

INFORMATION NEEDED FOR STRATEGIC PLANNING OF FISHERY MANAGEMENT IN SRI LANKA

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ABSTRACT

With the development of the fisheries sector, coastal fish production in Sri Lanka has reached an optimal level during the past few years. Management of the resources has therefore become an urgent need. Incompatibility of some management objectives in Sri Lanka's fisheries, together with the natural limits of the resources and open access, has necessitated consideration of special management measures based on sound scientific advice which must be based on scientific information, biological, technical, economic, social, environmental and institutional. The acquisition of all this information can be costly and therefore it is necessary to identify which data are of prime importance for a wide range of management decisions.

The statistical division of the Dept. of Fisheries and Aquatic Resources and the Marine Biological Resources Division of NARA are the two institutes responsible for the collection of this information. These two institutions have two independent but complementary systems for gathering the information needed for the assessment and management of fisheries resources. The Dept. of Fisheries has an island-wide data collecting system through a network of fishery inspectors. NARA's sampling programme covers the west, southwest, south, east and northeast coasts. In addition to the catch and effort data, NARA collects length frequency data for the purpose of fish stock assessment. Several other governmental and non-governmental institutions and fishermen's organisations, specifically the recently established Fisheries Cooperative Societies, have been identified as potential sources of information.

Several improvements to the existing data collecting systems at DFAR and NARA have been suggested with improvements to strengthen the cooperation between the two institutions. Lack of training, facilities and motivation for the field staff and lack of awareness among the fisheries officials and the resource users of the benefits of fisheries management are some of the constraints confronting the government in obtaining the necessary information for community based fisheries management.

1. INTRODUCTION

With the declaration of the Exclusive Economic Zone in 1976 the Government of Sri Lanka obtained sovereign rights over an ocean area of 536,000 km² and the natural resources therein (Anon., 1988). Fishing has been carried out since time immemorial and has been one of the important economic activities along the coast. Marine fisheries have developed considerably during the past few decades and the fish production has increased from around 40,000 tonnes in the 1950s to a present production of 180,000 tonnes (Anon., 1992). The backbone of the fishing industry in Sri Lanka is still the coastal fisheries, which contribute more than 90% of the total marine fish production. Coastal fish production has remained more or less stagnant over the past few years and it is now generally believed that the Sri Lankan coastal fishery has reached optimal levels of production although there are a few identified under utilised resources. Therefore, if Sri Lanka is to have sustainable development of the marine fisheries sector, the management of these resources is of prime importance. Realising the need and urgency the Ministry of Fisheries and Aquatic Resources has now established the Fisheries Management Unit in the Department of Fisheries and Aquatic Resources. Past experience in fisheries management has shown that entry

limitations and other centrally imposed regulations have not been very satisfactory. Therefore, the government is now encouraging the establishment of fishermen's cooperative societies at village level in order to promote a self regulatory approach to management and conservation of fisheries resources.

The choice of the objectives of fisheries management for the Government of Sri Lanka is not yet clear. The Government seeks to manage the fisheries in order to protect or enhance employment opportunities, increase fishermen's incomes, maximise net economic returns, increase fish production to provide a protein supply to the increasing population, achieve higher export earnings, conserve resources, etc. (Anon., 1990). These objectives are not entirely compatible and some can only be achieved at the expense of others. Further, unlike other natural resources, fisheries have special characteristics such as the natural limits to their yield, and the open access to the resource, which require special management measures. Whatever the management objective is, it has been generally accepted that the management of a fishery should be based to a large extent on scientific advice. This advice should be based on a reliable source of continuous and timely data. This paper attempts to describe the type of information needed for the management of fisheries, the current status of acquisition of this information, the constraints involved in such activities and the solutions proposed to overcome such problems in assessing and managing the marine fish resources in Sri Lanka.

2. TYPES OF INFORMATION NEEDED FOR FISHERIES MANAGEMENT IN SRI LANKA

As in other tropical countries the fisheries in Sri Lanka are multispecies, multigear fisheries and therefore the direct application of resource assessment methods available for single-species, single-gear fisheries is not possible. The involvement of around 100,000 fishermen in activities that are mostly small scale in nature has forced the government to consider improving the socio-economic status of these fishermen as an important management objective. In addition, fast development of industry and tourism along the coastal belt of Sri Lanka seems to have had negative impacts on the natural critical habitats such as estuaries, coral reefs, mangroves, and seagrass beds on which the fisheries resources depend at one stage or another.

