारतीय समुद्र के समुद्री जीव संपदाओं के अभिग्रहण एवं

प्रचार बाटा" नामक विषय पर आयोजित कार्यशाला की चर्चाओं के आधार पर तैयार किये प्रपत्र की ओर भागीदारों का ध्यान आकर्षित किया। कार्यशाला ने इस प्रपत्र में इसके अलावा समुद्री मत्स्यकी के समाज की अधिक स्थितियों को समाविष्ट करने के लिए उचित योजना के विकास करने का प्रस्ताव रखा। इस योजना के विकास के लिए सी. एम. एफ. आर. आइ., एफ. एस. आइ. और सी. आइ. एफ. टी. के सदस्यों को मिलाकर एक संयोजित समिति का गठन करके सी. एम. एफ. आर. आइ. द्वारा बैठक बुलाने का प्रस्ताव रखा गया। (कार्रवाई: सी. एम. एफ. आर. आइ.)

3. वाणिज्यिक मात्स्यकी का थोक-निर्धारण के लिए एकड़ और एकड़ भ्रम के आधार पर उचित निदर्शन नमूनों को तैयार करने की सिफारिश की गयी। (कार्रवाई: सी. एम. एफ. आर. आइ., सी. आइ. एफ. डी. और एफ. एस. आइ.)
4. कार्यशाला में राज्य की वर्तमान समुपयोजित संपदा एवं ऐसी संपदा जिसका समुपयोजन बढ़ाया जा सकता है इस विषय पर सी. एम. एफ. आर. आइ. का निर्णायक विश्लेषण यह था कि डोल जालों के स्थान पर अपवाही जाल और टूलजाल का क्रमानुगम उपयोग से महाराष्ट्र में मात्स्यकी उत्पादन बढ़ाया जा सकता है। अन्य कोई लक्ष्य इसके लिए उचित सिद्ध नहीं होगा क्योंकि लक्ष्य का निर्धारण करते वक्त विभव संपदा और वर्तमान समुपयोजन संपदा के बीच में आनेवाली दूरी पर विचार करना आवश्यक है। (कार्रवाई: एम. एफ. डी., महाराष्ट्र, सी. एम. एफ. आर. आइ. और कृषि मंत्रालय, भारत सरकार)
5. महाराष्ट्र में लगभग 60 कोश-संपादों का उपयोग हो रहा है। इस विषय पर अध्ययन चलाने का प्रस्ताव रखा गया कि परंपरागत मत्स्यन पर इसका क्या प्रभाव होगा। (कार्रवाई: सी. एम. एफ. आर. आइ.)
6. "गोल", "दारा", "कीध" और "बाम" आदि कुछ चिरप्रतिष्ठित संपदाएँ पिछले कई सालों से समृद्ध नहीं हैं। इसके कारणों पर जाँच करने का कार्य सी. एम. एफ. आर. आइ. को सौंपा गया। (कार्रवाई: सी. एम. एफ. आर. आइ.)
7. मत्स्यन में चिंगडियों के संरक्षण के लिए उचित वैज्ञानिक मात्स्यकी विनियम तैयार करने का प्रस्ताव रखा गया। (कार्रवाई: सी. एम. एफ. आर. आइ.)
8. महाराष्ट्र सरकार ने समुद्र तट से 40 फीट गहराई में मत्स्यन करके संपदा की वाणिज्यिक संभाव्यता पर विचार करने का प्रस्ताव रखा। इसके लिए एफ. एस. आइ. एक पाइलट प्रोजेक्ट की शुरुआत करें और अन्य संस्थाओं से मिलकर इसकी वाणिज्यिक संभाव्यताओं पर विचार करें। (कार्रवाई: एफ. एस. आइ.)
9. महाराष्ट्र में डोल नेट मत्स्यन प्रचालन की प्रसुखता को मानते हुए इस क्षेत्र की मत्स्य समृद्धि पर डोल नेट मत्स्यन के प्रभाव के

बारे में एक विस्तृत अध्ययन शुरू करने की सिफारिश की गयी। (कार्रवाई: सी. एम. एफ. आर. आइ.)

