RESEARCH PROJECTS 1972

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

COCHIN-11.

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

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C O C H I N - 11

List of Research Projects for 1972

I N T R O D U C T I O N

As per instructions received from the Council from time to time during the past two years, several projects which were of an allied nature, dealing with similar subjects, have been combined into single projects. Similarly, several other projects which were of little or no practical value have been abolished. The total number of projects in 1970 was 96 and this was reduced to 63 in 1971. In 1972 the number has been further reduced to 29. In doing so it has been ensured that the intrinsic value of none of the existing investigation is lost. On the contrary, each combined project has been carefully designed to increase the importance of the investigation. It is greatly hoped that the reduction in number will increase the effectiveness of the investigations and will help to summarize the findings in the progress report for each year which is to be submitted project-wise.

DIRECTOR

Central Marine Fisheries Research Institute
Cochin - 11

Title of Project:	Sample survey for estimating marine fish production and effort expended to get the production.

Project Code No: FSS/FRA/FS-1

Division: Fishery Survey and Statistics

Location: The coverage of the survey will be the entire coast-line of India. It will be planned, controlled and executed from Cochin.

Title of major project: ASSESSMENT OF MARINE FISHERY RESOURCES

Personnel:

Project Leader:

S.K. Banerji, SFS

Associates:

V. Sadasivan, FS
M.G. Dayanandan, AFS
S.K. Dharmaraja, AFS
A.K. Kesavan Nair, SRA
G. Balakrishnan, RA
Varghese Philipose, RA
K. Narayana Kurup, RA
P. Srinivasa Rao, RA
B. Prasanna Kumari, RA
K. Balan, RA

Objectives:

Estimation of marine fish production and effort in terms of number of operations of unit gear of different types. The detailed break up of the yield according to variety, region and type of gear.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

In a country where fishing is done by a large number of boats and landings take place all along the coast-line throughout the day and even during the night, adoption of a sampling technique suitable for our conditions seems to be the only possible means for the collection of data on catch and effort which are the two basic requirements for the assessment of exploited stocks.

For evolving a suitable sampling scheme, pilot surveys had been conducted by the Indian Council of Agricultural Research and Central Marine Fisheries Research Institute in early fifties on which the present sampling

technique is based. The important references are indicated below:-

1. Bal, D.V. and Banerji, S.K. 1951. A survey of the sea fisheries of India. Proc. Indo-Pacific Fish. Coun. Sec. II. 75-79.

2. Banerji, S.K. 1968. Estimation of marine fish production, Symposium on current status of fishery statistics, Journal of the Indian Society of Agricultural Statistics, Vol. 20, No.2, December.

3. Bazigos, C.P. 1970. Sampling techniques in inland fisheries with special reference to Volta Lake. UNDP Volta Lake Research Project. FIO: SF/GHA/10. 6 May 1970 St. S/1 & 2.

4. Chakraborty, D. 1967. Statistics in fishery research and development. Souvenir, 20th Anniversary, C.M.F.R.I. 1967: 130-132.

5. Nair, R.V. and Banerji, S.K. 1968. A survey of the statistics of marine fish catch in India from 1950 to 1962. Indian J. Fish., Vol. 12 No.1, 135-236.

6. Panse, V.G. and Sastry, K.V.R. 1960. Sample survey of fishery statistics. ETAP Report No.1247.

7. Sukhatme, P.V., Panse, V.G. and Sastry, K.V.R. 1958. Sampling technique for estimating catch of sea fish in India. Biometrics 14, 78-96.

8. Yamamoto, T. 1953. Sampling survey of fisheries catch statistics in Japan. Statistics and survey division. Ministry of Agriculture and Forestry, Tokyo, Japan.

Plan of work:

The design of sample survey involves space-time stratification. A number of geographically contiguous landing centres form the stratum in space. A ten day period of a month is the time stratum. The primary sampling unit is a centre-day/centre-group of two days. Sampling is also adopted over hours of the selected day and the enumerating units, which are landing boats, are selected on a systematic basis. The data on night catches are obtained by enquiry.

On the basis of estimates made for the primary sampling units, stratum estimates and their percentage error are arrived at. The period of estimation is a month.

Size composition of some of the commercially important species of fishes will be studied under a sample survey.

Title of Project: Frame survey

Project Code No: FSS/FRA/FS.2

Division: Fishery Survey and Statistics

Location: Coverage all marine fishing villages and landings centres in India. Controlled and supervised from Cochin.

Title of major project: ASSESSMENT OF MARINE FISHERY RESOURCES

Personnel:

Project Leader:

V. Sadasivan, FS

Associates:

S.K. Dharmaraja, AFS
G. Balakrishnan, RA
Varghese Philipose, RA
K. Narayana Kurup, RA
K. Balan, RA

Objectives:

Village-wise data on fishermen population, fishing units of different types and information on fish landing centres constitute the frame of surveys conducted by this Institute. These will also bring out the nature of changing pattern of fishing industry and its consequent impact on fishermen.

Total duration: One year

Date of initiation: 1971 - 4th Survey

Brief resume of literature:

The first session of the IPFC/IOFC Joint Working Party on Fishery Statistics recommended certain minimum requirements of a National Fishery Statistics System. This included statistics on fishing establishments, fishing man-power, fishing craft, fishing units, catch and fishing effort and value of the catch. The aim of the present project is to collect statistics on the first 4 items.

In this connection the following literature published by FAO may be referred to:-

FAO 1970. IPFC/IOFC Joint Working Party of experts on Indian Ocean & Western Pacific Statistics, Bangkok, December, 1960.

Plan of work:

Investigators will collect data by visiting different houses and fishing establishments in all the marine fishing villages in India. The data will include number of marine fishing villages, fishing establishments, marine fishermen population, number of active marine fishermen and number of fishing crafts etc. It is proposed to collect such data on a complete census basis every 10 years and obtain projected estimates for interim years based on sample survey data collected during these years. The implementation of the frame survey will depend upon the availability of travelling funds and field personnel.

Title of Project:	Stock assessment and estimation of potential yield of commercially important fishes
Project Code No:	FSS/FRA/ST. 1
Division:	Fishery Survey and Statistics
Location:	Cochin
Title of major project:	ASSESSMENT OF MARINE FISHERY RESOURCES
Personnel:	Project Leader: S.K. Banerji, SFS
	Associates: A.K. Kesavan Nair, SRA K. Narayana Kurup, RA P. Srinivasa Rao, RA

Objectives:

Annual assessment of the stocks of commercially important fishes is essential for a rational exploitation of these stocks. The Fifth Meeting of the ICAR Panel has indicated the importance for such stock assessments. The aim of this project is to find out the effect of fishing on the stocks of commercially important fish and thus determine the level of exploitation which will give the optimum sustained yields from the exploited stocks.

Total duration: 5 years

Date of initiation: 1970

Brief resume of literature:

The pioneering work of Baranov (1918) was the first attempt to build up mathematical models linking yield with growth, recruitment and mortality rates in order to determine the effect of fishing on a fish stock and to assess the optimum yield derivable from the North Sea plaice along with the associated level of exploitation. The model was further developed and made more realistic by Beverton and Holt (1957) and applied to plaice and haddock fisheries of the North Sea. The model has since been used widely to make assessment of ground fish stocks in temperate waters. Schaefer (1953, 1954) developed another model suitable for tropical pelagic fisheries and applied the same for the assessment of tuna stocks of the Pacific. Annual assessment of the exploited fish stocks using such models has become an important aspect of fisheries research in all countries.

Preliminary work along these lines has recently been undertaken to make assessment of the two of our most important pelagic fisheries, namely, the oil sardine and the mackerel. The assessment of stocks of numerous other commercially important fisheries are yet to be undertaken.

1. Banerji, S.K. 1968. An assessment of the exploited pelagic fisheries on the Indian Seas. Symp. on the living resources of the Seas around India. Central Marine Fisheries Research Institute, Cochin, December 7-10, 1968.

2. Banerji, S.K. and Krishnan, T.S. Preliminary assessment of the oil sardine population along the west coast of India (MS).

