

Proceedings of the Second Workshop on Scientific Results of *FORV Sagar Sampada*

Editors

V.K. Pillai
S.A.H. Abidi
V. Ravindran
K.K. Balachandran
Vikram V. Agadi



**Department of Ocean Development
Government of India
New Delhi
1996**

© 1996, Department of Ocean Development

Department of Ocean Development (DOD)
Government of India
Mahasagar Bhavan, Block No-12
C.G.O. Complex, Lodi Road
New Delhi-110 003
India

ISBN : 81-900656-0-2

Citation Styles

For entire volume

Pillai, V.K. Abidi, S.A.H., Ravindran, V., Balachandran, K.K. & Agadi, V.V. (Eds.) 1996. *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, (Department of Ocean Development, New Delhi), pp. 564.

For individual article

Goswamy, S.C. & Shrivastava, Y. 1996. Zooplankton standing stock, community structure and diversity in the northern Arabian Sea, In: *Proceedings of the Second Workshop on Scientific Results of FORV Sagar Sampada*, edited by V.K. Pillai, S.A.H. Abidi, V. Ravindran, K. K. Balachandran & V.V. Agadi, (Department of Ocean Development, New Delhi), pp. 127-137.

Designed and Printed by:

Publications & Information Directorate
Council of Scientific & Industrial Research
Pusa Campus, New Delhi-110 012
India

Studies of fisheries with the causative environmental factors - optimum utilisation of *FORV Sagar Sampada*'s capabilities

A. V.S. Murty*

Science House, 58-Girinagar, Cochin-682 020

ABSTRACT

Retaining the multidisciplinary character of research, *FORV Sagar Sampada* cruises got evolved into species-wise and sector-wise investigations to obtain complete cyclic pictures of species and sectors over seasons round the year for the EEZ waters of India. The paper aims at further transformation of the system of her cruises into problem-oriented investigations. Specific problems in pelagic fisheries of the waters around India are reasoned out for effective utilization of the unique sea-lab, the *FORV Sagar Sampada*. A rethinking is needed in planning and implementation of cruise programmes towards achieving realistic synthesis of studies of fisheries with the causative environmental factors.

INTRODUCTION

Fisheries of various species and the physical, chemical and biological aspects of the waters around India, particularly off the west coast of India were thoroughly studied by conducting exploratory cruises of various vessels of different organisations from the dawn of independence of India. Valuminous information was added by multinational fleet of research vessels during the IIOE Programme during early sixties.

Indian fishery oceanography gained status in marine sciences ever since the introduction of *R. V. Varuna* in 1960s under the Indo-Norwegian Project. Later it had a considerable boost during FAO/UNDP/IFP programmes in 1970s along the west coast of India. The introduction of the fishery oceanographic vessel *FORV Sagar Sampada* in the Indian waters in the middle of 1980 with modern equipments, brought a dramatic change in the scenario of methodology of investigations at sea.

*Present address: c/o Prof. C.Ayyanna, MIG -19, H.B. Colony, Visakhapatnam-530022.

Starting with multidisciplinary cruises extended to EEZ, the cruise programmes were reoriented to species-wise and sector-wise cruises to cover the EEZ waters in all the seasons of the year, both along east coast and west coast of India. The present workshop consolidates the additional knowledge obtained on the living resources and the concerned environmental factors from the mission-oriented research cruises undertaken by the vessel for the last 4-5 years (1989-'93). The present paper is a visionary into the near future programmes of the vessel by defining the problem-oriented cruises of the fully equipped *FORV Sagar Sampada*: the areas are envisaged where a synthesis could be achieved of the studies of pelagic fisheries with the largely causative factors of the aquatic environment aiming at rational utilisation of this unique sea-lab.

SPECIFIC ASPECTS OF INVESTIGATIONS

It has been shown that large annual fluctuations in the pelagic fisheries of oil sardine, mackerel and tuna like fisheries are due to environmental factors only (George, 1970; Banerji, 1973). The cumulative knowledge of fisheries from Indian coasts clearly shows the behavioural pattern of fish schools of different categories off the coasts of India. And the behaviour of fish schools suggests the areas of specific scientific investigations to be carried out as a follow-up action.

Oil sardines

In the past, oil sardine fishery was confined to the west coast of India concentrating the Kerala coast. In recent years, some schools of the species entered the conventional fishing grounds off the east coast of India. Ten years data of oil sardine catches (1975-'84) indicated that the catches crossed 1000 tonne mark off Tamil Nadu coast in 1984, whereas there were no recruits of the species in the fishing grounds of Andhra Pradesh (Dharmaraja *et al.* 1987; Alagaraja *et al.* 1987). However, in the recent years, there has been an increase of this species in landings from the east coast (Luther, 1988). Even on the west coast of India, sardine fishery would not start from the tip of the continent (Cape Comorin). The fishery skips off certain coastline from the tip and starts somewhere from Quilon and gradually extends further north along the west coast. This is a regular feature of oil sardine fishery along the west coast of India.