10. एफ. एस. आइ. द्वारा संकलित बाटा में जिन अपरंपरागत संपदाओं की ओर प्रचुरता है उन्हें चुनकर उचित संसाधन तकनीकी द्वारा उसके विकास करने का सुझाव दिया गया (कार्रवाई: सी. आइ. एफ. टी., सी. आइ. एफ. डी. और एस. एफ. डी. महाराष्ट्र)
11. सी. एम. एफ. आर. आइ. का महाराष्ट्र केन्द्र ने ऐसी कुछ संपदाओं की सुलभता के बारे में सूचना दी जिसका अब तक समुपयोजन नहीं हुआ है। वाणिज्यिक समुपयोजन के लिए इन संपदाओं के परिमाण के बारे में अतिरिक्त अध्ययन करने का प्रस्ताव रखा गया। (कार्रवाई: सी. एफ. एम. आर. आइ.)
12. मछली सुखाने की परंपरागत प्रणालियों के स्थान पर सौर ताप की प्रणाली अपनाने से धीवरों के विमुख हो जाने के कारणों पर निरीक्षण करना आवश्यक है। (कार्रवाई: सी. आर. एफ. डी. व सी. आइ. एफ. टी.)
13. मत्स्यन यान और यंत्रों के कम परिचालन खर्च पर विचार करते हुए यह निर्णय लिया गया कि इस विषय पर राज्य के लिए उचित तकनीकी के विकास के लिए अध्ययन शुरू किया जाय। (कार्रवाई: सी. आइ. एफ. डी. और सी. आइ. एफ. टी.)
14. टूलनेटों की जालाक्षियों के आकार की विविधता के बारे में और उसके नियमित बनाने के बारे में चर्चा हुई। विविध राज्यों से प्राप्त सूचना के अनुसार यह सुझाव दिया गया कि जालाक्षियों का आकार 35 मि. मी. से कम नहीं होना चाहिए। (कार्रवाई: एस. एफ. डी. महाराष्ट्र)
15. पर्यावरण एवं मत्स्यन रीतियों में होनेवाले परिवर्तनों को देखते हुए मत्स्य संपदाओं के बाटा के संग्रहण की आवश्यकता पर जोर डाला गया। (कार्रवाई: सी. एम. एफ. आर. आइ., सी. आइ. एफ. डी., एन. आइ. ओ व एफ. एस. आइ.)
16. महाराष्ट्र में जुनखरा जल मात्स्यकी संवर्धन के लिए उचित स्थान ढूँढ निकालने का प्रस्ताव रखा गया। (कार्रवाई: एस. एफ. डी., महाराष्ट्र, प्रदूषण नियंत्रण बोर्ड महाराष्ट्र व एन. आइ. ओ.)
17. समुद्री प्रदूषण के बारे में यह सुझाव दिया गया कि महाराष्ट्र की समुद्री प्रदूषण संबन्धी वर्तमान सूचनाओं को अभिलेखित किया जायें। जुनखरे जल क्षेत्रों के प्रदूषण का एक नक्शा तैयार करने का सुझाव भी दिया गया (कार्रवाई: एन. आइ. ओ. व प्रदूषण नियंत्रण बोर्ड, महाराष्ट्र)
18. परंपरागत मछुओं और यंत्रीकृत यानों में मत्स्यन करनेवाले सेक्टरों के बीच का संघर्ष मिटाने के कार्यक्रम का आयोजन किया जाय। (कार्रवाई: एस. एफ. डी. महाराष्ट्र)

19. समुद्री मत्स्य विनियम, नौयानों का पंजीकरण एवं अंतर्राज्यीय मत्स्यन क्षेत्रों का सीमांकन, आदि में होनेवाली कठिनाइयों के बारे में विचार करते हुए उचित वैज्ञानिक आधारों को विकसित करने का सुझाव दिया गया। (कार्रवाई: एम. एफ. डी. महाराष्ट्र, सी. एम. एफ. आर. आई और कृषि मंत्रालय, भारत सरकार)

20. देश के महत्वपूर्ण जलजीवालय जो तारापूर में हैं उसका नवीकरण करने का सुझाव दिया गया। (कार्रवाई: एस. एफ. डी, महाराष्ट्र)

**पृष्ठभूमि लेख 1 :** महाराष्ट्र तट पर झींगे मात्स्यकी और झींगे संवर्धन की समस्याएँ

एम. एस. सुत्तु, केन्द्रीय समुद्री मात्स्यकी अनुसंधान संस्थान का मद्रासकेन्द्र द्वारा तैयारित

