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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the Fishery Data Centre and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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Cover photo: Sun drying of flying fish in the Coromandal coast.

**SEMINAR ON THE ROLE OF SMALL-SCALE FISHERIES AND COASTAL
AQUACULTURE IN INTEGRATED RURAL DEVELOPMENT
6-9 DECEMBER 1978, MADRAS-RECOMMENDATIONS**

INTRODUCTION

In the recent years, the imperative need for uplifting the rural sector for achieving an overall development of the Nation's economy and status has been recognised. The coastal sector is essentially rural and is composed predominantly of fishing villages. The development of this sector would thus largely depend upon the improvement of the economic and social status of the fishermen communities. In spite of the significant role played by the fisheries sector in contributing to the Nation's wealth and export earnings, the majority of the fishermen belong to the low-income group and economically backward segment of the society and live below the poverty line. The traditional fisheries sector is not organised and the operational and marketing aspects are beset with problems.

Recently technologies of coastal aquaculture have been developed in India for increasing the production from the coastal and brackishwater areas. It is envisaged that these technologies could advantageously be blended with the existing avocation of the fishermen as well as with the agricultural and livestock practices. However, it is necessary to identify the technologies with reference to their adoptability by small fishermen and landless labour and financial and socioeconomic implications.

Realising that the time is ripe for opening a dialogue on the status of small-scale fisheries and the prospects for an integrated development of this sector through improvements in its traditional set-up and adoption of coastal aquaculture technologies, the Central Marine Fisheries Research Institute created the forum at the Seminar on the "Role of small-scale Fisheries and Coastal Aquaculture in Integrated Rural Development" which was held at Madras from 6th to 9th December 1978. Perhaps for the first time, fishermen representatives and leaders were actively involved in the discussions along with scientists, administrators, financing agencies and social workers.

Forty working papers and keynote addresses presented at the eight sessions of the Seminar formed the subject matter for discussions and several points of importance were highlighted by the participants. The papers and discussions lead to the adoption of several recommendations by the Seminar. These have been carefully scrutinised, edited and grouped and are presented here.

RECOMMENDATIONS

1. SMALL-SCALE FISHERIES

1.1. Diversification of Coastal Fisheries

The Seminar,

noting that the resources available to the small-scale fisheries consist of multiple species that co-exist in the same fishing grounds and that certain fish stocks which are in high demand are heavily fished while the others are under-exploited, and

realising the urgent need for the development of small-scale fisheries both for enhancing production and for improving the economy of the small fishermen,

recommends that more attention be paid to the development of small-scale fisheries by diversification of fishing effort through evolving appropriate technologies and that a critical evaluation of the impact of the recent introduction of new gears such as purse seine, mid-water trawl and pelagic trawl on the resources exploited by traditional crafts and gears be made for formulating regulatory measures, if necessary, to ensure rational fisheries development through diversification.

1.2. Fishery Resources

The Seminar,

realising that continuous assessment and monitoring of resources are essential to evolve viable management measures for the proper development of small-scale fisheries and to avoid over investment in developing any fisheries,

recommends that the resources assessment and monitoring systems may be strengthened so as to provide the data required for the regulation/conservation of the fisheries.

1.3. Craft and Gear

The Seminar,

noting that the fish stocks available to the small-scale fisheries could be harvested by simple crafts and gears and that the greater part of the investment in this sector is on these production means, and

realising the need for improvements in the existing designs of craft and gear for more efficient harvest,

recommends that improvements be effected, keeping operational efficiency and cost in view, to the existing craft types and gears using local material, expertise and skills with the full involvement of all concerned including the fishermen, and that besides the conventional timber used at present, suitable alternate material for the construction of traditional fishing crafts may be identified, tested and made available.

1.4. Transmission of Fisheries Information

The Seminar,

realising the need for quickly transmitting all fisheries information relating to developments in the field, prospects for fisheries in different regions, environment etc. to the fishermen for their use,

recommends that proper systems be developed on a regional basis for the quick collection and dissemination of fisheries information including forecasts, through All India Radio, Doordarshan, and other media.

2. COASTAL AQUACULTURE

2.1. Water and Species Resources

The Seminar,

noting that our country is endowed with immense water and species resources suitable for large-scale coastal aquaculture ventures, but

realising that specific data on the extent and ecological parameters of the different water areas with reference to their suitability for aquaculture are lacking.

recommends that a survey of the coastal and contiguous water areas be carried out in all maritime States and Union Territories to locate and map out suitable areas and to evaluate the cultivable species resources for coastal aquaculture.

2.2. Technological Base

The Seminar,

noting the recent technological advances in coastal aquaculture made in our country,

considering the need for strengthening the technological base, and

realising that the availability and timely supply of fish and shellfish seed are the most important prerequisites without which further development towards establishing commercial culture fisheries would not be possible,

recommends that intensive research be taken up to develop economically viable low-cost technologies for the farming of all cultivable species of economic importance in the coastal and contiguous waters and that emphasis be given to adopt the technology of hatchery production of seed leading to establishment of commercial seed-production centres for supply of quality seed to the farmers.

2.3. Economics of Culture

The Seminar,

noting that the small-scale entrepreneurs are hesitant to take up coastal aquaculture on commercial

scale due to lack of adequate and proven data on the economics of culture operations,

recommends that efforts be made to collect reliable data on the economics of operations of different culture systems in different areas and, after proper evaluation, these data be made available to the aquaculturists and others interested in their use.

3. INTEGRATED RURAL DEVELOPMENT

3.1. Integrated Development of Coastal Zone

The Seminar,

noting with great interest the concepts of blending traditional capture fisheries and coastal aquaculture and integrated farming of crop-livestock-fish/prawns towards proper utilisation of the synergy of the coastal ecosystem and increasing production, and

pointing out that adoption of such integrated operational practices would not only accelerate the harmonised development of the coastal sector but also would bring in a new economic order,

recommends that priority should be given to formulate and implement integrated systems of fisheries utilising the available technology, skills and materials throughout the coast and programmes for productive utilisation of coastal land area with suitable plantation crops and livestock.