Past experience has shown that biological assessment alone has not helped much in the management of the fishery resources in Sri Lanka. The management problems are highly localised and the information needed is of many kinds and will depend on the type and state of the fishery concerned and the kind of decisions to be made at different levels in the government hierarchy in different fisheries situations.

Therefore, the management of fisheries resources in Sri Lanka is not purely based on biological considerations but a complex mix of technical, biological, economic, social, political as well as environmental issues. The acquisition of this information is considered as one of the basic needs of management.

2.1 Biological information

A clear understanding of the fishery itself is the most important requirement in managing a

fishery. Biological information such as status of stocks, present yields, trends in catch per unit effort, changes in catch composition and length frequencies is important and fundamental information that has to be derived from a collection of statistical data from any fishery.

Identification of the major fish species caught in a fishery is of prime importance as misidentification of fish species would lead to many problems at a later stage of stock assessment analysis. In multi-species fisheries a catch may be made up of many species but at least the dominant species have to be identified to species level by using a published species catalogue and not by referring to the local names. In Sri Lanka the same local name is sometimes used in two locations for two different species and the same species at different locations is referred to by different local names.

The biological information has to be collected through stratified sampling to cover all the major fish landings, all types of craft/gear combinations, all major species and all the fishing seasons. The latter is an important factor as almost all of Sri Lanka's fisheries are affected to some extent by the seasonal monsoonal changes.

Recently there has been an increase in interest in length-based methods of assessing fish populations particularly in tropical waters where age-based assessments are not easy to carry out. The increased availability of computers among scientists and the development of computer packages such as ELEFAN, LFSA and MULTIFAN have increased the use of length-based methods of accessing fish stocks. The data needed for such assessment should come from an unbiased representative sample of the fish population. Most often the fisheries are selective and obtaining an unbiased sample from a fish population by sampling the commercial fish catch is out of the question. However, all attempts have to be made to get a least biased sample. A sampling scheme has to be designed in such a way that the length data of all the important species are recorded from all the fisheries which take that species of fish and all these fisheries are sampled adequately to get a representative sample. As the sampling has to be carried out at fish landing sites, at the fish markets or even on the deck of a fishing vessel, the design of such a programme has to be in accordance with local needs. Generally the opportunity to design a good sampling scheme comes when investigations have been carried out for a few years. Therefore at the initial stages it would be useful to study the chance of bias, sampling errors, the contribution of these errors to the final output from the assessment studies and how the sampling can be modified to reduce variance. Some practical points need to be carefully considered in length sampling. These are the type of length to be taken (standard, total or fork), what units are to be used and with what precision, what fish are to be measured and how many fish, etc. (Gulland and Rosenberg, 1992). Together with these length measurements other information about the source of the sample has to be recorded such as date, place of sample, type of craft and gear, total catch of the vessel by species etc. These are needed to raise the sampled lengths to the total production.

In addition to these data, statistics of a more biological nature are needed. These include length/weight data, data on reproductive biology such as sex ratios, fecundity, size at maturity and gonadal index for the identification of spawning areas and seasons, otolith collection for age and growth studies and stomach content collections to study the feeding biology. Data needed to study

the migration pattern and stock identification has to be collected when the stocks under study are migratory. Data on oceanographic parameters such as plankton distribution, currents and change of physical parameters such as temperature, salinity, thermocline etc. would also be useful in understanding the distribution and abundance of fish stocks.

2.2 Technical information

Some of the technical information such as the numbers and kind of fishing craft and gear, their seasonal operational patterns with the details of fishing such as area of operation, fishing depth, specifications of gear used, the bait used if any, could be collected together with the biological information through the same sampling programme.

Other technical information such as the availability of infrastructure facilities such as harbours, anchorages, ice plants, water supply, fuel supply and repair facilities needs to be collected as this is essential information for some management decisions.

The seasonal nature of the fishing affected by the monsoonal changes has established a migratory pattern of the fishermen from one coast to the other. The number of fishermen and the craft that migrate during the seasons have to be counted in estimating the fishing effort.

2.3 Economic information

Economic information such as the trends in fish prices, cost and earnings of various craft/gear combinations, additional income from the incidental catches (ancillary fisheries), distribution of assets and income, capital investment and the returns in relation to changes in fishing effort is needed for economic assessment of the fisheries. The monthly variations of these economic data are useful as all the fisheries in Sri Lanka show seasonal variations affected by the monsoonal changes. The information on alternative employment opportunities available in different fishing communities is also useful especially when there is a need to reduce the fishing effort.