Since the oil sardines are fast moving migratory fishes confining to the surface and subsurface waters above the thermocline (the mixed layer), and since one cannot expect any drastic changes of water characteristics of temperature, salinity, oxygen or plankton conditions of the mixed layer, some eddy current system in the mixed layer must be single largest causative factor responsible for such a pattern of oil sardine fishery (Murty, 1993). Therefore, the immediately required scientific attempt is to tackle the migration of the species from the point of view of distribution of currents at the surface and subsurface depths.

Anchovies

Anchovies concentrate in the waters of the Gulf of Mannar and Cape Comorin during southwest monsoon season (June-August), as if the fish schools are taking shelter in those waters in order to avoid the vagaries of southwest monsoon along the west coast of India; and as soon as the monsoon ceases, the anchovies move towards west coast of India and spread up to Ratnagiri in the north and Quilon in the south during the rest of the year. Venkataraman (1956) working on anchovies that were recruited to the fishery at Calicut observed from length frequency studies that the fishery was mainly constituted by the first and second year classes and that the same stock is absent from fishing grounds from July to September and then reappeared from October onwards. Relatively stable conditions of the sheltered waters of the Gulf of Mannar during monsoon period are attributed for migration of anchovies to those waters (Narayana Pillai, 1982).

The exact cause of their migration to the Gulf of Mannar waters during the southwest monsoon period requires to be established. The upwelling process along the west coast of India during southwest monsoon period no doubt brings certain amount of instability or turbulence in the waters. Lowered temperatures and oxygen deficiency are also the effects of upwelling.

The *FORV Sagar Sampada* investigations, during July-August 1987 in the Quilon Bank and the Gulf of Mannar (Murty *et al.* 1990), showed a lot of contrast in the T-S diagrams. The Gulf of Mannar waters were found warmer (26°-27°C) and more saline (about 35.5%) than the Quilon Bank waters where the temperature ranged from 26 to 21°C and the salinity from 34 to 34.6×10^{-3} . Moreover, the Gulf of Mannar waters also showed thermal instability having thermal inversions in the subsurface depths of water. Therefore factors other than instability appear to be causative factors for the migration of these fishes to the Gulf of Mannar waters during monsoon period. Therefore, a thorough investigation is necessary to identify the responsible factors.

Island group ecosystems

The Lakshadweep group of islands consist of 27 islands in the Arabian Sea and the Andaman and Nicobar group of islands consist of about 300 islands. It was evident from the records of measurements of phytoplankton concentration, pigment and primary productivity that the coral reef waters are not so productive. The remarkable transparency of coral waters is sufficient testimony to the dearth of phytoplankton (Tranter & George, 1972).

Vast areas of seas around the islands of Lakshadweep and Andaman and Nicobar Islands are lying virtually unexploited. In almost all the inhabited islands, except a few, only subsistence fishing is carried out (Jones & Banerji, 1973; Alagaraja, 1987). The waters around the group of islands are pollution-free with possible multi-ranged scale of eddy currents. There is an urgent need of exploring the island ecosystems with a stress on coral reefs, reef fishes, fishery and the eddy circulations of the island waters. Inclusion of Maldivé group of islands would compliment such exploratory

investigation of these island ecosystems. Such a step would provide a sound data base for exploitation of the untapped marine living resources and the ecosystems of the islands around India.

Tagging programme

CMFRI scientists gained some experience in tagging experiments on sardine and mackerel in the later half of 1970s (Prabhu & Venkataraman, 1970). While the released number of oil sardine was in hundreds and thousands from different centres along the coast, the recoveries were very poor, counting only in units. The system of tagging requires to incorporate and adopt modern methods. Moreover, the time and place of tagging should suit to the exact purpose of releasing tagged fishes. Tagging for the sake of experimentation was over. It requires a new phase of approach of tagging suitable to the specific environmental conditions which are assumed to govern the movement of fishes. If few fishes are selected from their school and released later into the water after tagging, the movement of such fishes differs from the track of movement of their own group. It is therefore ideal to find out, if not already put into practice elsewhere in other seas, species-appropriate method of tagging a major portion of a school of fishes at a time from a place. Methods should be evolved to follow the tagged fishes at sea instead of recovering the tagged fish from the fishermen later on land.