3.2. Development of Fishermen Community

The Seminar,

noting that, in spite of the significant development of fisheries during the last three decades, the majority of fishermen still live below the poverty line,

and

realising that the uplift of the fishermen community, socially and economically, is an urgent need so that they are not left out of the mainstream of National development

recommends that the State Governments accelerate their fishermen-welfare programmes to provide adequate facilities, aid and conces-

sions to the fishermen community for simultaneous development of the community along with others, and encourage and provide necessary technical and infrastructure facilities for taking up employment-and-income generating additional avocations in the coastal areas.

4. INFRASTRUCTURE FACILITIES

4.1. Landing Facilities

The Seminar,

noting that at present landing facilities for the crafts engaged in small-scale fisheries are meagre and that during adverse weather conditions and monsoon beach landing of the crafts is extremely difficult, and

realising that high investments would be required to provide modern fishing harbour facilities,

recommends that effective beach landing facilities be established at all important landing centres and approach roads and other infrastructure facilities be provided.

4.2. Fish Preservation and Processing

The Seminar,

noting that the present conditions of handling of fish catches at sea and on landing leave much to be desired, and

realising that proper preservation and processing are essential for producing quality products and realising better prices and that sophisticated techniques are beyond the reach of artisanal fishermen,

recommends that simple but effective preservation and processing techniques within the technical ability and economic capacity of fishermen should be evolved; particular attention be paid to the use of solar energy; fish curing yards with required facilities be established/re-established; canning of fish in suitable cheap containers be evolved; and steps be undertaken to minimise the loss of protein quality and vitamin contents during processing of fish products.

4.3. Marketing

The Seminar,

recognising that the marketing and distribution of fish catches are beset with many problems due to small landings, middleman problem, inadequate infrastructure facilities and marketing opportunities, and

realising that one of the means for the uplift of the economic conditions of the fishermen is to ensure him a fair price for his produce,

recommends that effective systems be established in all maritime States and Union Territories to take up distribution and marketing of fish catches landed by small-scale fisheries and that immediate steps be taken to carry out indicative surveys to collect market intelligence and to promote internal marketing.

5. EDUCATION, TRAINING AND EXTENSION

5.1. Assessment of Needs and Training Facilities

The Seminar,

realising the vital need for expertise and manpower for the development of coastal aquaculture and small-scale fisheries, and the importance of creating the manpower through phased-out training programmes, and

noting that no reliable estimates are available on the requirements of different categories of personnel and training needs,

recommends that an assessment of requirements of technical, managerial and operative personnel for a phased development of small-scale fisheries and coastal aquaculture for the next 25 years be made and, on this basis, adequate training facilities at different levels be established; that need-based training be imparted to fishermen and fish farmers through Fishermen Training Centres and Krishi Vigyan Kendras; and that, besides these training facilities, the fishermen be educated through other means of non-formal education on the self efforts needed for improving their saving habits, nutritional and hygienic standards and socio-economic conditions, and the fishermen

leaders themselves should endeavour to give the necessary guidance and assistance in this.

5.2. Extension

The Seminar,

realising that extension service has a pivotal role to play in the development and advancement of small-scale fisheries as well as coastal aquaculture as an agency between the R & D programmes and end-users, and

noting that the extension facilities available at present are totally inadequate for playing a meaningful role,

recommends that the existing extension activities may be strengthened to meet the growing demands of technology transfer and developmental programmes and new extension facilities be created wherever they are not available at present so that each State and Union Territory will have full-fledged fisheries extension service.

6. FISHERMEN CO-OPERATIVES

The Seminar,

realising that quick progress of the small-scale fisheries depends to a great extent on the credit facilities and other services available to fishermen on favourable terms and conditions and that the Co-operative System is the best means for providing such services, and

noting with concern that at present the fishermen co-operatives are generally ineffective due to an interplay of many factors,

recommends that functional co-operatives to serve all the activities and needs of the fishermen be established.

7. FISHERIES FINANCING

The Seminar,

considering the immense potential for the development of coastal aquaculture and small-scale fisheries in the country and the large investments needed for the purpose, and

noting that the fishing industry has certain unique characteristics different from other land-based industries and that any financing agency will have to take these conditions and the general illiteracy of fishermen into consideration.

recommends that separate provisions and guidelines be made by the commercial banks for providing financial assistance and loans through simplified procedural formalities and with minimum delay to help the quick development of the fisheries sector, eventually leading to the establishment of Fisheries Banks.

8. PUBLIC POLICIES AND PLANNING

8.1. General Policy and Priorities

The Seminar,

drawing attention to the need for sustained Government support and interest which are essential for the development of both the small-scale fisheries and coastal aquaculture, and

suggesting that the Government may announce well-defined policies, strategies and guidelines for the development of these fisheries, in the making of which the fishermen/fish farmers themselves may be fully involved,

recommends that high priority be assigned for the development of these fisheries and that coastal aquaculture be recognised as an industry to facilitate its quicker growth.

8.2. Distribution of Water Areas for Farming

The Seminar,

noting the availability of water spreads suitable for coastal aquaculture under the control of the State Governments and the possibility of utilising the same by the small, marginal and landless fishermen and fish farmers for the purpose,

recommends that a viable policy for the distribution of such water areas to the coastal fishermen and fish farmers for aquaculture purposes be formulated and implemented.

8.3. Subsidy and Incentive Schemes

The Seminar,

noting that coastal aquaculture is a rapidly developing field in the country and for its proper development and growth liberal Governmental aid and incentives are necessary in the initial stages, as was the case with the introduction of mechanised boats,

recommends that suitable subsidy and incentive schemes be instituted for the quicker establishment and proper growth of the coastal aquaculture industry and constraints in respect of taxes, high cost of material etc. may be removed.