Among cost factors, the investment cost, the operational cost – consisting of the cost of fuel, food, water, bait and ice, the loan instalments, the insurance and repair and maintenance cost – are generally considered important. The cost of salaries of the skipper and the crew and their sharing system is needed to consider the income of the owner, skipper and the crew separately. In Sri Lanka the usual sharing system is that the owner gets 50% of the net income and the balance is shared among the skipper and the crew with the skipper getting 50% more than a crew member.

2.4 Social information

Social information includes the present number of full time and part time fishermen, their movement trends into and out of fisheries, conflicts among different groups of fishermen, functioning of formal and informal fishermen's organisations, etc. Fishing household could be taken as the sampling unit in collecting this information and the selection of households should represent boat owners, gear owners, boat/gear owners, crew members, skippers and others conducting fishery-related and non-fishery-related activities. The information on the social structure could be obtained by sampling the households for the family structure (age, sex, income earning group), level of education of the members of the family, facilities available such as water

and electricity, ownership of the house, ownership of craft/gear, loan information, family expenditure and other family income. There is considerable social heterogeneity in many fishing communities so information on religion and ethnic group also has to be collected.

The local customs and traditional concepts of property rights to fishing grounds are of prime importance in considering the introduction of community based management systems. This type of information is available among the fishermen involved in traditional fishing practices such as those using beach seines along the coast and stake net fishermen in the estuaries and lagoons.

Marketing information could also be useful in fisheries management in Sri Lanka. The involvement of middleman in marketing has resulted in fishermen getting low prices for their catch and the consumers paying high prices for their fish. Information on the use of fisherwomen in fish marketing and in other post-harvest operations which have been traditionally practised has to be given some consideration. The involvement of fisheries cooperative societies in fish marketing and market information such as the minimum size of lobsters and crabs could be used to implement the management regulations already available. The use of marketing information in fisheries management has proved successful in Japan (Anon., 1993).

2.5 Environmental information

The increase in human settlement and industrial development in the coastal areas of Sri Lanka have increased the pressure on the coastal environment leading to degradation of natural habitats and resources. The use of explosives (dynamite), the use of destructive fishing gear such as trammel nets on coral reef areas and the developing aquaculture industry are causing degradation of coastal ecosystems. The developing ornamental fish trade also seems to be having a negative impact on the coral reefs as the ornamental fish collectors use destructive fishing methods in collecting these organisms. Industrial development in the coastal areas and the use of agro-chemicals in upstream areas is also becoming a threat to the quality of water in coastal areas, particularly the waters in the estuaries and lagoons.

Therefore information on human activities and coastal habitats, and the monitoring of water quality in the coastal and estuarine systems should be given priority.

2.6 Institutional information

This is basic information needed for community-based fishery management in any country. The research institutions together with the statistical divisions are responsible for the establishment of the objective data base and as such bear an important responsibility in the process of development and management. The functions and profiles of the fisheries scientists and the structure of the fishery research institutions should evolve together with the management concepts and this evolution should be at national, regional and international levels.

Apart from these institutes there often exist a variety of other potential sources of information for fisheries management, not all of which may be effectively utilised at present. Such sources may include the universities, individual fishermen and fisherwomen, fishermen's groups or organisations, marketing organisations, data from fishing licences, etc. Information on the

physical and institutional infrastructure such as enforcement power, existing management skills, rules and regulations, available management facilities and research facilities is basic information needed for planning fishery management. To promote community-based management systems information on the institutional structure of these fisheries cooperative societies and their scientific, technical and administrative capabilities are of vital importance.

3. CURRENT ACQUISITION OF INFORMATION AND ITS LIMITATIONS

In Sri Lanka, the management and development of aquatic resources comes under the purview of the Ministry of Fisheries and Aquatic Resources Development. The statistical division of the Department of Fisheries and Aquatic Resources and the Marine Biological Resources Division of the National Aquatic Resources Research and Development Agency (NARA) are the institutes under this ministry which are responsible for collecting this information. Among other organisations the universities, non-government organisations, the recently established fisheries cooperatives and other fisheries organisations also collect some information on fisheries.

The collection of information on fisheries in Sri Lanka is mainly carried out by the following two institutions under the Ministry of Fisheries and Aquatic Resources.

3.1 Department of Fisheries and Aquatic Resources

There are 15 District Fisheries Extension Offices in the marine sector with a total of 143 Fishery Inspector (FI) Divisions (Anon., 1992). Each of these divisions has a Fishery inspector who is responsible for the collection of fisheries statistics. At present there are about 80 Fishery Inspectors collecting fisheries statistics, from two landing sites each (Rodrigo, pers. comm.) using the following procedure.