FORV SAGAR SAMPADA'S CAPABILITIES

FORV Sagar Sampada is the ideal research vessel for conducting such specific problem-oriented cruises. Vessel's endurance at sea is long, exceeding 30 days at a stretch, well equipped with modern gadgets for environmental data collection and analyses on board. However, as the vertical draught of the vessel is 5.6 m with gross tonnage of 2661 tons and with huge super structure, it is risky to cruise in the nearshore waters especially during monsoons. Two or more cadalmin-type of vessels or the medium vessels of Fishery Survey of India can work in succession in the shallow waters in liaison with *FORV Sagar Sampada*. This type of fleet arrangement is necessary for the specific investigations connected with fishes living in shallow waters such as anchovies (10-15 m depth) and the aquatic ecosystems of the islands.

Perhaps the facilities of aquarium tanks on board *FORV Sagar Sampada* can best be utilized for conducting pilot projects of various live fishes. The preferential behaviour of anchovies for the Gulf of Mannar waters than for the Quilon Bank waters during monsoon period can be studied by suitably designing the experiment on board. The maximum size of the anchovie fish is about 100 mm only (UNDP/FAO, 1976). It is relatively easy to handle the live anchovies in aquaria, as they are small in size. Physiological factors of anchovies responding to specific conditions of waters can thus be identified in such preliminary observations on board. Scientists at times may overstay at sea, if their new findings in the cruise demand.

REFERENCES

- Alagaraja, K 1987. An appraisal of the marine fisheries of Lakshadweep and Andaman & Nicobar Islands, *CMFRI Special Pub. No. 39*: pp.16.
- Alagaraja, K., Yohannan, K.C., Ammini, P.L. & Pavithran, P.P. 1987. An appraisal of the marine fisheries in Andhra Pradesh, *CMFRI Special Pub. No.33*: pp.52.
- Banerji, S.K. 1973. An assessment of the exploited pelagic fisheries of the Indian seas, In: *Proc. Symp. Living Resources of the Seas Around India, (CMFRI Cochin)* 114-136.
- Dharmaraja, S.K., Vijayalakshmi, K, Haja Najumudeen S., Prasad, C.J. Seynudeen, M.B., Anandan, K., Karthikeyan, M. & Balakrishnan, G. 1987. An appraisal of the marine fisheries of Tamil Nadu and Pondicherry, *CMFRI Special Pub. No.34*: pp.63.
- George, P.C. 1970. The present status of our knowledge on the pelagic fisheries of India with suggestions for planned exploitation of the resources, In: *Proc. Symp. on Development of Deep Sea Fishing*. [Government of India, Ministry of Food and Agriculture (Dept. of Agriculture), New Delhi], pp. 119.
- Jones, S. & Banerji, S K. 1973. A review of the living resources of the central Indian Ocean. In: *Proc. Symp. Living Resources of the Seas around India (CMFRI Special Pub.)* 1-17.
- Luther, G 1988. Oil sardine, an emerging new fishery resource along the east coast, *Mar. Fish. Infro. Serv. T & E Ser.* 88: 13-19.
- Mathew, K.J. (Ed), 1990. *Proc. First Workshop on Scientific Results of FORV Sagar Sampada*, (CMFRI, Cochin) pp. 465.
- Murty, A.V.S., 1993. The impact on sardine fishery of the winter surface currents in the north Indian Ocean including the Bay of Bengal and the Arabian Sea - A need for international cooperative study, *J. Aqua. Biol.* 8: 24-29.
- Murty, A.V.S., Gopalakrishna Pillai, N., Zaffar Khan, M., Sanil Kumar, K.V. & Alavandi, S.V. 1990. Variation in fish catches from the continental shelf between Quilon and Gulf of Mannar and its relation to oceanographic conditions during the southwest monsoon period, In: *Proc. First workshop on Scientific Results of FORV Sagar Sampada*, edited by K.J. Mathew, (CMFRI, Cochin) 291-294.
- Narayana Pillai, V., 1982 *Physical characteristics of the coastal waters off the southwest coast of India with an attempt to study the possible relationship with sardines, mackerel and anchovy fisheries*. Ph.D. thesis, University of Cochin, pp. 107.
- Prabhu, M.S. & Venkataraman, G. 1970. Mackerel and oil sardine tagging programme 1966 to 1969, *Bull. Cent. Mar. Fish. Res. Inst.* 17: pp.31.
- Tranter, D.J. & George, J. 1972. Zooplankton abundance at Kavarathi and Kalpeni atolls in the Laccadives, In: *Proc. Symp. Corals and Coral Reefs*, edited by C. Mukundan & C.S. Gopinadha Pillai, (Mar. Biol. Ass. India, Cochin) 239-256.
- UNDP/FAO. 1970. *Pelagic Fisheries Project, Progress Report No.13*: pp. 107.
- Venkataraman, G 1956. Studies on some aspects of the biology of the common anchovy. *Thrissoctes mystax* (Bloch and Schneider), *Indian J.Fish.* 3: 311-333.