भारत के झींगा-उत्पादन में महाराष्ट्र का सबसे पहला स्थान है। 1982-86 के दौरान की समुद्री झींगे पकड़ सूची आगे दी जाती है। (वर्गों में)

वर्ष	पेनीआइड झींगे	नॉन-पेनीआइड झींगे	कुल
1982	33,914	40,809	74,723
1983	36,027	32,134	68,161
1984	43,934	39,230	83,164
1985	51,793	55,180	1,06,973
1986	46,341	57,387	1,03,728

लगभग सारे पेनीआइड झींगे और नॉन पेनीआइड झींगे के स्थलन टालर और "डोल" नेट से प्राप्त होते हैं। इन दोनों रीतीयों के मत्स्यन में झींगों का जाति-संयोजन लगभग अलग है। जब टालर पकड़ में निर्यात योग्य बड़े पेनीआइड झींगे मिलते हैं तब "डोल" जाल स्थलन से छोटे आकार के नॉन पेनीआइड झींगे प्राप्त होते हैं। महाराष्ट्र की झींगे मात्स्यकी की विशेषता उनकी बहुजातीयता है। हर वर्ष की पकड़ में उतार-चढ़ाव भी देख जा सकता है। परन्तु पिछले पाँच वर्ष की झींगे मात्स्यकी की पकड़ में सामान्य बढती ही दिखायी पड़ी है। पेनीआइड झींगों के बारे में बंबई समुद्र पर डा. राममूर्ति के अध्ययन के अनुसार यहाँ का स्थिर स्टॉक 13,000 टन है। साधारणतया स्थिर स्टॉक के 60 % समुपयोजन योग्य माना जाता है। यहाँ की वर्तमान वार्षिक उपलब्धि लगभग 9,000 टन है। इसलिए मत्स्यन प्रयास बढ़ाने से कोई फायदा नहीं होगा।

प्रस्तुत क्षेत्र में उपलब्ध छोटी यांत्रिक नौकाओं से मत्स्यन आसान है। इसलिए यहाँ बड़े टालरों की आवश्यकता नहीं है। वर्तमान नौकाओं से रात में भी मत्स्यन सुसाध्य है। डा. राममूर्ति के अध्ययनों ने इस विषय पर प्रकाश डाला है कि झींगे के आकार एवं मात्रा में एक उल्टा सा संबंध है। उन्होंने यह भी देखा कि लगभग पूरे साल में झींगों में प्रजनन होता है। मानसून में मत्स्यन श्रम में एक प्राकृतिक विराम होता है जो स्टॉक की प्राकृतिक संरक्षा के लिए सहायक सिद्ध होता है।

## झींगे संवर्धन के लिए अवसर

महाराष्ट्र तट उत्तम चुनखरे जल संपदाओं से अनुगृहीत है जो झींगे संवर्धन फार्मों की स्थापना के लिए अनुयोज्य है। लेकिन इसका ठीक सर्वेक्षण अभी तक हुआ नहीं है। झींगे संवर्धन के विकास के लिए झींगे फार्म और झींगे हैचरियों का एकसाथ विकास अनिवार्य है।

**पृष्ठभूमि लेख 2 :** महाराष्ट्र में समुद्री मात्स्यकी अनुसंधान एवं विकास की सामान्य समस्याएँ

एस. राममूर्ति, सी. एम. एफ. आर. आई. का मद्रास अनुसंधान केन्द्र द्वारा तैयारित

महाराष्ट्र की तट-रेखा 720 कि. मी. और शेल्फ क्षेत्र 90,000 वर्ग कि. मी. है। इसके अलावा समुपयोजन के लिए उपयुक्त 20,000 वर्ग कि. मी. भी है। अब शेल्फ के सिर्फ 30% का समुपयोजन हो रहा है। इस क्षेत्र की प्राकृतिक वार्षिक पकड़ तीन लाख टन है जबकि पकड़ साभ्यता 3.7 से 4.0 लाख टन है। इसलिये इस सीमित क्षेत्र में कमिक रूप से बंधित प्रयास के जरिए उत्पादन बढ़ाने की गुंजाइश है।