3. Baranov 1918. On the question of biological basis of fisheries. Nanchnuvii issledovaleskii iktislogisheskii Institut Investiia. 1(1): 81-128.

4. Beverton, R.J.H. and S.J. Holt, 1957. On the dynamics of exploited fish populations. Fish. Invest. Lond. Ser. II: 19. 533 pp.

5. Schaefer, M.B. 1953. Fisheries dynamics and the concept of maximum equilibrium catch - Proc. Calif. Caribb. Fish. Inst. 6th Annual Session, 53-64.

6. _____ 1954. Some aspects of the dynamics of populations important in the management of commercial marine fisheries. Bull. Inter. Amer. Trop. Tuna Comm. 1(2).

Plan of work:

The plan of work includes the following aspects:

1. Analysis of monthly data on fish size. Estimation of age and growth. Expression of growth by suitable mathematical equation.
2. Collection of the data of sample size composition mentioned above. Conversion of available catch data (by weight) to size/age composition in number for every fishing season.
3. Estimation of relative abundance of various age groups for every fishing season.
4. Estimation of fishing and natural mortality rates.
5. Developing suitable mathematical models for estimating the yield by making use of other parameters (recruitment, growth and mortality rates) and estimating the maximum potential yield from each fishery along with the associated levels of exploitation.
6. Utilization of suitable biological informations for stock measurement and estimating the potential yield.

Title of Project: Fishery data centre

Project Code No.: FSS/FRA/ST. 2

Division: Fishery Survey and Statistics

Location: Cochin

Title of major project: ASSESSMENT OF MARINE FISHERY RESOURCES

Personnel:

Project Leader:

S.K. Banerji, SFS

Associates:

M.G. Dayanandan, AFS
S.K. Dharmaraja, AFS
A.K. Kesavan Nair, SRA
G. Balakrishnan, RA
P.Karunakaran Nair, RA
B.Prasanna Kumari, RA

Objectives:

The Fishery Data Centre will be the store-house of all the data on exploratory and commercial fishing operations along with the environmental data. To start with, the relevant data from all exploratory vessels will be collected and their analysis will enable to draw up contour maps of various fisheries in relation to their abundance which will ultimately be of great value in the exploitation of untapped fishery resources.

Total duration: Being a store-house of all types of exploratory fishing data, the establishment of a Fishery Data Centre is envisaged as a long-term and permanent scheme. However, the scheme will be developed gradually as the programme of exploratory survey gathers momentum.

Date of initiation: 1971

Plan of work:

1. Preparation and distribution of standard forms for the collection of relevant data.
2. Codifying and storing the data.
3. Processing of the data and preparation of charts showing abundance of fish of different types.

Title of Project:	Fishery and biology of the oil sardine, Sardinella longiceps.
Project Code No:	FB/MF/1
Division:	Fishery Biology
Location:	Karwar, Mangalore, Calicut and Cochin.
Title of major Project:	INVESTIGATIONS ON MAJOR FISHERIES
Personnel:	Project Leader:

B.T. Antony Raja, JFS

Associates:

V. Balan, JFS
M.H.Dhulkhed, AFS
G.G.Annigeri, SRA
V.S. Rangaswamy, RA
R. Raghu, JSA

Objectives:

i) to study variations in the relative abundance of oil sardine in space and time off the west coast of India,

ii) to assess the variations in the catch of juveniles in relation to rainfall,

iii) to study the biological aspects such as age, growth, sex ratio, spawnin migration and

iv) to conduct racial studies for determining whether the exploited stock consists of a homogenous population.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

The undermentioned publication reviews up to date all the work hitherto carried out on the oil sardine.

Antony Raja, B.T. 1969. The Indian Oil Sardine. Bull. cent. mar. Fish. Res. Inst. No.16

Plan of work:

1. A regular record of catch and effort data on oil sardine landed by different gears will be maintained at the centres selected for biological stud
2. Correlation between catch data and the amounts of rainfall during the monsoon season will be made.
3. Based on the routine sampling for biological studies, the various biological aspects will be evaluated.
4. The nature and movement of oil sardine shoals and the related problems will be studied by a regular programme of tagging.
5. Racial studies on the species will also be undertaken

Title of Project:	Fishery and biology of the Indian mackerel, Rastrelliger kanagurta and other species of Rastrelliger.
Project Code No:	FB/MF/2
Division:	Fishery Biology
Location:	Karwar, Mangalore, Calicut, Cochin, Vizhinjam, Mandapam, Madras & Port Blair
Title of major project:	INVESTIGATIONS ON MAJOR FISHERIES
Personnel:	Project Leader: G. Seshappa, FS
	Associates: M. Vasudev Pai, JFS V. Balakrishnan, JFS P. Vijayaraghavan, JFS A. Noble, AFS V.N. Bande, AFS J.C. Gnanamuttu, SRA T.M. Yohannan, RA P. Livingston, RA

Objectives:

i) To study the relative abundance of mackerel in space and time, and

ii) to investigate the various biological aspects such as age, growth, sex composition, maturation, fecundity, feeding habits, migration and spawning behaviour.

Toal duration:	Continuing
Date of initiation:	Already in progress

Brief resume of literature:

The existing knowledge on the fluctuations in the catches of mackerel and on the different biological aspects such as age, growth, maturity, spawning and feeding habits ~~can be obtained from~~ has been reviewed in the undermentioned publication:

Nair, R.V., S.K. Banerji, K.Virabhadra Rao, G. Venkataraman, K.V. Narayana Rao and V. Balakrishnan, 1970. The Indian Mackerel. Bull. cent. mar. Fish. Res. Inst. No.24: 102 pp.

Plan of work:

1. Catch and effort data on mackerel will be collected at different centres mentioned above, based on random sampling.
2. Biological data will be collected to study the size composition, age, growth, maturity, spawning, feeding habits etc. at all the centres.
3. Tagging of mackerel will be carried out to study the movement of mackerel and other related problems.
4. Special studies on other species of Rastrelliger will be carried out at Port Blair and Madras

Title of Project:	Fishery and biology of prawns and shrimps
Project Code No:	FB/MF/3
Division:	Fishery Biology
Location:	Veraval, Bombay, Karwar, Mangalore, Calicut, Cochin, Colachel, Mandapam, Madras, Kakinada.
Title of major project:	INVESTIGATION ON MAJOR FISHERIES
Personnel:	Project Leader:
	K.H. Mohamed, FS
	Associates:
	S. Ramamurthy, JFS K. Radhakrishna, AFS V.M. Deshmukh, AFS M.M. Thomas, SRA N. Neelakanta Pillai, SRA M. Aravindakshan, SRA K.Y. Telang, SRA G. Sudhakara Rao, SRA Kuber Vidyasagar, SRA D. Sivalingam, SRA P.E. Sampson Manickam, RA K.Devarajan, RA K.K.Sukumaran, RA K.V.George, RA K.Rajasekharan Nair, RA M. Kathirvel, RA and others

Objectives:

1. To collect and maintain accurate data in respect of all important species of prawns in order to study the intensity and sequence of their occurrence in the commercial catches. To keep watch on the effect of fishing on the stocks and to advise management policies as and when required to ensure maximum sustained yield.

2. To evaluate the various biological factors such as age and growth, food and feeding habits, maturation, spawning and fecundity, migration and behaviour of the commercially important prawns.

3. To study the intensity of prawn resources and their distribution at various depths and areas covered by trawlers and to prepare maps showing their distribution.

4. To study the physical and chemical factors related to prawn grounds and the animal assemblages associated with it. To assess how far these factors influence the prawn fishery of the area.

5. To elucidate the salient features of early life-history of penaid prawns and to find out differentiating characteristics of various larval and post-larval stages. To study the seasonal occurrence and abundance of larvae.

6. To study the migratory movements and rate of growth of different species of prawns.

7. To study the abundance of larval and juvenile prawns that enter and leave the nursery area and to determine their numbers, size composition and other biological characteristics. To understand the influence of tides and lunar phases in the recruitment of larvae and juveniles.