8.4. Accident and Natural Calamity Benefits

The Seminar,

realising the hazardous and risky nature of the fishing profession, frequent occurrences of natural calamities such as cyclones and tidal waves hitting the fishermen out at sea and at their abodes, and the disabilities and loss of life and property caused while engaged in fishing,

recommends that they be provided adequate compensation promptly under all the above circumstances and appropriate accident reliefs be instituted, and that the function of compensation in cases of injuries, loss of life, and equipments be taken over by the Government of India as a package measure.

9. PROTECTION AGAINST DAMAGES TO ENVIRONMENT

The Seminar,

noting that human interference is upsetting the natural balance of the ecosystem through indiscriminate denudation of mangroves and quarrying of corals leading to extensive coastal erosion, and through uncontrolled discharge of domestic, agro and industrial wastes leading to pollution of the environment, and

stressing the need for maintenance of natural balance of the ecosystem for the protection of all the living resources therein,

recommends that the State Governments take immediate steps to develop necessary action

plan for the protection of the coastal zone against such damages and that effective steps be undertaken to protect the living resources therein from destructive human interference and pollution based on criteria and guidelines that may be framed by expert committees constituted in all the maritime States and Union Territories.

In order to bring a better economic order in the rural sector, proper follow-up action on these recommendations by the various nodal agencies is necessary. The respective agencies may be identified as: Department of Agriculture and Department of Rural Development, Ministry of Agriculture and Irrigation, Government of India; Department of Science and Technology, Government of India; Indian Council of Agricultural

Research; Governments of maritime States and Union Territories; Agricultural Universities; Marine Products Export Development Authority; Directorate of Marketing and Inspection, Government of India; Statistical Bureaus of maritime States and Union Territories; Reserve Bank of India; Agricultural Refinance Development Corporation; Industrial Development Bank of India; State Financial Corporations; General Insurance Corporation of India; State Pollution Boards; Council of Scientific and Industrial Research; Indian Board for Wildlife; Bombay Natural History Society, Bombay; Voluntary and other Social Welfare organisations and media such as All India Radio and Door-darshan. These recommendations are published in the Marine Fisheries Information Service so as to make them available to all concerned.

E. G. Silas
Director, C. M. F. R. I.
& Convener

Seminar on the role of small-scale
fisheries and coastal aquaculture
in integrated rural development



NEWS—INDIA AND OVERSEAS

Fish production moves-up in India

The fish production in 1977-78 was 2.54 million tonnes with marine fish production at 1.26 million tonnes as against 2.4 million tonnes in 1976-77 with marine production of 1.35 million tonnes. The export earnings from marine products in 1977-78 were Rs. 180.95 crores as compared to Rs. 189.12 crores in 1976-77. The decline in terms of value was due to depreciation of the value of Indian currency vis-a-vis U. S. dollars. Factors like introduction of mechanised craft, improvement of indigenous craft, mapping and charting operations, assistance to commercial exploitation activities and enhancement of yields through improved techniques of culture are responsible for the progress in the field of fisheries.

In inland fisheries the central scheme of Fish Farmers Development Agencies (FFDA) has been initiated with the ultimate objective of raising the present production of 600kg of fish per ha of water area to 3000

kg per ha. FFDA have been established for training fish farmers, to provide loans for inputs and to mobilise institutional credits for reclamation of tanks. Rs. 1.9 crores were released as grants-in-aid to States for setting up FFDA during 1977-78.

In brackishwater fisheries, under a pilot project the Central Government has sanctioned setting up of 50 ha brackishwater farms in West Bengal, Andhra Pradesh, Kerala, Tamil Nadu and Orissa at an expected expenditure of 72 lakhs.

In marine fisheries 1070 mechanised boats were introduced, bringing the total to 14,400. The State Fisheries Corporations are given cent percent assistance to set up pilot projects for diversification of processing and marketing. In the coastal fishing villages special schemes for integrated development of infrastructural facilities at an outlay of Rs. 125 crores have been launched by the Central Government in order to support the developmental programme.

Alien trawlers busy in Indian waters

The Marine Times reports that powerful trawlers, presumably from Taiwan and Thailand are operating within the economic zone of India, constituting a menace to Indian trawlers with lesser power pack. On the east coast of India from bases at Calcutta, Visakhapatnam and Paradip several Indian companies are operating Mexican type trawlers within a range of 120 miles from the coast. Overseas trawlers, much bigger in size, fitted with more powerful engines and with better equipments and nets have been noticed to operate in this area by several of these Indian trawlers. Representations have been made to Government of India, urging the government to come forward to uphold the right of Indian trawlers to fish within their own economic zone.

Somali desert nomads become sea fishermen

One of the most unusual "retraining" operation to be undertaken by a country is that of making fishermen out of nomads in Somalia. This has become necessary because of prolonged drought which killed thousands of the nomads and decimated their herds of goats and camels. It was started in 1975 when 15,000 of the nomads were airlifted to fishing villages for training as fishermen, along with 100,000 others shifted for retraining as farmers.

Surprisingly enough they have quickly adapted themselves to the entirely new way of life, although in the beginning even the smell of cooking fish made them sick. They soon lost the fear of the water and learnt to swim. Then they were taught handling of boats and nets and seamanship, the women being trained to skin, gut, dry and smoke fish. Now the 1200 nomad men who have completed their training are fast becoming as skilled as the traditional local fishermen.

FNI 16 (8): August 1977.

Man-made upwelling

Taiwan's fishing opportunities have been dwindling as the 200-mile Exclusive Economic Zone limits adopted by many countries exclude many of her long-range vessels from undertaking fishing in distant waters. Efforts are therefore being increased to enhance the productivity of her own coastal waters. The National Taiwan University and a Government department have been jointly examining a project to improve the fish resource by stimulating upwelling in the sea.

In a pilot scheme devices known as contraction and extension tubes are being used to bring nutrients up from the sea bottom to nourish phytoplankton which attract zooplankton and fish in turn.