Sampling for catch statistics is only one of many duties the FIs have to attend to, such as registration of craft, loan recovery and other administrative matters. Two selected landing centres in each FI subdivision are sampled by the FI once a month. Ten predetermined craft of 3.5 GT class, out-board engine craft and non-mechanised craft are sampled. The type of gear used, catch by species, the number of craft operating on a sampling day, information on migratory fishermen, fish prices and information on processed fish are recorded by the FI at each sampling site (Rodrigo, pers. comm.).

The FRP boats and traditional craft with outboard engines have been grouped together irrespective of their fishery and landings. The number of craft sampled is the same irrespective of the fact that the fleet sizes are significantly different between landing centres. Stratification of the sampling by type of gear is not being attempted. The ten selected craft of each category may have different combinations of fishing gear in different centres and this may even change seasonally. Moreover, the stratification of the area is based on DFEO divisions which do not take into account fish distribution or the fishing conditions around the island. There is no proper sampling system for beach seine landings because of practical difficulties in sampling. Fish production was grouped under 11 'varieties'. These were increased to 30 in 1983, but discontinued later. Estimation of production is made by eye as the catch is not weighed in many landing places.

3.2 National Aquatic Resources Agency (NARA)

NARA, being the research arm of the Ministry of Fisheries and Aquatic Resources is responsible for conducting research needed for the management and development of fisheries and aquatic resources. The Marine Biological Resources Division of NARA which deals with marine fisheries resources, has a system of collecting information on fisheries that has two distinct components.

3.2.1 A continuous data collecting system for two major fisheries - large pelagic and small pelagic

This system of continuous data collection on fisheries was formalised through the establishment of a sampling programme in 1987 which was initially meant for the collection of data on the large pelagic fisheries targeting tuna and tuna-like species. This programme now collects data on both the large pelagic and small pelagic fisheries (mainly the small-meshed gill net fishery).

There are 12 data collectors (samplers) placed at the major fish landing sites along the west, southwest, south, east and northeast coasts of the island. These samplers are advanced level qualified personnel who were initially trained at NARA as well as in the field. They are engaged full time in data collection and they conduct sampling for around 20 days a month (10 days for small pelagic and 10 days for large pelagic). On each sampling day a total of 25 boats are sampled from a landing site proportionately covering all the craft/gear combinations for the fishery. Technical information such as the type of gear (number of panels in gill nets, mesh sizes, the number of hooks on long lines, bait used, etc.) for each boat sampled and the number of craft of each category operated on the sampling day is also recorded.

The catch of each boat is recorded by species (for small pelagic there are 23 species and species groups and for large pelagic, 25 species and species groups). For small pelagic the catch of each species is taken by counting the number of baskets or by eye estimation and the large pelagic catch is recorded by numbers with three size categories for two species (yellow fin tuna and skipjack tuna). The length measurements of about five dominant species in the small pelagic catch and all tuna species, billfish and seerfish in the large pelagic catch are taken from around 20 fish of each species from each craft sampled (when the numbers are small all fish are measured). This sampling programme does not cover the north and northwest but all the major large pelagic landings are covered.

The beach seine operations are monitored only at a few selected sites due to practical problems. The data collected by the samplers are brought to the NARA head office once a month and are clarified and screened by the research officers in charge of the sampling programme before being entered into the computer data base. Monitoring of the activities of the samplers is carried out by the NARA research staff, who make surprise visits to each of the landing centres at least twice a month.

This sampling programme gives estimates of the monthly effort, catch rates and production for each craft/gear combination and the length frequency data of the important species.

3.2.2 A short term data collecting system (1-2 yrs) for other fisheries to address specific management problems

These data are mainly for studies that NARA has to conduct, at the request of the Ministry of Fisheries, to address the conflict situations in fisheries. This also covers the other important fisheries such as those for demersals, prawns and lobsters and the lagoon fisheries, which are not covered by the main sampling programme. The information on these fisheries is also used in providing the necessary management recommendations.

In addition, more detailed biological data such as length/weight data, data on reproductive biology and feeding biology of some commercially important species are collected by the research staff of NARA under various research projects. Information on social, economic, technical and environmental aspects of fisheries is collected by NARA under various projects. However this information has been limited to geographical areas covered by those projects.

4. POSSIBLE IMPROVEMENTS IN DATA COLLECTION AND ANALYSIS

The two existing systems of data collection for fisheries are complementary as the NARA sampling programme collects detailed biological information needed for fish stock assessments in addition to the catch and effort data. However, several improvements could be made to both these data collecting systems and cooperation between NARA and the Statistical Division should be strengthened so that reliable catch statistics are collected and the data can be used with confidence in assessing and managing the fisheries resources of Sri Lanka.