8. To investigate the relationship between the abundance of larvae and the commercial prawn landings of the area.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

Prawns and shrimps form 96.42% of the average annual crustacean production, which amounts to 10.89% of the annual marine fish production. In the annual landings of prawns and shrimps from 1957 to 1970, although minor fluctuations are seen, the data depict a general rising trend and the fluctuations are found to be random in nature.

The trend of prawn landings and their fluctuations at different centres of the coasts, percentage contribution, seasonal occurrence, distribution and size composition of each species contributing to the fishery have been studied.

The population structure and the effects of exploitation on prawn stocks of some areas have been studied to some extent. The prawn catches from the marine region consists mainly of the 0-year and 1st year class in the case of smaller species such as Metapenaeus dobsoni and Parapenaeopsis stylifera and 1st and 2nd year class in the case of larger species such as M. affinis, M. monoceros and P. indicus. In M. dobsoni it has been shown that fluctuation in the catch is mainly due to the abundance of 0-year class. Estimates of mortality rate of M. dobsoni have been made. Data are, however, incomplete in the case of other commercially important species.

Of the several species of prawns recorded from the Indian Seas, only about a dozen species contribute to the commercial fisheries. Life history and biology of most of these species are still imperfectly known. Divergent views have been expressed regarding the age and growth, maturity and breeding seasons, migratory pattern and recruitment to the fishery, etc. Spawning grounds of most of the species have not been demarcated although the prawns are known to breed in deeper waters.

1. CMFRI, 1969 Prawn Fisheries of India, Bull. cent. mar. Fish. Res. Inst. No. 14: 1-305.

2. George, M.J. 1962 On the breeding of Penaeids and the recruitment of their postlarvae into the backwaters of Cochin. Indian J.Fish. 9(1): 110-16.

3. _____ 1963 Post-larval abundance as a possible index of fishing success in the prawn Metapenaeus dobsoni (Mier). Indian J. Fish. 10A(1): 135-39

4. George, M.J. and K.H. Mohamed 1966. An assessment of marine prawn fishery resources of Kanyakumari District, South west coast of India. Proc. Indo-Pacif. Fish. Counc. 12th Sess.

5. George, M.J., S.K. Banerji, and K.H. Mohamed 1968. Size distribution and movement of the commercial prawns of the southwest coast of India. FAO Fish. Rep., 57(2): 265-284.

6. George, M.J., K. Raman and P. Karunakaran Nair 1963 Observations on the offshore prawn fishery of Cochin. Indian J. Fish.10A(2): 460-499.

7. George, M.J., K.H. Mohamed and N.N. Pillai 1968 Observations on the paddy field prawn filtration of Kerala. India FAO Fish. Rep 57(2): 427-442.

8. Gopalakrishnan, V. 1952. Food and feeding habits of Penaeus indicus M. Ed. J. Madras Univ. (B), 22(1): 69-75.

9. Menon, M.K., and K. Raman 1961. Observations on the prawn fishery of the Cochin backwaters with special reference to the stake-net catches. Indian J. Fish., 8(1): 1-23

10. Mohamed, K.H. 1967. The prawn Fisheries. 20th Aniv. Souvenir, Central Marine Fisheries Research Institute, Mandapam Camp. 75-81.

11. Mohamed, K.H., and C. Suseelan 1968 The deep-sea prawn resources off the south-west coast of India. Symp. Living resources of the seas around India, Cochin.

12. Panikkar, N.K. and M.K. Menon 1955. Prawn fisheries of India. Proc. Indo-Pacif. Fish. Counc., 6(3): 328-344.

13. Priscilla Caces Borja and S.B. Rasalan 1968. A review of the culture of SUGIO, Penaeus monodon Fabricius, in the Philippines, FAO Fish. Rep. No.57, Vol.2.

14. Subrahmanyan, M. 1965. Lunar diurnal tidal periodicity in relation to the prawn abundance and migration in Godavari estuarine system. Fish. Tech., 2(1): 26-41

Plan of work:

1. Regular samples of prawns caught by different gears will be obtained separately from three different environments viz., estuaries, inshore and offshore areas. These samples will be collected from different centres of both the coasts of India.

2. The collections will be analysed in detail in the laboratory and all biological data on each of the species will be recorded. Size frequency distribution, sex ratio, maturity etc. will be recorded for each species.

3. Mean size of all commercial species of prawns will be estimated and recorded on an yearly basis from each centre.

4. The data will be maintained in especially designed tables in permanent registers.

5. Significant flucutations in the mean size and annual catch if noted will be immediately reported.

6. Faunistic and resources survey, particularly of the deep water prawns, will be undertaken.

7. Detailed analysis of the data will be carried out by the different groups to study the biological factors such as age and growth, food and feeding, spawning behaviour, migratory patterns etc. of each commercial species.

8. Special collections, as and when required, in addition to the basic data, will be made.

9. Experiments will be conducted to induce spawning of prawns under laboratory conditions.

10. Rearing of the larvae and adults of important species will be undertaken in the laboratory with a view to develop culture techniques together with the existing practices of culture of prawns in paddyfields.

11. Environmental data of the prawn grounds will be collected and attempts will be made to correlate the same with prawn abundance.

12. Regular collections to study the rate of immigrations and emigration of larval and juvenile prawns in the estuaries and backwaters will be undertaken.

Title of Project:	Fishery and biology of commercially important Elasmobranchs
Project Code No:	FB/OF/1
Division:	Fishery Biology
Location:	Bombay, Tuticorin, Mandapam, Chidambaram and Madras
Title of major project:	INVESTIGATIONS ON OTHER FISHERIES
Personnel:	Project Leader: R.V. Nair, Deputy Director
	Associates: P. Devadas, RA S. Shanmugham, RA K.K.Appukuttan, RA Prabakaran Nair, RA R. Soundararajan, RA M.E. Rajapandiyan, RA

Objectives:

1. To find out the regional and species-wise abundance of sharks, rays and skates and their seasonal fluctuations, and

2. to elucidate the various biological aspects such as food and feeding habits, age and growth, reproductive and embryonic development of commercially important species of sharks, rays and skates.

Total duration: Continuing

Date of initiation: 1971

Brief resume of literature:

In the ten year period 1959-1968, the average annual landings of elasmobranchs in India was 33,223 tonnes forming 3.68% of the total marine fish production. The sharks represented by genera, Scoliodon, Carcharias, Hypoprion and Galeocerdo and the rays and skates belonging to the genera, Gymnura, Trygon, Himantura, Actobatis and Rhynchobatus are commercially very important as they provide a rich source of food, liver oil, vitamins, fish manure, tanning oil etc.

In order to exploit the potential elasmobranchs resources, an adequate knowledge of the identity, distribution, biology and fisheries of the various species is very essential.

Some important references on the subject are:

1. Chidambaram, K. and Menon, M.D., 1946. Investigation on the shark fishery of Madras Presidency. Govt. of Madras Publication.

2. C.M.F.R. Institute, 1969 Marine Fisheries Production in India Bull. cent. mar. Fish. Res. Inst. No.6, 144 pp.

3. Day, F. 1878 Fishes of India. Vol. I and II, Bernard Quaritch, London

4. Misra, K.S. 1955 On the distribution of elasmobranchs and chimaeras of the Indian region in relation to the mean annual isotherms. Rec. Ind. Mus., 53: 73-86

5. Prasad, R.R. 1945. The structure, phylogenetic significance and function of the nidamental glads of a few elasmobranchs of the Madras coast. Proc. Nat. Inst. Sci. India, 11: 282-302.

6. Prasad, R.R. 1945. Further observations on the structure and functions of nidamental glads of a few elasmobranchs of Madras coast. Proc. Indian Acad. Sci., 22B: 368-373.

7. Sarangadhar, P.N. 1943 Tiger shark, Galeocerdo tigrinus. Feeding and breeding habits. J. Bom. nat. Hist. Soc., 44: 102-110.

8. Setna, S.B. and P.N. Sarangadhar 1948. Observations on the development of Chiloscyllium griseum, Pristis cuspidatus, Rhynchobatus djeddensis. Rec. Indian. Mus., 46: 25-29.