FNI 16 (9): Sept. 1977

A Japanese synthetic feed for prawns

A highly nutritious synthetic prawn feed has been developed by the Japanese firm Kyowa Kogyo Co. Ltd. Known as *Evia* Kyowa, the feed is suitable for intensive prawn rearing. It is claimed to be five to six times more nutritious than fresh feeds and can be used far more sparingly—nearly 20%—than other conventional feeds. The conversion ratio of intake to body weight is from 2.0 to 2.2.

Different feed types like crumble varieties and pellets are produced for each of four growth stages of young, intermediate, those nearing adult stage and adult. Experiments have proved that the feed does not disintegrate quickly.

Fish Farming International 5 (1): March 1978.

Built - in computer in clupeoid fishes

A study by Sir John Gray and Professor E. J. Denton of the Marine Biological Association Laboratory in Plymouth, England indicates that small shoaling fish such as the pilchard and the herring may have a computing mechanism previously unknown in the animal kingdom.

Fish hearing is already known to be spread over a very wide range. It is now being shown to have a uniform ability to hear sounds from ultra-low to ultra-high frequencies. This faculty also extends over the range of depth in which the fish may move, and the speed at which it changes depth.

The lateral line in the body of the fishes possesses sense cells that inform the fish of pressure and water movement. According to the present study the clupeoid fishes possess lateral line whose complexity and structure are quite extraordinary. They can listen on more than one channel at the same time to several sources of underwater sound. It amounts to a sonar system depending not on sending out sounds and waiting for a reflection but on the difference in kinds of sound received from the same source.

The herring can probably sense the direction of source of sound, its absolute energy and compute its distance.

F. N. I. 17 (6): June 1978

Prawns that thrive on oil

The conventional view is that oil is a pollutant and in the sea it is harmful to marine life. Recently American research workers have found a species of prawn that apparently thrives well on hydrocarbons. This is based on an investigation started years ago by the United States National Marine Fisheries Service (NMFS) on effects of ocean floor oil deposits on deep sea animals. Series of experimental trawling in areas with and without oil has shown the presence of scarlet prawns much more abundant at stations contaminated by oil.

This is explained by what happens to the oil at sea. After a few days the toxic components of oil disappear and in due course a large microbial population begins to attack the oil lumps. This produces chemical compounds including sugars, amines and alcohols that attracts many invertebrates. The oil combination with these organisms feeding on it, develops into more food which attracts the prawns. Such investigations

would probably change the overall understanding of the long range effects of pollution.

F. N. I. 17 (6): June 1978

Detecting poachers at night

An instrument known as *BIS Night Scope* has been developed by a British firm. It is a device which does not emit any form of light, yet gives clear night vision by amplifying available light at least 50,000 times. It is a large monocular weighing 2.8 kg and 460 mm in overall length, powered by a battery with a life of 80-100 hours. *BIS Night Scope* is controlled by an on/off switch and a focus knob. Its rubber eye guard incorporates a shutter which opens automatically when pressed against the eye. Full details can be obtained from Bonaventure International (Security) Ltd., Bonaventure House, 18 Jermyn St., London.

Fishing News, July 14, 1978



BOOKS

Foundations of Bioenergetics. By Harold J. Morowitz. Academic Press, New York, pp 368, 1978.

This book introduces and develops the subject of bioenergetics for biologists, biophysicists and biochemists. It begins with a biologically oriented development of thermodynamics and treats the free energy of biological material, electrochemistry and oxidation-reduction reaction among other topics. There is extensive discussion of thermodynamics, information theory, statistical mechanics, ecological energetics, kinetics, fluctuation theory and irreversible thermodynamics. Topics like life at absolute zero, limitations of classical thermodynamics, entropy and living systems which are not usually treated in standard texts are covered. Throughout the book particular attention is given to clarifying the conceptual bases. The experimental and theoretic foundations of all statements are

carefully explained. For the modern biologist and biophysicist this book is suitable for use as a text or reference source.

Environmental systems planning, design and control. Vol. I., pp 441 and Vol. II. pp 486. Edited by Y. Sawaragi and H. Akashi. Pergamon Press, Oxford, 1978.

The two volumes contain the proceedings of the International Federation of Automatic Control Symposium on environmental systems planning, design and control conducted at Kyoto, Japan from 1-5 August, 1977. Volume I contains the papers presented in the technical sessions, modeling and simulation of air pollution, modeling and simulation of water systems, modeling and control of industrial systems, measurement and monitoring of air pollution, methodology for

planning and control, water management systems, prediction of air pollution, observation and identification problems, methodology for water resources management, urban systems, quality control of river water and remote sensing technique and application. Volume II contains papers presented in the sessions modeling and control of water treatment systems, road traffic noise, regional systems, design of waste-water treatment systems, traffic systems, waste-management systems, control of air pollution, economic development and environment, modeling of biochemical reaction systems, environmental assessment, environmental policy and planning and fishery production. This volume also contains the opening and closing addresses along with the special and invited lectures delivered at the symposium.

Biology of Benthic Organisms. Edited by B. F. Keegan, P. O. Ceidigh and P. J. S. Boaden. Pergamon Press, Oxford/New York, pp 630, 1977.

This volume deals with the proceedings of the 11th European Symposium on Marine Biology held at University College, Galway (Ireland) from 5th to 11th October, 1976. It contains sixty three papers presented on different aspects of the biology of benthic organisms. The authors' typescripts are reproduced in their original form with the inherent typographical limitations. Benthic ecology, benthic production, macro, meio and micro benthic community structures, feeding in benthic community, epibenthic assemblages and ecophysiological approaches to distribution of benthic organisms are some of the important topics under which the papers presented could be grouped.

Assessing the effects of power-plant-induced mortality on fish populations. Edited by Webster Van Winkle. Pergamon Press, New York/Toronto, pp 380, 1977.