4.1 Suggested improvements to the data collecting system in the Department of Fisheries and Aquatic Resources

- i. The distribution of fishing effort along the coast should be the basic criterion in order to stratify the sampling area. The number of craft sampled should be proportional to the total fishing fleet at a particular landing site.
- ii. Production should be estimated on the basis of craft/gear combinations. At present only three categories of craft are identified and no reference is made to the type of gear.
- iii. The efficiency of the FRP boats and traditional craft with outboard engines differs greatly and therefore should be treated separately.
- iv. Although around 30 species are listed in the data sheets used by the FIs in the field the fish production is given only by 11 species and species groups. Analysis should be carried out for each of these species separately. The rock fish category should be broken down into at least five species and/or families.

4.2 Suggested improvements to the data collecting system at NARA

- i. The sampling programme should be extended to the north and northwest areas to obtain data on the important fisheries in those areas. eg. small pelagic, demersals and prawns.

- ii. Economic data on fishing activities should be recorded. This could be done to a limited extent by the samplers of NARA.
- iii. Socio-economic data on fishermen engaged in different fisheries and fish marketing data should be collected. This could be done by the proposed Socio-Economic and Marketing Division to be established in NARA.
- iv. To address the multi-disciplinary issues related to fisheries NARA should collect more environmental information, particularly that relating to fisheries.
- v. As oceanographic parameters are also important to an understanding of fish distribution and abundance more fishery-related oceanographic data should be collected.

4.3 Suggested improvements to data collection and cooperation between institutions

- i. The field staff of the Department and NARA should be given in-service group training.
- ii. Field sampling manuals should be prepared to assist the field workers in identifying fishing craft, fishing gear and fish species.
- iii. Catch/effort data available from the NARA sampling programme could be used in estimating the production figures for at least the large pelagic fisheries. Discussions on this have already been initiated at the Statistical Sub-Committee. To get more reliable information from the developing offshore fisheries, attempts are being made by the ADB Fisheries Project and the UNDP/Management project to introduce a system of log books for the collection of data.
- iv. NARA research staff should get involved in discussions and meetings concerning data collection and management decisions.
- v. Data collected by these two institutes should be published jointly at least quarterly in the form of a statistical bulletin.
- iv. More and more community organisations could be involved in the collection of information on fisheries. DFAR and NARA could make use of the fisheries cooperative societies for this purpose.

5. CONSTRAINTS CONFRONTING THE GOVERNMENT IN OBTAINING INFORMATION AND PROPOSED SOLUTIONS

- i. The fishery inspectors attached to the different DFEO divisions are the key people engaged in the process of island wide data collection. However this is just one duty they have to perform among many others; indeed other administrative duties have more priority. At least two FIs from each DFEO divisions should be released for full time data collection so that they can be at the landing sites when the fish are landed, sampling days could be increased and more landing sites could be covered. The number of FIs in the Department of Fisheries has to be increased.
- ii. No separate production estimates are available for the lagoon fisheries. The data collected by the FIs are added to the coastal fish production. As the management of the lagoons in Sri Lanka is becoming increasingly important a system has to be developed to collect and analyse data on the lagoon fisheries.
- iii. Recent development of the ornamental fish trade has increased the exploitation of marine ornamental fish and other invertebrates. Although export figures are available, there is no system for collecting the data needed for assessment and management of these resources. A monitoring programme is suggested.
- iv. As stock assessment and ongoing monitoring of resources is essential for management, the sampling programme carried out by NARA needs further strengthening, with more data collectors and more research officers to analyse the data.
- v. Some of the field staff probably do not know the value of accurate information. Therefore training should be provided to all staff engaged in field work about the value of accurate data and the responsibility they have in this task.
- vi. The field staff are not motivated to carry out the data collection reliably. They should be given the required facilities such as motorcycles and other incentives such as subsistence and overtime payments.
- viii. Most of the fishermen who provide the information to the field staff are not aware of the purpose of the continuous data collection. They should therefore be educated through extension programmes. This would be very useful in securing their cooperation and in getting accurate data.
- ix. Information on the success stories of traditional community-based management systems and the indigenous knowledge of fisheries in resource management has to be collected. This information should be passed to the fisheries cooperative societies to encourage communities to become involved in participatory management approaches.
- x. Since community based management is a new concept, there is lack of awareness among government officials such as fishery managers, planners, scientists,

administrators and even the politicians and also the fishing communities of the benefits of adopting participatory approaches to increasing the sustainability of coastal resources. This hinders the collection of information needed for fisheries management. More awareness programmes are needed.

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