9. Setna, S.B. and P.N. Sarangdhar 1946 Selachian fauna of Bombay waters. Proc. nat. Inst. Sci. India., 12: 243-259.

10. Setna, S.B. and P.N.Sarangadhar, 1949. Studies on the development of some Bombay elasmobranchs. Rec. Ind. Mus., 47: 203-216.

11. Setna, S.N. and P.N. Sarangdhar, 1950. Breeding habits of some Bombay elasmobranchs. Ibid. 48: 25-54.

Plan of work:

1. Estimation of species-wise catch trends with reference to different types of gears at selected centres.
2. Determination of age and growth
3. Study of length-weight relationship.
4. Analysis of gut contents.
5. Observations on the maturity of gonads.
6. Investigations on fecundity, variation in the numbers of intrauterine embryos, duration and periodicity of gestation (in viviparious form) and other relevant aspects of study to determine the reproductive potentiality of the various species.

Title of Project	Fishery and biology of Bombay duck, anchovies and lesser sardines.
Project Code No.	FB/OF/2
Division:	Fishery Biology
Location:	Veraval, Bombay, Karwar, Kozhikode, Cochin, Vizhinjam, Tuticorin, Mandapam, Madras, Waltair and Port Blair.
Title of major project:	INVESTIGATIONS ON OTHER FISHERIES (PELAGIC RESOURCES)
Personnel:	Project Leader: S.V. Bapat, JFS

Associates:

A.S. Kaikini, AFS	Bombay duck investigations
A. Kurian, RA	
*B.T. Antony Raja, JFS	Lesser sardine investigations
K. Rangarajan, AFS	
P. Sam Bennet, AFS	
T. Appa Rao, SRA	
R. Marichamy, SRA	
S. Lazarus, RA	
*G. Luther, AFS	Anchovies investigations
V. Ramamohana Rao, AFS	
R. Marichamy, SRA	

Objectives:

To study the characteristics of the fish stocks, the effect of fishing on the stocks and to elucidate the various biological features of commercially important fishes in each group.

Total duration: Continuing.

Date of initiation: 1969

Brief resume of literature:

Some of the important publications are those of Bapat (1970), Nair (1960), Bennet (1971), Radhakrishnan (1967).

Plan of work:

With respect to each species on which investigations are already continuing, the plan of work will be as follows:

1. Accurate resources data especially on catch and effort will be collected from landing centres and also by the personnel participating in the exploratory fishing surveys carried out by fishing vessels.

2. Biological aspects such as age and growth, food and feeding habits, maturity, sex ratio, spawning and migration will be studied along with stock assessment.

3. Meristic counts and morphometric characters of Bombay duck, and other groups will be studied with a view to determine different stocks.

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* Associate leaders of respective investigations.

Title of Project:	Fishery and biology of the tunas, seerfishes and billfishes
Project Code No.	FB/OF/3
Division:	Fishery Biology
Location:	Vizhinjam, Minicoy and Mandapam
Title of major project:	INVESTIGATIONS ON OTHER FISHERIES (PELAGIC RESOURCES)
Personnel:	Project Leader: M.D.K. Kuthalingam, JFS Associates: M.S. Rajagopalan, AFS M.M. Meiyappan, RA M. Devaraj, SRA

Objectives:

To study the biology and fishery of commercially important species of tunas, seerfishes and billfishes.

Total duration:	Five years
Date of initiation:	1970

Brief resume of literature:

In the Indian Ocean and adjacent seas, there is large potential for exploiting the pelagic oceanic species of fishes comprising the tunas, seerfishes and billfishes. Detailed investigations on the biology and fisheries of this group is essential for the proper exploitation and management of the resources.

The undermentioned publications have reviewed in detail the existing knowledge on the systematics and biology of the various species under this group.

1. Jones, S. and E.G. Silas, 1964. A systematic review of the Scombroid fishes of India. Proc. Symp. Scombroid Fishes, Mar. Biol. Ass. India, Pt. I: 1-106.

2. Nakamura, I., T. Iwai and K. Matsubara, 1968. A review of the sailfish, spearfish and swordfish of the world. Misaki. Mar. Biol. Inst. Kyoto Univ. Spec. Rep. No. 4: 1-95.

3. Nair, R.V., K. Veerabhadra Rao and K. Dorairaj, 1970. The Tuna and Tuna-like fishes of India. Bull. Cent. mar. Fish. Res. Inst. No. 23: 93 pp.

Plan of work:

1. Species-wise catch trends of tunas at selected centres of observation will be studied.

2. The biology and fishery of the coastal species of tunas will be studied at the different centres.

3. Biology and fishery of the skipjack will be studied in the Laccadives.

4. The abundance and fluctuations in the baitfishes resources in the Laccadives will also be investigated.

5. The fishery and biology of the commercially important species of seerfishes and billfishes will be studied and taxonomic features on the groups will be looked into whenever necessary.

Title of Project:	Biology of catfishes, perches, carangids and lizard fishes
Project code No.	FB/DR/1
Division:	Fishery Biology
Location:	Bombay, Cochin, Vizhinjam, Tuticorin, Mandapam, Madras and Waltair
Title of major project:	INVESTIGATIONS ON DEMERSAL RESOURCES
Personnel:	Project Leader:
	B. Krishnamoorthi, JFS
	Associates:
	P. Mojumder, AFS, M. Gopinatha Menon, RA — Catfish investigations
	K. Alagarswami, JFS, P.T. Meenakshisundaram, AFS, C.R. Shanmugavelu, AFS, M.G. Dayanandan, AFS, P. Nammalwar, RA — Perches investigations
	*K. Alagarswami, JFS, S. Basheeruddin, AFS — Lizard fishes investigations
	*S. Reuben, SRA, P.V. Sreenivasan, RA — Carangid investigations

Objectives:

To study the fishery and biology of commercially important species of catfishes, perches, lizard fishes and carangids.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

Singh, V.D. & M.S. Rege, 1968. J. Bombay nat. Hist. Soc., 65(1):75-87.

Krishnamoorthi, B. 1968. Proc. Symp. Living Resources of Seas around India (in press).

Silas, E.G. 1969. Bull. cent. mar. Fish. Res. Inst. No. 12.

Plan of work:

1. Detailed investigations on biological aspects such as, age, growth, reproduction, migration and feeding habits.
2. Participation of the personnel in the actual fishing operations of the exploratory fishing vessels for collection of fishery and environmental data.

* Associate leader of respective investigations.

Title of Project: Biology of sciaenids, flatfishes and polynemids

Project code No. FB/DR/2

Division: Fishery Biology

Location: Bombay, Karwar, Mangalore, Kozhikode, Mandapam, Madras, Waltair.

Title of major project: INVESTIGATIONS ON DEMERSAL RESOURCES

Personnel:

Project Leader:

T. Tholasilingam, FS

Associates:

S.J. Rajan, AFS	Sciaenid investigations
T. Appa Rao, SRA	
R.S. Lal Mohan, SRA	
K.V. Somasekharan Nair, RA	
A. Jayaprakash, RA	
K. S. Sundaram, RA	
C. Muthiah, RA	
*G. Seshappa, FS	Flat fish investigations
A.C.C.Victor, RA	
*K. Dorairaj, SRA	Polynemid investigations

Objectives:

To study the fishery and biology of commercially important species of sciaenids, flatfishes and polynemid fishes.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

Seshappa, G. 1968. Proc. Symp. Liv. Res. of the Seas around India (in press).

Rao, K.V.S. 1971. Indian J. Fish. 15:88-99.

Yazdani, G.M. 1966. J. Zool. Soc. India, 15(1):64-65.

Kagwade, P.V. 1970. Bull. cent. mar. Fish. Res. Inst. No.18:69 pp.

Plan of work:

1. To elucidate biological aspects such as age, growth rate, food and feeding habits, maturation, spawning etc. of commercially important species under each group.
2. Population studies on the malabar sole, Cynoglossus macrostomus.
3. Participation of the personnel in exploratory fishing vessels for the collection of biological and environmental data.