This is the proceedings of the conference on assessing the effects of power-plant-induced mortality on fish populations held at Gatlinburg, Tennessee from May 3 to 6, 1977, sponsored by Oakridge National Laboratory operated by Union Carbide Corporation, U. S. Energy Research and Development Administration and the Electric Power Research Institute. It contains six parts dealing with (1) case histories, (2) estimating abundance, production and mortality rates of young fish, (3) compensation and stock-recruitment relationships, (4) monitoring programmes and data analysis, (5) use of population models and (6) conclusions and recommendations.

Thermohaline fine structure of the ocean. By K. N. Federov. Translated into English by D. A. Brown. Pergamon Press, Oxford, pp 170, 1978.

This book treats the subject of the recently discovered phenomenon of fine-scale stratification in the ocean, and of those physical processes which participate in its formation and govern its evolution. Some aspects of methodology are discussed in connection with the fine structure measurements in the ocean. Complex interrelations between the fine-scale stratification of the ocean water and such important physical processes as molecular diffusion, convection, turbulence, internal gravity waves, internal motions and mean currents are considered. Author and subject indexes have been added to the English edition and the references have been brought upto date.



SMALL-SCALE FISHERIES AT LAWSON'S BAY WALTAIR*

One of the most important fish landing centres in Andhra Pradesh is perhaps the centre at Lawson's Bay, Waltair. Here fishermen from three adjacent fishing villages viz., Jalaripeta, Vasavanipallem and Moolapalem with indigenous and traditional craft and gear land their catches which are chiefly disposed off in local markets. As elsewhere along the Andhra coast, the common craft here are the catamarans and the masula boats. The shore-seines, boat-seines, gill nets, bottom-set gill nets (also known as silk-nets) and hooks & line are the chief gears used. About 1000 active fishermen are engaged

in the fishing operations conducted through major part of the year in and around coastal waters off Visakhapatnam.

Data on fish catches at Lawsons' Bay collected over a period of 9 years from 1970 to 1978 (Tables 1 to 6 and Fig. 1) show that on an average 560 tonnes of fish per annum are landed at this centre. At an average rate of 50 paise per kg or Rs. 500/- per tonne, the yield from this catch amounts to a sum of about Rs. 2.8 lakhs.

* Prepared by: Staff of Waltair Research Centre.

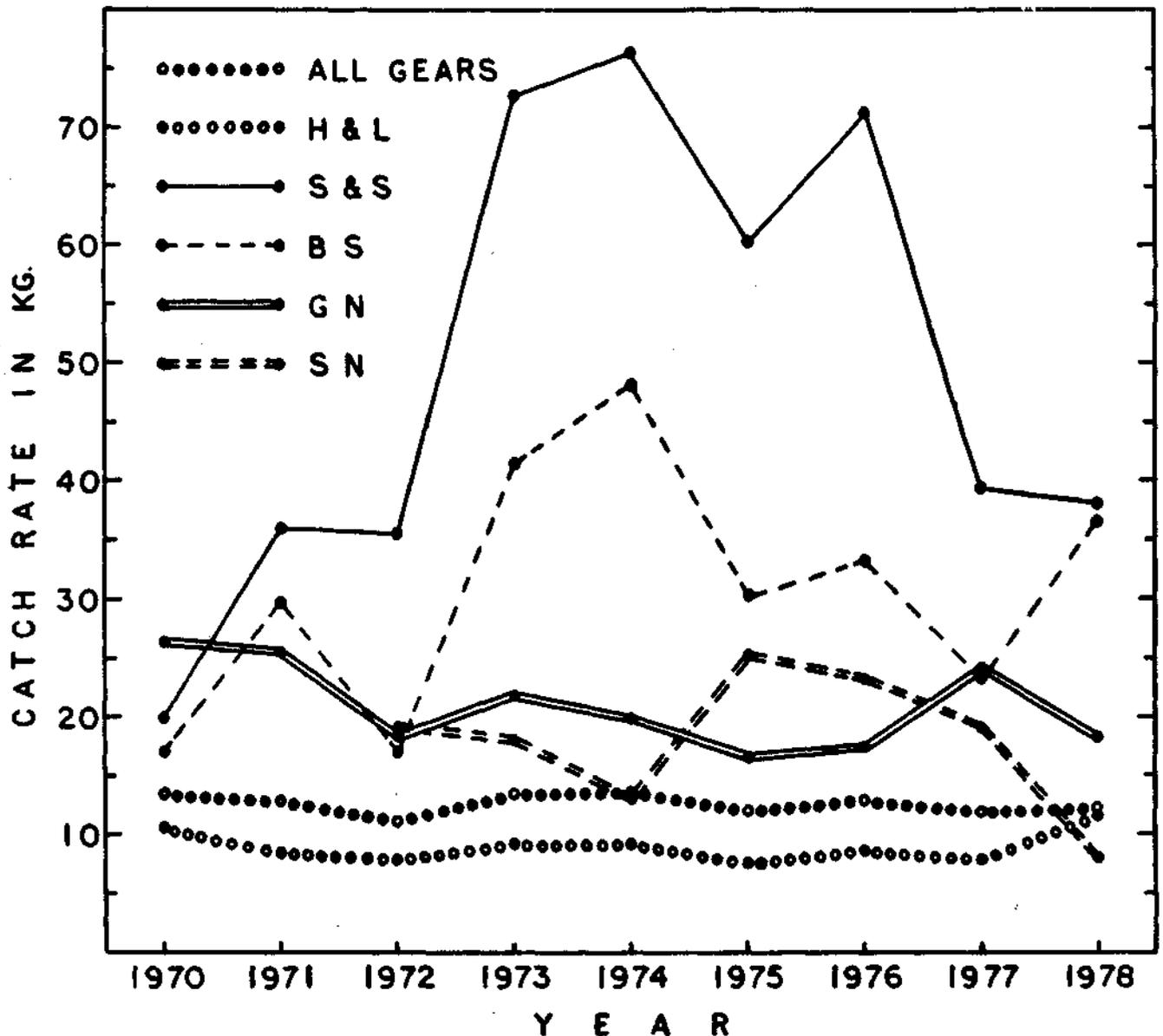


Fig. 1 Trends in the annual catch rates (C/U) of shore-seine (S & S), boat-seine (BS), gill net (GN), bottom-set gill net (SN), hooks & line (H&L) and all gears during the years from 1970 to 1978.