प्रस्तुत 3 लाख उत्पादन महाराष्ट्र और गुजरात दोनों की देन है। इसलिये इसमें से महाराष्ट्र का हिस्सा, अलग से प्राकृतिक करना है। एक समुद्रवर्ती राज्य की मात्स्यकी के विकास एवं युक्तिसंगत समुपयोजन के लिए पकड़ और पकड़-श्रम का सही प्राकलन आवश्यक है।

1977 में एम. टी. मुरीना के द्वारा भारत के उत्तर-पूर्वी तट पर एक सर्वेक्षण किया गया था। प्रस्तुत सर्वेक्षण में यह देख लिया गया कि वेलापवर्ती मध्यजल आनायान से पकड़ दर बहुत ऊँचा हो पाया है। पकड़ी गयी मुख्य मछली, कट बॉगडा, पॉम्फ्रेट, फ्रीतामीन, सर्पमीन आदि थीं।

महाराष्ट्र में समुद्री मत्स्यन विनियम अधिनियम पहले ही लागू किया गया है पर इसका अनुपालन उचित रूप से नहीं हो रहा है। इसलिए इसका पुनरीक्षण करना आवश्यक है। महाराष्ट्र और गुजरात से बाणिज्य की दृष्टि से महत्वपूर्ण बंबिल ज्यादा मिलती है। इन दोनों राज्यों से पाये जानेवाले इस प्रवर्ग के आकार, परस्पर निर्भरता एवं प्रवासी स्वभावों पर अध्ययन आवश्यक है।

हाल ही में महाराष्ट्र में झींगे ज्यादा मिल रहे हैं। निरीक्षणों के अनुसार इसका समुपयोजन बढ़ाना ही उचित है। क्योंकि कि ये झींगे अल्पायु है। फिर भी, बर्गनाश न होने को स्टोक पर सतत ध्यान रखना भी आवश्यक है। झींगे के अलावा सुरमई, प्रोडफिन त्रीम आदि भी यहाँ की संपदायें हैं। सुरमई अपवाही जालों से पकड़ी जाती हैं। वर्तमान मत्स्यन क्षेत्रों से लगातार प्राप्ति के लिए टाल जाल की जालाक्षियों का आकार बढ़ाना आवश्यक है।

महाराष्ट्र तट की मोल्स्क संपदाओं के बारे में कोई सूचना नहीं है। इसके ठीक समुपयोजन के लिए विभव संपदाओं पर निरंतर सर्वेक्षण करना है।

उत्पादन के संकंध में प्रग्रहण मात्स्यकी की अपनी सीमायें होती हैं। उत्पादन बढ़ाने के लिये जल कृषि अनुयोज्य है। महाराष्ट्र के

1,800 हे. नुनखरे जल क्षेत्र मत्स्य कृषि केलिये अनुयोज्य है। जलकृषि केलिये यहाँ उपलब्ध झीलों के बड़े प्रवर्ग जैसे पेनिअस जैपनिकस और पी. पेनीसिलाटस का परीक्षण कर सकते हैं। इसके अलावा महाराष्ट्र में मसल, शुक्ति, फिन फिश आदि की खेती भी की जा सकती है।

### पृष्ठभूमि लेख 3 : महाराष्ट्र में समुद्री मात्स्यकी अनुसंधान:

पी. बी. कगवाडे, सी. एम. एफ. आर. आइ. का बम्बई अनुसंधान केन्द्र द्वारा तैयारित

उत्तमवीं सदी के पाँचवीं दशक में बम्बई सौराष्ट्र के समुद्र में उद्ग-आनायान शुरू करने के फलस्वरूप वाणिज्यिक दृष्टि से महत्वपूर्ण मछली बड़ी मात्रा में प्राप्त होने लगी। प्रारंभ काल में प्राप्त वाणिज्य की दृष्टि से महत्वपूर्ण मछली दारा, गोल, कोथ, वाम, करकारा, दोमा, चिंगटी, सुरा, रे आदि थीं। इसके बाद शेण्डे, चपटी मछली, क्लूपेड्स आदि वाणिज्य की दृष्टि से कम महत्वपूर्ण मछली भी प्राप्त होने लगी थीं। बंबई-सौराष्ट्र और कच क्षेत्र का, दो दशकों तक लगातार समुपयोजन किया गया जिसके परिणाम स्वरूप कई स्पीशीज़ों की मात्स्यकी में घटती दिखायी पड़ी। सातवीं दशक में झीगे पर जो आयात माँग हुई उसने इसका मत्स्यन चिंगट आनायों के ज़रिये शुरू करने को प्रेरणा दी। झीगे मत्स्यन की शुरुआत “दारा”, “गोल”, “कोथ” आदि घटती हुई मछली फिर से बढ़ाने का कारण बन गया। इस मात्स्यकी की वर्तमान स्थिति का विवरण निम्नस्थ है।