* Associate leader of respective investigations.

Title of Project:	Biology of silver bellies, silver biddies, ribbon fishes, pomfrets and eels
Project code No.	FB/DR/3
Division:	Fishery Biology
Location:	Veraval, Bombay, Mandapam, Madras, Kakinada
Title of major project:	INVESTIGATION ON DEMERSAL RESOURCES
Personnel:	Project Leader: G. Venkataraman, JFS
	Associates:
	K. Venkatasubba Rao, AFS, C.R. Shanmugavelu, AFS, J.C. Gnanamuthu, SRA — Silver bellies and silver biddies investigations
	*P.T. Meenakshisundaram, AFS, K.A. Narasimham, AFS, J.C. Gnanamuthu, SRA — Ribbon fish investigations
	*Kuber Vidyasagar, SRA — Pomfret investigations
	*D.M. Punwani, AFS — Eel investigations

Objectives:

1. To study the fishery and biology of silver bellies, silver biddies and commercially important species of ribbon fishes, pomfrets and eels.

Total duration: Continuing

Date of initiation: : 1969

Brief resume of literature:

Venkataraman, G. 1960. Indian J. Fish., 7:275-306.

Sivaprakasam, T.E. 1965. Ibid. 10(1):140-147.

Bal, D.V. and K.H. Mohamed, 1957. J. Bombay Nat. Hist. Soc., 54(3):732-740.

James, P.S.B.R. 1967. Memoir No.1. Mar. biol. Ass. India. 226 p.

Plan of work:

1. To carry out detailed investigations on the biological aspects such as age, growth rate, reproduction and feeding habits of selected species under each group.
2. Participation of the personnel in exploratory fishing vessels for collecting fishery and environmental data.
3. To study the probable effect on the abundance of silver bellies consequent on the erection of a fish meal plant at Mandapam.

* Associate leader of respective investigations.

Title of Project:	Evaluation of demersal resources of some selected areas (in collaboration with DSF)
Project code No.	FB/DR/4
Division:	Fishery Biology
Location:	Cochin, Kakinada, Port Blair
Major project:	INVESTIGATION ON DEMERSAL RESOURCES
Personnel:	Project Leader:
	C. Mukundan, AFS (Cochin area)
	Associates:
	*K.A. Narasimham, AFS G. Sudhakara Rao, SRA Y. Appana Sastry, RA W. Venugopalan, RA — Kakinada area
	*V.N. Bande, AFS R. Marichamy, SRA — Port Blair area

Objectives:

1. To evaluate, the area-wise and region-wise abundance of demersal resources by making detailed investigations at some selected areas such as Cochin, Kakinada, and Port Blair.

Duration: 5 years

Date of initiation: 1972

Brief resume of literature:

Rao, K. Virabhadra 1969. Bull. Cent. mar. Fish. Res. Inst.,6:69 pp.

Plan of work:

1. The distribution pattern and fluctuations in the abundance of constituent species in each area will be studied.

2. Participation of the personnel in the actual fishing operations for the collection of fishery and environmental data.

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* Associate leaders of respective areas of investigations.

Title of Project: Fishery and biology of other crustaceans

Project Code No. FB/Misc/1

Division: Fishery Biology

Location: Cochin, Colachel, Muttom, Mandapam, Kakinada

Major project: MISCELLANEOUS INVESTIGATIONS

Personnel:

Project Leader:

K.H. Mohamed, FS

Associates:

G. Sudhakara Rao, SRA
K.M.S. Ameer Hamsa, SRA
M. Kathirvel, RA

Objectives:

1. To collect resources data on shallow water lobster, deep water lobsters and commercially important crabs.
2. To elucidate the various biological aspects such as age and growth, food and feeding habits, maturation, spawning, migration and behaviour of commercially important species of lobsters and crabs. (Panulirus homarus, Puerulus sewelli, Portunus pelagicus, Scylla serrata).

Duration: Continuing

Date of initiation: 1969

Brief resume of literature:

George, M.J. 1967. Proc. Symp. Crustacea. Mar. biol. Ass. India, Pt. IV, 1308-1316.

Rao, P. Vedavyasa and M.J. George 1968. Abst. Symp. Liv. Res. Seas Around India.

George, P.C. and K. Ramesh Nayak 1961. Indian J. Fish. 8(1):44-55.

George, M.J., K.H. Mohamed and N.N. Pillai, 1968. FAO Fish. Rep. 57(2):427-492.

Plan of work:

1. Regular observation on species-wise abundance of the different groups.
2. Studies on biological aspects.
3. Migration studies.
4. Larval development and rearing of the lobsters.

Title of Project:	Biology, fishery and stock assessment of molluscs of commercial importance
Project Code No.	FB/Misc/2
Division:	Fishery Biology
Location:	Tuticorin, Vizhinjam, Mandapam, Cochin and Madras
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader:
	K. Nagappan Nayar, JFS
	Associates:
	E.G. Silas, SFS S. Mahadevan, AFS K. Satyanarayana Rao, AFS G.P. Kumaraswami Achari, SRA R. Sarvesan, SRA K. Rama Das, RA

Objectives:

1. To study the ecology and biology of chank and pearl oyster, their population dynamics, and charting of pearl banks and chank beds.
2. To study the biological and ecological aspects of edible oyster, C. madrassensis.
3. To study the fishery and biology of green and brown mussels.
4. To study the taxonomy, fishery and biology of cephalopods.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

Mahadevan and Nagappan Nayar (1966, 1968), Rao (1956); Durvey (1965), Jones (1950, 1968).

Plan of work:

1. At Tuticorin, pearl banks and chank beds will be surveyed using SCUBA for the underwater observations on their ecology. Stock assessment of pearl oyster and chanks.
2. Biology, ecology and physiological aspects of C. madrassensis will be investigated at Mandapam.
3. Biology of green and brown mussels, their ecology and potential resources will be investigated at Vizhinjam.
4. Systematics, and fishery biology studies on commercially important squids will be studied at Cochin and Madras.

Title of Project:	Experiments on pearl culture
Project Code No.	FB/Misc/3
Division:	Fishery Biology
Location:	Tuticorin and Mandapam Camp
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader K. Alagarswami Associates·

Objectives:

To conduct experiments on pearl culture and to develop a suitable technique for cultured pearls from the Indian pearl oyster.

Total duration: 2 years

Date of initiation: 1972

Brief resume of literature:

Japan is the country of cultured pearl industry and has enjoyed a virtual monopoly in this field. Recently several countries like Australia and Philippines with pearl oyster resources have started pearl culture (Tranter, 1957; Wells, 1965). In India, the initial experiments conducted at Krusadai during the years 1933-'40 were not successful (Devanesen and Chidambaram, 1956; Devanesen and Chacko, 1958). Alagarswami (1970) has described the Japanese pearl culture methods and has indicated the prospects of pearl culture in India.

Alagarswami, K. 1970. Pearl culture in Japan and its lessons for India. Proc. Symp. Mollusca, III: 975-993. Mar. biol. Ass. India.

Devanesen, D.W. and P.I. Chacko. 1958. Report on the culture pearl experiments at the Marine Fisheries Biological Station, Krusadai Island, Gulf of Mannar. Contr. Mar. Biol. Sta. Krusadai Is., Gulf of Mannar, 5:1-26.

Devanesen, D.W. and K. Chidambaram. 1956. Results obtained at the pearl oyster farm, Krusadai Island, Gulf of Mannar and their application to the problems relating to pearl fisheries in the Gulf of Mannar, Part I. Ibid., 4:1-89.

Tranter, D.J. 1957. Pearl culture in Australia. Aust. J. Sci., 19:230-232.

Wells, V. 1965. How northern pearl farms are progressing. Aust. Fish. Newslett., 24(6):25.

Plan of work:

1. Farming of pearl oysters (Pinctada fucata) at suitable sites off Tuticorin and Mandapam in the Gulf of Mannar;
2. Conditioning of pearl oysters for pearl culture;
3. Production of nuclei from suitable shell material indigenously (and import of shell beads from Japan for the present experiments);
4. Nucleus implantation experiments;
5. Post-operation care of oysters;
6. Collection of cultured pearls.