The most effective gear is the hooks & line, followed by the bottom-set gill net, the gill net, the shore-seine and the boat-seine in the order of importance mentioned (Table 6). With an annual average catch rate of 9.2 kg/U, the catch rates of hooks & line ranged from 7.7 to 11.6 kg/U (Table 1). The corresponding figures for bottom-set gill nets, gill nets, shore-seine and boat-seine respectively were: 16.7 kg/U—from 8.1 to 25.3 kg/U—(Table 2); 22.3 kg/U—from 16.7 to 26.5 Kg/U (Table 3); 54.3 kg/U—from 20 to 76.2 kg/U (Table 4); and 29.7 kg/U—from 17 to 48.4 kg/U (Table 5). An analysis of variance revealed that the variations in catch rates between gears were, as expected, significantly different whereas between years they were not significantly different. In other words, the fluctuations in the catches at Lawson's Bay may be due to fishery independent factors such as changes in the environment. In general the months from April to August witnessed peak catch returns.

A large number of species are landed by each boat-net combination. Nevertheless, those that were fishery in importance were few and more or less characteristic of the gear employed. For example, about 40 to 50 species were landed by the bottom-set gill net during the course of a year. But only 20 species were of any importance and of these substantial contribution was made by only 10 to 11 species (Table 2). Similar was the situation in the case of all the other gears. Taking into consideration only the first 10 or 11 species in respect

of each gear and pooling all the data for 9 years together, it became apparent that the fisheries at Lawson's Bay are supported mainly by the following 16 species:

Sl. No.	Name of species	% contribution	Common name
1.	<i>Scomberomorus guttatus</i>	15.8	Seer fish
2.	<i>Sardinella</i> spp.	12.9	Lesser sardines
3.	Sharks	9.0	Sharks
4.	<i>Anchoviella</i> spp.	8.0	White bait
5.	<i>Scomberomorus commersonii</i>	6.7	Seer fish
6.	Tuna	4.9	Tuna
7.	<i>Tachysurus thalassinus</i>	4.2	Cat fish
8.	<i>Histiophorus gladius</i>	4.0	Sail fish
9.	<i>Ilisha filigera</i>	3.5	Herring
10.	<i>Rastrelliger canagurta</i>	2.9	Mackerel
11.	<i>Trichiurus</i> spp.	2.7	Ribbon fish
12.	<i>Tachysurus tenuispinis</i>	2.5	Cat fish
13.	<i>Chorinemus</i> spp.	1.9	Leather skin
14.	<i>Dussumieria</i> spp.	1.3	Rainbow sardine
15.	<i>Chirocentrus dorab</i>	1.0	Wolf herring
16.	Other cat fish	0.9	—

Furthermore, it was also evident that excepting the cat fishes (*T. thalassinus* and *T. tenuispinis*) and *Trichiurus* spp. all other species are the main supporters of pelagic fisheries at Lawson's Bay as elsewhere in the country. Considering the fact that large scale fishing by mechanised boats has been established and conducted off Visakhapatnam and substantial expansion and exploitation of demersal fisheries are contemplated, the present result is of significance because of the very nature of the small-scale fisheries at Lawson's Bay and there is no reason to believe that conflicts of interest exist.

Table 1 Hooks & line—Specieswise estimated annual catches (in kg) during the years from 1970 to 1978 at Lawson's Bay, Waltair

Species	1970	1971	1972	1973	1974	1975	1976	1977	1978	All years	%	Rank
<i>S. guttatus</i>	1,49,072	74,417	81,905	65,239	1,09,856	66,669	60,797	68,221	69,517	7,45,693	27.2	1
Sharks	48,613	41,948	48,305	32,283	60,569	45,018	40,594	42,806	63,656	4,23,792	15.5	2
<i>S. commersonii</i>	34,972	43,564	76,064	36,133	29,032	27,365	20,922	33,754	29,034	3,30,840	12.1	3
Tuna	16,231	13,446	17,361	17,627	24,101	18,901	24,310	20,698	86,489	2,39,164	8.7	4
<i>H. gladius</i>	50,900	17,022	13,058	19,549	30,704	8,347	17,739	31,203	13,982	2,02,504	7.4	5
<i>T. thalassinus</i>	12,484	26,149	22,690	19,453	18,862	10,263	12,265	40,724	13,324	1,76,214	6.4	6
<i>Chorinemus</i> spp.	15,697	14,897		5,819	11,792	16,834	12,217	3,088	16,140	96,484	3.5	7
<i>T. tenuispinis</i>				8,891		4,038	9,764	5,903	12,207	40,803	1.5	8
Other catfishes	10,665	28,916								39,581	1.4	9
<i>S. zygaena</i>	18,139		11,905						1,476	31,520	1.2	10
<i>P. hasta</i>	4,931	13,506							9,770	28,207	1.0	11
<i>C. dorab</i>				8,848	5,543	3,888		4,779	3,134	26,192	1.0	12
<i>Lutjanus</i> spp.			7,383	8,014	4,964				5,688	26,049	1.0	13
Turtle							23,382			23,382	0.9	14
<i>Coryphaena</i> spp.			5,537				5,278		6,178	16,993	0.6	15
Skates		9,041								9,041	0.3	16
<i>R. canadus</i>					3,015			3,232	1,800	8,047	0.3	17
Miscellaneous	43,265	47,574	36,557	31,099	19,793	28,155	19,503	15,645	31,788	2,73,379	17.5	
All fish (C)	4,04,969	3,30,480	3,20,765	2,52,955	3,18,231	2,29,478	2,46,771	2,70,053	3,64,183	27,37,885		
No. of Units (U)	37,600	37,646	37,212	27,785	35,100	29,960	29,023	32,201	31,497	2,98,024		
Catch rate (C/U)	10.8	8.8	8.6	9.1	9.1	7.7	8.5	8.4	11.6	9.2		

Table 2 Bottom-set Gill net (Silk net)—Specieswise estimated annual catches (in kg) during the years from 1970 to 1978 at Lawson's Bay, Waltair.