पिछले दो दशकों में गुजरात में “दारा” मात्स्यकी की पकड़ लग-भग 2.3 से 2.5 हजारों टनों पर स्थिर थी और महाराष्ट्र में इसका वार्षिक औसत पकड़ 1.4 से 1.7 हजार टन थी। “गोल” मात्स्यकी में उल्लेखनीय घटती हुई है। “कोथ” मात्स्यकी प्रारंभ से ही कम परिमाण की थी और इस में फिर से हास हुआ है। “करकारा” एकदम लुप्त हो गयी है। एम. टी. सुरीना नामक पोत के ज़रिए 1977 के दौरान किये गये सर्वेक्षण से प्राप्त सूचना के अनुसार 55-90 मी. की गहराई में “करकारा” की बड़ी संपदा है। वर्ष के दौरान तलीय एवं वेलापवर्ती आनायन के ज़रिए 4.7 टन पकड़ भी मिली थी। ये सब “करकारा” मात्स्यकी की लभ्यता का प्रमाण है। महाराष्ट्र में सर्पमीन की पकड़ लगभग स्थिर है।

पॉलीनेमस हेप्टाडाक्टिलस, सेटोडेस एरुमी, इलिशा एलांगटा और आइफिलिगेरा आदि की भी अवनति दिखायी पड़ी। नेमिप्टेरिडस, सौरिदा, कर्कट, महाचिंगट, स्क्विड्स और कटलफिश आदि अनायन मात्स्यकी की नयी उपलब्धियाँ हैं। महाराष्ट्र की मात्स्यकी में बम्बिल का प्रमुख स्थान है। “डोल” जाल से इसे फँसाया जाता है। 1960-70 के वर्षों में पकड़ 30,000 टन पर स्थिर थी। 1975 के बाद इस में वृद्धि दिखायी पड़ी और 1981 में सब से अधिक पकड़ याने 82,000 टन तक आ पहुँची। इसके बाद 1984 में 58,000 टन पकड़ मिली थी। पॉम्फ्रेट मुख्यतः तटीय जाति मछली है और इन्हें अपवाही जाल और “डोल” जाल से पकड़ते हैं। “डोल” जाल के ज़रिए अधिक मात्रा में किशोरों पकड़ने पर भी प्रतिवर्ष इसका पकड़ लगभग 16,000 टन पर स्थिर रहा।

### कालिकट में स्थलित “ब्लैकटिप सुरा”

कालिकट से 14 कि. मी. उत्तर एलातूर में मई 12, 1988 को एक ब्लैकटिप सुरा का स्थलन हुआ। बडिश रज्जु से इसे पकड़ा गया था। विलोभक के रूप में द्यूना माँस का उपयोग किया गया था। इसे एलातूर के उत्तर-पश्चिमी भाग से लगभग 35 मी गहराई से पकड़ा गया। इसमें टैगिंग का चिह्न दिखायी पड़ा।

एलातूर में मई 19, 1988 को और एक ब्लैकटिप सुरा का स्थलन हुआ। लेकिन इस में टैगिंग का कोई चिह्न नहीं था।

### महाराष्ट्र के प्रतिपट की मात्स्यकी समुद्र विज्ञानीय स्थितियाँ

महाराष्ट्र की तट रेखा 720 कि. मी. और महाद्वीपीय शेल्फ क्षेत्र 89,096 कि. मी. है। असल में यह मछलियों का एक केन्द्र है और यहाँ से करीब 0.27 दशलक्ष टन मछली पकड़ी जाती है। विश्व के किसी भी अन्य स्थान के समान महाराष्ट्र की मात्स्यकी भी ताप, लवणता, जल-धारा, मानसून, तूफान, प्रकाश, विलोम ऑक्सिजन का अंश, अकार्बनिक पोषक जैसे फोस्फेट, नैट्रेट, और सिलिकेट पादप्लवक, प्राणीप्लवक व नितल-जीवजात जैसे अजैव समुद्रविज्ञानीय तत्वों से प्रभावित है।