N.B:- This Project will be conducted in cooperation with the Project on "Ecology and biology of the chank and pearl oyster" based at Tuticorin and with the cooperation of the Department of Fisheries, Government of Tamil Nadu.

Title of Project: Ichthyofaunal investigations

Project Code No. FB/Misc/4

Division: Fishery Biology

Location: Mandapam and Vizhinjam

Title of major project: MISCELLANEOUS INVESTIGATIONS

Personnel:

Project Leader:

R.V. Nair, Deputy Director

Associates:

M.D.K. Kuthalingam, JFS
M. Kumaran, Curator
R.S. Lal Mohan, SRA
M. Devaraj, SRA

Objectives:

To carry out ichthyofaunal investigations of the Indian Seas.

Total duration: 3 Years

Date of initiation: 1971

Brief resume of literature:

Day, F. 1878. Fishes of India, Bernard Quaritch. London.

Weber, M. and Beaufort, L.F. 1913-1962. Fishes of the Indo-Australian Archipelago. Vols. 2-11. E.J. Brill, Leiden.

Munro, I.S.R. The Marine and Freshwater fishes of Ceylon. Dept. of Ext. Attains, Canberra.

Plan of work:

The taxonomy and distribution of fishes occurring in the Indian Seas will be studied.

Title of Project:	Environmental studies - Physical and Chemical aspects.
Project Code No.	MBO/ES/1
Division:	Marine Biology and Oceanography
Location:	Bombay, Karwar, Mangalore, Calicut, Cochin, Minicoy, Tuticorin, Mandapam, Madras, Waltair and Port Blair.
Title of major project:	ENVIRONMENTAL STUDIES
Personnel:	Project Leader:
	A.V.S. Murthy, FS
	Associates:
	G.S. Sharma, JFS C.P. Ramamirtham, AFS D. Sadananda Rao, AFS — All Regions
	K.N. Krishna Kartha, AFS K. Radhakrishnan, AFS N.S. Radhakrishnan, AFS P. Mojumder, AFS G.G. Annigeri, SRA K.G. Girijavallabhan, SRA, R. Marichamy, SRA M.M. Meiyyappan, RA — Inshore waters
	V. Kunjukrishna Pillai, SRA C.K. Gopinathan, SRA K.V. George, RA K.J. Joseph, RA Pon. Siraimeetan, RA — Backwaters and estuaries

Objectives:

1. Collection, processing and interpretation of data on physical and chemical properties of sea water such as temperature, density, salinity, oxygen content, nutrient contents, and on marine meteorological aspects.

2. To study the correlation between physical and chemical parameters needed for fishery data.

3. To assess the role of nutrients in phytoplankton productivity.

4. To study sedimentation in estuaries.

5. To study the development of new techniques and instrumentation in marine research.

6. To study the fisheries of backwaters in relation to physical and chemical conditions already known. Special emphasis to be given on the shrimp fishery of the backwaters and estuarine areas acting as nursery grounds for young shrimp.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

1. Uda, M. 1952. J. Tokyo Univ. Fish., 38(3) : 363-389

2. Strickland, J.D.H and T.R. Parsons. 1968. Bull. Fish. Res. Bd. Canada. No. 167.

Plan of work:

1. Routine hydrographical data to be collected, processed and analysed for physical and chemical properties in the respective regions.

2. Meteorological data to be collected wherever possible.

3. The hydrographical data already collected by the Institute from Research Vessels will be processed and analysed for vertical and horizontal distribution patterns for temperature, salinity, dissolved oxygen and computed parameters will be charted out and made available for use in fishery investigations.

4. The nutrient contents in the sea water will be analysed and processed for their seasonal distribution patterns in relation to the rate of primary organic production.

5. Sedimentation in estuaries will be studied by sounding method and also by analysis of suspended matter.

6. Data on temperature, salinity, oxygen content, nutrient content, p^H, alakalinity, conductivity, turbidity, plankton, primary productivity and fisheries of the Cochin backwater will be collected with special emphasis of the prawn fisheries of the region.

Title of Project: Environmental studies — Circulation and related phenomena.

Project Code No. MBO/ES/2

Division: Marine Biology and Oceanography

Location: Cochin

Title of major project: ENVIRONMENTAL STUDIES

Personnel:

Project Leader:

V.S. Sharma, JFS

Associates:

A.V.S. Murthy, FS
C.P. Ramamirtham, AFS
N.P. Kunhikrishnan, JSA
K.P. Viswanathan, LFA

Objectives:

To study the seasonal variations in circulation (both vertical and horizontal) off the west coast of India and in the Northern Indian Ocean based on available data at the Institute and also from those obtainable from International agencies and to examine the influence of upwelling, sinking and related phenomena on different fisheries.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

1. Montgomery, R.B. 1923. Papers in physical oceanography and meteorology 6(2) : 55.
2. Wyrtki, K. 1962. IIOE. coll. Rep., 1 : 133-149.
3. Sharma, G.S. 1966. J. Mar. Biol. Ass. India, 8(1):8-19.
4. _____ 1968. Proc. Symp. Indian Ocean March 1967, N.I.S.I. No. 38 : 263-276.

Plan of work:

1. Based on the oceanographic data collected by the Institute since 1957, monthly temperature anomaly maps will be prepared by a graphical technique for inferring the intensity and duration of upwelling and sinking off the west coast of India.
2. The data already available from the cruises of R.V. Varuna and other vessels, those collected during the IIOE period and relevant data available from the Indian Meteorological Department will be examined to study the following:
   a) the phenomenon of circulation off the west coast of India based on isentropic analysis;
   b) the dynamical anomalies;
   c) the drift currents induced by atomospheric winds; and
   d) the distribution pattern of salinity, dissolved oxygen, depths and acceleration at different isonosteric surfaces.

Title of Project:	**Studies on phytoplankton productivity**
Project Code No.	MBO/ES/3
Division:	Marine Biology and Oceanography
Location:	Bombay, Karwar, Calicut, Cochin, Tuticorin, Madras and Waltair.
Title of major project:	ENVIRONMENTAL STUDIES
Personnel:	Project Leader: P.V. Ramachandran Nair, JFS Associates: K. Radhakrishna, AFS V.S.K. Chennubhotla, AFS K.G. Girijavallabhan, SRA C.P. Gopinathan, SRA K.J. Joseph, RA

Objectives:

1. To assess the potential productivity of the shelf waters along the west and east coasts of India.

2. To estimate the standing crop of phytoplankton organisms and to determine the relationship between phytoplankton productivity and phytoplankton biomass.

3. To study the influence of isolated environmental factors on unialagal cultures.

4. Qualitative and quantitative studies on phytoplankton of offshore and oceanic waters.

Total duration: Continuing

Date of initiation: 1969

Brief resume of literature:

1. Steeman Nielsen, E and E.A. Jensen. 1967. Galathea Repts.I
2. Prasad, R.R., S.K. Banerji and P.V.R. Nair. 1970. Indian J. Anim. Sci. 40(1) : 73-98.
3. Richards, F.A. and T.G. Thompson. 1952. J. Mar. Res.II : 156-172.
4. Aruga, Y. 1965. Bot. Mag. Tokyo., 78 : 280-288, 360-365.
5. Grontved,J. 1960. Medd. Danmarks. Fisk. Havund 3(3) : 55-92.

Plan of work:

1. Organic production in the sea to be determined by ^{14}C technique.

2. Estimation of standing crop of phytoplankton by pigment analysis and by total cell counts.

3. Suitable culture experiments to be planned and carried out to assess the influence of each environmental factor on unialgal cultures.