Species	1972	1973	1974	1975	1976	1977	1978	All years	%	Rank	
<i>I. filigera</i>	56,571	32,794	3,353	37,247	2,898	5,636	5,353	1,43,852	20.9	1	
<i>R. canagurta</i>	15,446	8,813	21,176	6,969	3,134	41,166	5,682	1,02,386	14.8	2	
<i>T. tenuispinis</i>	13,580	25,738	3,239	9,779	2,322	11,232	2,793	68,683	10.0	3	
<i>C. dorab</i>	9,843	15,021	1,664	5,372	1,920	5,466	8,909	48,195	7.0	4	
<i>S. guttatus</i>	6,457	13,358	1,513	7,390	1,739	5,940	11,665	48,062	6.9	5	
<i>T. thalassinus</i>	6,142	7,798	2,213	9,164	2,352	4,271	1,976	33,916	4.9	6	
Sharks	4,369			2,538	690	2,666		19,560	29.823	4.3	7
Other carangids	13,524	5,665						2,751	21,940	3.2	8
<i>Hilsa</i> spp.					5,772	8,664	546	14,982	2.2	9	
<i>Trichiurus</i> spp.			3,671	10,063				13,734	2.0	10	
Prawns	5,429	5,073					945	11,447	1.7	11	
Other catfish		5,845					4,769	10,614	1.5	12	
Other sciaenids			2,163	4,533	1,228		1,365	9,289	1.3	13	
<i>Psenes indicus</i>			1,680			4,552	512	6,744	1.0	14	
<i>S. niger</i>				4,873			1,259	6,132	0.9	15	
Squids		5,158						5,158	0.7	16	
<i>S. commersonii</i>						2,263	2,132	4,395	0.6	17	
Other clupeoids	3,248						546	3,794	0.6	18	
<i>Trissocles</i> spp.			2,025				834	2,859	0.4	19	
<i>Leiognathus</i> spp.					501			501	0.1	20	
Miscellaneous	25,199	35,489	7,789	12,179	2,674	7,242	12,516	1,03,088	14.9		
All fish (C)	1,59,808	1,60,752	50,486	1,10,107	25,230	99,098	84,113	6,89,594			
No. of Units (U)	8,259	8,936	3,825	4,349	1,083	4,510	10,373	41,335			
Catch rate (C/U)	19.3	18.0	13.2	25.3	23.3	22.2	8.1	16.7			

Table 3 Gill net—Specieswise estimated annual catches (in kg) during the years from 1970 to 1978 at Lawson's Bay, Waltair

Species	1970	1971	1972	1973	1974	1975	1976	1977	1978	All years	%	Rank
<i>Sardinella</i> spp.	1,82,734	1,38,432	49,818	28,177	91,759	30,471	50,414	39,973	14,135	6,25,913	86.4	1
<i>I. filigera</i>		18,770	152			1,289	4,380			24,591	3.4	2
Prawns		11,159								11,159	1.5	3
<i>Dussumieria</i> spp.	450	3,012	2,262	154	208	2,656	1,882			10,624	1.5	4
<i>Thrissocles</i> spp.	2,811		958				2,715			6,484	0.9	5
<i>R. canagurta</i>	3,585		425	923			1,200			6,133	0.8	6
Other catfish		3,464								3,464	0.5	7
<i>Trichiurus</i> spp.						3,368				3,368	0.5	8
<i>Leiognathus</i> spp.	855		1,369				677			2,901	0.4	9
<i>T. tenuispinis</i>		2,118								2,118	0.3	10
<i>T. thalassinus</i>						1,029				1,029	0.1	11
Miscellaneous	917	18,562	131	1,004	356	4,500	848		22	26,340	3.6	
All fish (C)	1,91,352	1,95,517	55,115	30,258	92,323	43,313	62,116	39,973	14,157	7,24,124		
No. of Units (U)	7,230	7,673	2,953	1,379	4,590	2,597	3,565	1,668	767	32,422		
Catch rate (C/U)	26.5	25.5	18.7	21.9	20.1	16.7	17.4	24.0	18.5	22.3		

Table 4 Shore-seine—Specieswise estimated annual catches (in kg) during the years from 1970 to 1978 at Lawson's Bay, Waltair

Species	1970	1971	1972	1973	1974	1975	1976	1977	1978	All years	%	Rank
<i>Anchoviella</i> spp.	1,493	5,080	7,040	58,526	51,019	34,040	59,626	53,250	37,926	3,08,000	62.3	1
<i>D. dayii</i>					1,575		32,691			34,266	6.9	2
<i>R. canagurta</i>	92	3,124	501	1,143	15,534	2,242		663	718	24,017	4.9	3
<i>Sardinella</i> spp.	2,229	1,416	1,091	3,627	1,343	5,185	3,004	2,826	2,211	22,932	4.6	4
<i>Leiognathus</i> spp.	426	1,027	4,824	2,061	4,096	1,062	3,480	1,529	1,589	20,094	4.1	5
<i>Trichiurus</i> spp.	570	206	232	225	16,903				281	18,417	3.7	6
<i>Dussumieria</i> spp.		5,002	684	737	700	7,448	415	1,957	1,358	18,301	3.7	7
Tuna		194				3,960	2,910			7,064	1.4	8
<i>Acetes</i> spp.				4,123	1,503				4,127	9,753	2.0	9
Sciaenids			3,032			206	476		78	3,792	0.8	10
<i>Thrissocles</i> spp.		1,364	382		703		288	75	361	3,173	0.6	11
<i>Sphyaena</i> spp.							2,227			2,227	0.5	12
Other carangids	54			655	380					1,089	0.2	13
Miscellaneous	755	1,185	1,252	1,692	2,020	643	1,820	2,013	10,135	21,515	4.3	
All fish (C)	5,619	18,598	19,038	72,789	95,776	54,786	1,06,937	62,313	5,8784	4,94,640		
No. of Units (U)	281	517	530	1,000	1,257	910	1,504	1,569	1,539	9,107		
Catch rate (C/U)	20.0	36.0	35.9	72.8	76.2	60.2	71.1	39.7	38.2	54.3		