प्रत्यक्ष या अप्रत्यक्ष रूप से अन्य तत्वों का नियंत्रण करनेवाले सबसे मुख्य तत्व हैं तापमान व लवणीयता। महाराष्ट्र के सागर के जलपृष्ठ में तापमान अधिक होता है और गहराई में कम, वैसे उपरितल में 50 मीटर गहराई तक का पानी समतापी है। 50 मीटर से अधिक गहराई के पानी का तापमान सीधे घटता जाता है। मौसम के अनुसार तापमान में अन्तर होता है। साधारणतः प्रत्येक ऋतु में ज्यादा अन्तर स्पष्ट नहीं होता है लेकिन दक्षिण पश्चिम मानसून के दौरान तापमान में अन्तर आता है।

समुद्री खातावरण में जिस प्रकार तापमान में अन्तर होता है उस प्रकार खारापन में अन्तर नहीं होता है। गहराई के अनुसार भी खारापन में अन्तर नहीं होता है। फिर भी, खारापन में होने वाला छोटा सा अन्तर भी समुद्री संपदा सहन नहीं कर पाता। महाराष्ट्र के समुद्र जल पृष्ठ का खारापन 35.4 व 36.6 ‰ के बीच का है। उत्तर से दक्षिण की ओर जाने पर इस खारापन में कमी होती है। खारापन में ऋतु परिवर्तन से कोई विशेष अन्तर दीख नहीं पड़ता। जल प्रवाह की बात ली जायें तो उत्तर-पूर्वी मनसून (नवंबर-जनवरी) के दौरान वर्षा कम मिलती है और मन्द जल-पृष्ठ प्रवाह दक्षिण उत्तर दिशा में होता है। दक्षिण-पश्चिम मानसून (जून-सितंबर) के दौरान अच्छी वर्षा मिलती है और जलपृष्ठ प्रवाह उत्तर-दक्षिण दिशा में होता है। इस समुद्र में स्थानीय भंवर और विसर्प भी साधारण हैं मानसून के पूर्व और बाद में तूफान और चक्रवात भी होता है। कभी कभी चक्रवात के दौरान लहरों की ऊँचाई 4.5 मीटर तक हो जाती है।

महाराष्ट्र के तट में 50 मीटर तक की गहराई में संतृप्त मात्रा में ऑक्सिजन देखा जाता है। इसका वार्षिक औसत 4.0 से 5.2 ml./l.

के बीच है जबकि 1,000 मीटर की गहराई में ऑक्सिजन में घट-बढ़ देखने को आया है। पानी में ऑक्सिजन का ऊर्ध्वर वितरण समान नहीं है। ऑक्सिजन मिनिमा के दो कालम हैं, एक 100 व 400 मीटर और दूसरा 800 व 500 मी. के बीच का है। इन दोनों के बीच ऑक्सिजन माक्सिमा आती है।

कोई भी पारिस्थितिक तंत्र में अकार्बनिक पोषक जैसे फोस्फेट, नैट्रेट व सिलिकेट का महत्वपूर्ण स्थान है। महाराष्ट्र के समुद्र में फोस्फेट का अंश कम है। नैट्रेट भी सामान्यतः कम है तो सिलिकेट बहुत अधिक है।

समुद्र की प्राथमिक उत्पादिकता या जल-सस्य उत्पादन में सूर्यप्रकाश एक महत्वपूर्ण अंग है। महाराष्ट्र के उपतट समुद्र में सुप्रकाशी क्षेत्र 25-30 मीटर तक व्याप्त है तो अपतट समुद्र में यह 40-60 मीटर तक फैला है।