4. Taxonomical and ecological studies on phytoplankton of offshore and oceanic waters.

Title of Project:	Studies on secondary production and related aspects.
Project Code No.	MBO/ PI/1
Division:	Marine Biology and Oceanography
Location:	*Bombay, Karwar, Mangalore, Calicut, Cochin, Tuticorin, Mandapam, Madras, Waltair and Port Blair.
Title of major project:	ZOOPLANKTON INVESTIGATIONS
Personnel:	Project Leader:
	E.G. Silas, SFS
	Associates:
	K.G. Girijavallabhan, SRA P. Dhandapani, SRA P. Parameswaran Pillai, SRA K.J. Mathew, SRA R. Marichamy, SRA M. Srinivasan, RA M.M. Meiyyappan, RA K. Rengarajan, RA C.M. James, Research Scholar P.K. Martin Thompson, Research Scholar and others.

Objectives:

In any fishery oriented investigation, the proper understanding of the relationship between the fishes that constitute the fishery and zooplankton which constitute their food is an essential prerequisite. The most important factor that influence the fishery of a region is the plankton production. Apart from primary production which gives the first important link in the food chain of the sea, it is essential to follow the cycle of events and transformation of material of different trophic levels so as to give valid predictions regarding the natural fluctuations in the abundance of fish stocks.

This project is aimed at elucidating the above mentioned ecological aspects with particular reference to fisheries and also to highlight the role of zooplankton in the complex marine food chain.

Total duration: Continuing

Date of initiation: 1969

Brief resume of Literature:

The undermentioned publications give important and useful information relevant to the project :

1. Steele, J.H. (Ed) 1970. The Marine Food Chain. Oliver and Boyd, Edinburgh.

2. Subrahmanyan, R. 1959-1965. Studies on the phytoplankton of the west coast of India. Part I to IV.

3. Prasad, R.R. 1968. II OE Plankton Atlases. 1(1 & 2).

4. Fleminger, A. 1964. CALCOFI Atlas, No. 2.

5. Sewell, R.B.S. 1929-1942. Mem. Indian Mus. 10: 1-221.

6. George, P.C. 1963. J. Zool. Soc. India, 5 (1) : 76-107.

7. Mauchline, J and L.R. Fisher. 1969. Advances in Marine Biology, VII.

8. Fraser, F.C. 1936. Discovery Rep. XIV, 1-192.

9. Russel, F.S. 1935. J. Mar. Biol. Ass. U.K., 20(2) : 309-332.

10. Totton, A.K. 1954. Discovery Rep. 27: 1-162.

Plan of work:

1. Collection of zooplankton samples using standard methods.
2. Estimation of zooplankton biomass.
3. Taxonomy and biology of important zooplankton groups such as Copepoda, Decapod larvae, Chaetognatha, pelagic Tunicata, Euphausiacea, pelagic Gastropoda, larval Cephalopoda, Ostracoda, Siphonophora to be studied.
4. Study of the importance of zooplankton as indicators of water masses.
5. Study the distribution and abundance of these groups with special reference to hydrographic conditions.
6. To assess the role of zooplankton in the marine food chain.
7. To study the importance of bioscattering and to identify the biological constituents of Deep Scattering Layer.

Title of Project:	Studies on fish eggs and larvae from the plankton
Project Code No.	MBO/PL/5
Division:	Marine Biology and Oceanography
Location:	Bombay, Karwar, Mangalore, Calicut, Cochin, Vizhinjam, Minicoy, Tuticorin, Mandapam, Waltair and Port Blair.
Title of major project:	ZOOPLANKTON INVESTIGATIONS
Personnel:	Project Leader: E.G. Silas, SFS Associates: P. Vijayaraghavan, JFS, V. Kunjukrishna Pillai, SRA K.G. Girijavallabhan, SRA G.S.D. Selvaraj, RA M. M. Meiyyappan, RA K. Rengarajan, RA M. Rajagopalan, RA Pon. Siraimeetan, RA P. Karuppaswamy, RA

Objectives:

1. Quantitative assessment of total fish eggs and larvae in the plankton.

2. To locate spawning grounds and study the spawning seasons and spawning intensities.

3. To estimate the recruitment to the stocks.

4. To make detailed life history studies on important species.

5. To prepare charts showing distribution of fish eggs and larvae in space and time.

6. To study the influence of environmental factors affecting the abundance and distribution of fish eggs and larvae.

Total duration: 5 years

Date of initiation: 1969

Brief resume of literature:

Previous investigations on fish eggs and larvae from the Indian Seas chiefly include the qualitative aspects such as the descriptive stages of eggs and larvae of some species. Very little information is

available on the quantitative and seasonal abundance of fish eggs and larvae. One serious drawback has been the lack of information on the specific identity of fish eggs and larvae which is partly due to the paucity of information on the ichthyofauna.

1. Ahlstrom, E.H. 1954. Fish. Bull. U.S. Fish Wildl. Serv. 93(56) : 83-140

2. _____ 1959. Ibd., 161: 107-146; 165 : 185-213

3. Jones, S. and P. Bensam. 1968. Bull. Cent. mar. Fish. Res. Inst. No. 3 : 1-154.

4. Mito, S. 1961. Sci. Bull. Fac. Agri. Kyushu Univ., 18(3):285-310.

5. Silas, E.G. and K.C. George, 1970. J. mar. biol. Ass. India. 11(1) :

6. Delsman, H.C. 1922-1938. Fish eggs and larvae from the Java Sea, Nos. 1-24. Published as a series in Trebuia, Vols.2 to 16.

Plan of work:

1. Sorting of fish eggs and larvae from the zooplankton samples.
2. Estimation of abundance of total fish eggs and larvae for the preparation of synoptic charts.
3. The subsorting of fish eggs and larvae and the study of the seasonal abundance and fluctuations of major constituent species.
4. Description of the various stages of life history.
5. Preparation of keys for the identification of the fish eggs and larvae.
6. Abundance and distribution of fish eggs and larvae in relation to environmental factors.
7. Determination of spawning periods and locate spawning grounds.
8. Survey of egg and larval surveys to study the survival and recruitment to the fishable stocks.

Title of Project: Survey and culture of economically important seaweeds.

Project Code No. MBO/Misc/1

Division: Marine Biology and Oceanography

Location: Mandapam

Title of major project: MISCELLANEOUS INVESTIGATIONS

Personnel:

Project Leader:

M. Umamaheswara Rao, AFS

Associates:

P.S. Kuriakose, RA
N. Kaliaperumal, RA

Objectives:

1. To survey the seaweed resources of the Tamil Nadu coast from Mandapam to Colachel for estimating the standing crop of seaweeds and for maping productive areas.

2. To carry out culture experiments under laboratory conditions on commercially important seaweeds to investigate the life-history and to develop suitable techniques for seaweed farming.

Total duration: Continuing

Date of Initiation: 1971

Brief resume of literature:

Rao, M. Umamaheswara, 1971. Bull. Cent. mar. Fish Res. Inst. No. 20

Plan of work:

1. Survey of seaweed resources will be planned and conducted in collaboration with the State Fisheries Department and C.S.M.C.R.I.

2. Seaweed sample will be collected along transects from different stations.

3. Laboratory culture of seaweeds will be maintained for studying the life-history and physiological factors.

Title of Project:	Investigations on deep water fishes
Project Code No.	MBO/ Misc/2
Division:	Marine Biology and oceanography
Location:	Cochin
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader: E.G. Silas, SFS Associates: M.S. Rajagopalan, AFS V. Kunjukrishna Pillai, SRA G.S.D. Selvaraj, RA M. Rajagopalan, RA A. Regunathan, RA I. David Raj, RA K. Nandakumar and others

Objectives:

1. To investigate the qualitative aspects of demersal, midwater and pelagic fishes caught by various exploratory fishing gears employed by R.V. Varuna and other vessels in the continental shelf, continental slope and oceanic waters.

2. To study the demersal fish complexes and associated organisms occurring at different depths of the continental shelf and continental slope.

3. To investigate the different aspects of the biology of the dominant species.

4. To assess the potential fishery resources based on exploratory surveys and also in relation to hydrographic conditions.