Table 5 Boat-Seine-Specieswise estimated annual catches (in kg) during the years from 1970 to 1978 at Lawson's Bay, Waltair

Species	1970	1971	1972	1973	1974	1975	1976	1977	1978	All years	%	Rank
<i>Trichurus</i> spp.	5,554	10,433	1,978	4,360	54,524	12,315	4,688	3,237	3,360	1,00,449	25.5	1
<i>Anchoviella</i> spp.	2,980	24,477	579	7,807	17,885	2,638	9,936	18,923	11,795	97,020	24.7	2
<i>Dussumieria</i> spp.		11,204				2,802			24,363	38,369	9.8	3
<i>S. niger</i>	2,945	10,485	430		554	2,280				16,694	4.2	4
<i>T. tenuispinis</i>		1,547				8,947	544	3,193	155	14,386	3.7	5
<i>R. canagurta</i>		3,211		4,925			1,753	182	3,750	13,821	3.5	6
<i>Leiognathus</i> spp.	3,634	2,054	1,267	366	1,318	1,629	478	757		11,503	2.9	7
<i>Acetes</i> spp.	4,802			2,077		2,925	908	213	480	11,405	2.9	8
Prawns	4,769	4,773	446		820				121	10,929	2.8	9
<i>I. filigera</i>	4,372		276	364		1,733	2,647			9,392	2.4	10
Sciaenids	2,162	1,649			1,615	1,313	1,608		487	8,834	2.4	11
<i>Sardinella</i> spp.		2,447			798			704	2,672	6,621	1.7	12
Other carangids	5,388			336						5,724	1.5	13
<i>S. argenteus</i>	3,886									3,886	1.0	14
Other catfish			253	1,835						2,088	0.5	15
<i>S. tumbil</i>				2,074						2,074	0.5	16
<i>C. dorab</i>						764	882		159	1,805	0.5	17
<i>Hilsa</i> spp.							1,008			1,008	0.3	18
Miscellaneous	12,408	5,124	3,806	1,476	3,012	4,036	2,923	1,540	3,012	37,337	9.5	
All fish	52,900	77,404	9,035	25,620	80,526	41,382	27,375	28,749	50,354	3,93,345		
No. of Units (U)	3,058	2,587	531	619	1,665	1,360	818	1,232	1,378	13,248		
Catch rate (C/U)	17.3	29.9	17.0	41.4	48.4	30.4	33.5	23.3	36.5	29.7		

Table 6 Gearwise all years estimated catches (kg) of the most important species supporting the fisheries at Lawson's Bay, Waltair

Species	Hooks & line	Bottom-Set Gill net	Gill net	Shore-seine	Boat seine	All gears	%	Rank
<i>S. guttatus</i>	7,45,693	48,062				7,93,755	15.8	1
<i>Sardinella</i> spp.			6,25,913	22,932		6,48,845	12.9	2
Sharks	4,23,792	29,823				4,53,615	9.0	3
<i>Anchoviella</i> spp.				3,08,000	97,020	4,05,020	8.0	4
<i>S. commersonii</i>	3,30,840					3,30,840	6.7	5
Tuna	2,39,164			7,064		2,46,228	4.9	6
<i>T. thalassinus</i>	1,76,214	33,916	1,029			2,11,159	4.2	7
<i>H. gladius</i>	2,02,504					2,02,504	4.0	8
<i>I. filigera</i>		1,43,852	24,591		9,392	1,77,835	3.5	9
<i>R. canagurta</i>		1,02,386	6,133	24,017	13,821	1,46,357	2.9	10
<i>Trichurus</i> spp.		13,734	3,368	18,417	1,00,449	1,35,968	2.7	11
<i>T. tenuispinis</i>	40,803	68,683	2,118		14,386	1,25,910	2.5	12
<i>Chorinemus</i> spp.	96,484					96,484	1.9	13
<i>Dussumieria</i> spp.			10,624	18,301	38,369	67,294	1.3	14
<i>C. dorab</i>		48,195				48,195	1.0	15
Other catfish	39,581		3,464			43,045	0.9	16
<i>Leiognathus</i> spp.			2,901	20,094	11,503	34,498	0.9	17
<i>D. dayii</i>				34,266		34,266	0.7	18
Prawns		11,447	11,159		10,929	33,535	0.7	19
<i>S. zygaena</i>	31,520					31,520	0.6	20
Other carangids		21,940				21,940	0.4	21
<i>Acetes</i> spp.				9,753	11,405	21,158	0.4	22
<i>S. niger</i>					16,694	16,694	0.3	23
<i>Hilsa</i> spp.		14,982				14,982	0.3	24
<i>Thrissoles</i> spp.			6,484			6,484	0.1	25
Other sciaenids				3,792		3,792	0.1	26
Miscellaneous	4,11,290	1,52,574	26,340	28,004	69,377	6,87,585	13.6	
All fish (C)	27,37,885	6,89,594	7,24,124	4,94,640	3,93,345	50,39,588		
No. of Units (U)	2,98,024	41,335	32,422	9,107	13,248	3,94,136		
Catch rate (C/U)	9.2	16.7	22.3	54.3	29.7	12.8		
Average annual catch (tonnes)	304.2	98.5	80.5	54.6	43.7	559.95		



Compiled and prepared by M. J. George, and G. Subbaraju.

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