किसी भी समुद्र की उत्पादिकता उसकी जल-सस्यों की मात्रा के आधार पर आँकी जाती है। इस पादप उत्पादन को प्राथमिक उत्पादन कहा जाता है और उत्पादिकता प्रतियूनिट टाइम व यूनिट अयतन क्षेत्र विस्तार पर आँकी जाती है। महाराष्ट्र के समुद्रों में मानसून के पूर्व के महीनों में प्राथमिक उत्पादन अधिक होता है और दक्षिण पश्चिम मानसून के दौरान कम। जलवायु स्थितियों में होनेवाला परिवर्तन प्राथमिक उत्पादन में प्रभाव डालता है। प्राथमिक उत्पादन, पादप्लवकों में वर्तमान क्लोरोफिल नामक पिंगमेन्ट और सूर्यप्रकाश से होता है। ऐसे पिंगमेंटों में क्लोरोफिलस मुख्य हैं। समुद्री पारिस्थितिक तंत्रों के क्लोरोफिलों में सबसे महत्वपूर्ण है क्लोरोफिल-ए। महाराष्ट्र समुद्र के तटीय पानी में क्लोरोफिल का परास 10-20 मि.ग्रा./मिनिट स्क्वयर है।

प्राणीप्लवक जो मुक्त-प्लव अर्धसूक्ष्म जीवी हैं पादप्लवकों के बीच की अच्छी कड़ी हैं। समुद्र में प्राणीप्लवकों की अधिकता समुद्री संपदा का प्रमाण है। महाराष्ट्र के उत्तरी समुद्री तटों में प्राणीप्लवक जैवमात्रा बहुत अधिक है। शेल्फ पानी व अपतटों में भी इसकी मात्रा समीचीन दिखायी पड़ी। प्राणीप्लवकों में ओस्ट्राकोड, कोपिपोड और सैल्पा मुख्य थे।

नितल जीवजाल जो समुद्र तल में रहनेवाले हैं तलमज्जी मछलियों का मुख्य आहार है। इस में बड़ों का ग्रूप माक्रोबेन्थोस और छोटी का मीयोबेन्थोस है। महाराष्ट्र के समुद्र में माक्रोबेन्थोस का औसत 6.75 कि. ग्रा. है और मीयोबेन्थोस का परास 12.65-14.74 कि. ग्रा. है।

महाराष्ट्र का पानी बहुत उर्वर है जो प्लवकों के उत्पादन केलिये सहायक होता है। प्लवकों के उत्पादन बढ़ने के साथ ही साथ यहाँ मछलियों का स्थलन भी बढ़ता है।

अक्टूबर-नवंबर के महीनों में महाराष्ट्र के तलमज्जी मात्स्यकी समुद्र तट की ओर बढ़ती है। इस उत्प्रवसन का कारण आक्सिजन मिनिमम लेयर का तटीय प्रवाह है।

महाराष्ट्र से समुपयोजित की जानेवाली मात्स्यकी सिर्फ 0.36 दशलक्ष टन के निकट है। असल में यहाँ मात्स्यकी का अवशेषण हो रहा है क्योंकि यहाँ उपलब्ध पादप्लवकों की मात्रा 163 यूनिट है तो पकड़ी जानेवाली मछली सिर्फ एक यूनिट है। यहाँ से प्राप्त होनेवाली मुख्य मछली बम्बिल, क्रोकर्स, चिंगट, फितामीन, शिंगटी आदि है। महाराष्ट्र के समुद्र से इसकी दुगुनी संपदा मिलने की गुंजाइश है।



#### GUIDE TO CONTRIBUTORS

The articles intended for publication in the MFIS should be based on actual research findings on long-term or short-term projects of the CMFRI and should be in a language comprehensible to the layman. Elaborate perspectives, material and methods, taxonomy, keys to species and genera, statistical methods and models, elaborate tables, references and such, being only useful to specialists, are to be avoided. Field keys that may be of help to fishermen or industry are acceptable. Self-speaking photographs may be profusely included, but histograms should be carefully selected for easy understanding to the non-technical eye. The write-up should not be in the format of a scientific paper. Unlike in journals, suggestions and advices based on tested research results intended for fishing industry, fishery managers and planners can be given in definitive terms. Whereas only cost benefit ratios and indices worked out based on observed costs and values are acceptable in a journal, the observed costs and values, inspite of their transitionality, are more appropriate for MFIS. Any article intended for MFIS should not exceed 15 pages typed in double space on foolscap paper.