5. To study the correlation between the occurrence of deep water fishes and the abudance of fish eggs and larvae.

Total duration:	4 years
Date of initiation:	1969

Brief resume of literature:

Till very recently, large scale exploratory fishing in the Indian seas have been confined to demersal fishing from depths upto 75 m on the continental shelf. Since 1963 a systematic programme of exploration of deeper areas, especially the continental shelf edge and the upper con-

cont...1

tinental slope off the south west coast of India, has been undertaken (75 to 450 m) by R.V. Varuna and other vessels of the INP for assessing the demersal fish resources. These surveys have thrown light on important demersal fishing grounds and potential demersal fish resources. Several fishes, crustaceans and molluscs hitherto unknwon from these waters, have been abundantly found in deep waters.

For the first time during the exploratory fishing cruises of R.V. Varuna and other vessels, drift nets and purse seines have been used for pelagic fishes such as tunas with interesting results.

1. Rao, K.V. 1969. Bull. cent. mar. Fish. Res, Inst. No. 6:1-69.
2. Silas, E.G., G.S.D. Selvaraj and A. Regunathan. 1969. Curr. Sci. 38(5) : 105-106.
3. Silas, E.G., 1969. Ibid., No. 12 : 1-86.
4. Silas, E.G and N.K. Prasad. 1969. Curr. Sci. 38 (20): 484-486
5. George, M.J. and P.V. Rao. 1966. Pro. Symp. Crustacea I:327-336.

Plan of work:

Since the distribution of several species of fishes from the continental slope and oceanic waters have been recorded for the first time in India, the preparation of suitable taxonomic information will facilitate their future identification. Such works will also be helpful in the identification of eggs and larvae of fishes from the plankton.

1. Regular participation in the exploratory surveys for obtaining samples of the dominant species for studies on their feeding habits and spawning behaviour will be carried out.
2. Echo surveys will be carried out for investigating the fish concentrations and fishing grounds.
3. Assessment will be made of potential fishery resources based on exploratory fishing data.

Title of Project:	Investigations on the mud banks of Kerala coast and their influence on the fisheries
Project Code No.	MBO/Misc/ 3
Division:	Marine Biology and Oceanography
Location:	Cochin
Title of major project:	MISCELLANEOUS INVESTICATIONS
Personnel:	Project Leader: A.V.S. Murthy, FS
	Associates: D. Sadananda Rao, AFS K.J. Mathew, SRA C.P. Gopinathan, SRA C.K. Gopinathan, SRA A. Regunathan, RA P.G. Jacob, RA

Objectives:

The formation ~~occur~~ of mud banks is an interesting phenomenon specific to the Kerala State. It has a very important bearing on the fishery in some parts of Kerala and needs intensive investigations on their formation, existence and disappearance and their influence on the fishery.

Total duration: Continuing

Date of initiation: 1971

Brief resume of literature:

1. Sadananda Rao, D. 1967. The mud banks of the west coast of India. CMFRI 20th Anniv. Souvenier., pp. 99-102.

2. Damodran, R. and C. Hridayanathan. 1966. Studies of the mud banks of the Kerala coast. IIOE Symp. 1966.

3. Seshappa, G. 1953. Observations on the physical and biological features of the inshore sea bottom along the Malabar coast. Proc. nat. Inst. Sci. India. 19(2) : 257-279.

4. _____ 1953. Phosphate content of mud banks along the Malabar coast. Nature, Lond., 171, p. 526.

Plan of work:

1. Collections at regular intervals of data on physical, chemical and biological aspects.
2. Investigation on the influence of mud banks on the fishery.

Title of Project:	Aquaculture, its potential and practical applications
Project Code No.	MBO/Misc/4
Division:	Marine biology and oceanography
Location:	Cochin, Mandapam and Tuticorin.
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader: S.Z Qasim, Director Associates: K. Satyanarayana Rao, AFS M.S. Rajagopalan, AFS M. Dharmamba, AFS

Objectives:

To investigate the possibilities of mariculture, with special reference to oysters, shrimps and other suitable teleosts.

Total duration: Continuing

Date of initiation: 1971

Brief resume of literature:

1. Pickford, G.E. and J.W. Atz. 1957. The Physiology of Pituitary gland. N.Y. Zool. Soc., New York.
2. Narayanan Kutty,M. 1969. FAO. Fish. Rep., 57(3) : 957-969.
3. George, M.J., K.H. Mohamed and N.N. Pillai. 1968. Ibid., 57(2) : 427-442.
4. Tampi, P.R.S. 1969. Indian Farming, 19(9) : 53-56.
5. Rao, P.V. 1970. IPFC. Symp. on coastal aquaculture, Bangkok.

Plan of work:

1. Sea water and brackish water fish and shrimp farming and culture of clam and oysters will be undertaken in suitable areas of Tuticorin and Mandapam.
2. Qualitative and quantitative assessment of the availability of fry, fingerlings and juveniles of fishes suitable for salt water culture at Narakkal and other suitable areas.
3. To investigate on the physiological aspects connected with culturing of animals.

Title of Project:	Energy flow in some selected ecosystems
Project Code No.	MBO/Misc/ 5
Division:	Marine Biology and Oceanography
Location:	Cochin
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader:
	S.Z. Qasim, Director
	Associates:
	P.V. Ramachandran Nair, JFS Kumari Vinci, RA D.C.V. Easterson, RA P.G. Jacob, RA C.V. Mathew, RA T. Chandrasekhara Gupta, Research Scholar Thambi Cherian, Research Scholar

Objectives:

To study the primary and secondary production rates in some selected environments for determining the ecological efficiency and transfer of energy at different trophic levels. For the cultivation and harvesting of resources, it is essential to have an understanding of the food chains and a detailed knowledge of energetics in these environments.

Total duration: 2 years

Date of initiation: 1971

Brief resume of literature:

Marine food chains play an important role in Man's search for proteinous food. Recently much emphasis has been given on researches connected with the various aspects of the trophic relations in the sea with a view to determine the efficiency of food conversion.

'Marine Food Chain' (Ed. John Steele) Oliver and Boyd (1970)

Plan of work:

Several areas have been selected in which the conditions of production and energy transfer can be determined throughout the year. Seasonal variability and the magnitude of organic production, phytoplankton standing crop are being studied and measurements are made simultaneously on the biomass of zooplankton and fish.

Title of Project:	Marine environmental damage (pollution, engineering works and other man-made changes
Project Code No.	MBO/Misc/
Division:	Marine Biology and Oceanography
Location:	Cochin
Title of major project:	MISCELLANEOUS INVESTIGATIONS
Personnel:	Project Leader:
	S.Z. Qasim, Director
	Associates:
	P.V. Ramachandran Nair, JFS M.S. Rajagopalan, AFS C.K. Gopinathan, SRA V. Chandrika, RA C. Thankappan Pillai, LFA

Objectives:

In recent years, there has been a world-wide awareness of the problem of marine pollution because of the immense growth of human population and industries, large scale application of pesticides and several other forms of human interference with the natural environments. Apart from these, certain biological phenomena like phytoplankton blooms. create condition which lead to pollution and ultimately deoxygenation of water and mortality of fish and other marine life. Hence, studies on marine environmental damage by different sources become an obvious necessity.

Total duration:	3 years
Date of initiation:	1971

Brief resume of literature:

Proceedings of the technical conference on marine pollution,FAO,1971

Plan of work:

1. The main sources of marine pollution are: domestic sewage discharge into the sea; direct effluents from industrial plants; pesticides like DDT; oil spills from tankers and biological phenomena like blooming of phytoplankton.
2. To begin with, investigations will be taken up on the deleterious effects on phytoplankton, zooplankton and fish as a result of man-made changes in the environment.
3. In areas where other forms of pollution occur, suitable surveys will be conducted to identify the type of pollution and to suggest remedial measures.
4. Studies will also be conducted on some organisms in the environment to measure the effects of pollution(bioassys) on their survival growth and reproduction.

ABBREVIATIONS USED

SFS	-	Senior Fishery Scientist
FS	-	Fishery Scientist
JFS	-	Junior Fishery Scientist
AFS	-	Assistant Fishery Scientist
SRA	-	Senior Research Assistant
RA	-	Research Assistant
JSA	-	Junior Scientific Assistant