Marine Fisheries Resources Current Status and Potenital for Development (public/private sector development programme)

by
R. Maldeniya
Senior Research Officer, National Aquatic Resources Agency (NARA)

Since ancient time Sri Lanka has exploited natural resources in the coastal waters and varied interface between land and sea. The shallow seas yielded protein resources and other compensatory food stuff and raw materials needed to sustain the society. Through the extended jursdiction in 1978, Sri Lanka gained sovereign right over an ocean area of 536,000 sq. km and the resources therein, which is about 12 times than its land area. This new opportunities called for a reappraisal of national polices to take greater advantage of the resources and to increase the contribution they make to national economy, social and nutritional objectives.

Marine environment

The country has a coastline of approximately 17,000 km dotted with a number of brackish water estuaries, lagoons, tidal flats, swamps, etc. Marine area from the shore up to the edge of the continental shelf (coastal zone) is relatively narrow and average around 22 km. Towards north, the shelf widens to extensive shallow banks in Gulf of Mannar, Palk Bay and Pedro Bank areas. The total area of the shelf is about 26,000 sq. km., which is around 11% of the area of the Exclusive Economic Zone (EEZ). With the exception of a few restricted areas of the Gulf of Mannar, off Pedro Bank and possibly south-east of Hambantota, the edge of the continental shelf falls rapidly. The shelf is generally rocky, particularly between Colombo and Batticaloa. The northern part, particularly the Palk Strait is predominantly muddy and muddy sand. There is no upwelling areas with significant importance to the fisheries resources. The most important coastal habitats are the coral reefs, sea grass beds and mangroves. These environments sustain tremendous marine life diversity and are critical habitats for all the coastal communities. The offshore and deep sea area extends up to 200 miles, except in the north, west and south-west where it is narrower owing to the location of the EEZ boundaries of India and Maldives.

Fisheries Resources and Current Exploitation Status .

Coastal waters

Sri Lanka being a tropical country its waters are very rich in species and much varied in quantity. The average density of fish biomass in the shelf area inside 100 fathoms has been estimated at 100 t per nm^2 (Seatersdal and de Bruin, 1978). Within the coastal waters, the distribution of fisheries resources show variation with the distance from the shore. The resources in the inshore areas up to 3-5 km from the coast vary from the resources beyond. Distribution of many small pelagics; sardines, herrings, anchovice, etc. and demersals; snappers, empers, carangids, groupers, etc. and other nonfinfish resources such as shrimps, lob-

sters, crabs, squids, cuttlefish, bivalves, etc. are more concentrated in the inshore habitats. Small pelagics generally form dense schools mostly in upper waters. Relative distribution patter of small pelagics has shown that the coastal waters of the north-west and north-east has the highest density distribution (Pajot, 1977). Characteristic of tropical multispecies fisheries, a large number of species are reported in the coastal fish catches but only few make a significant contribution. The medium size pelagics such as Indian mackeral, flying fish, halfbeaks, gar fish, ribbon fish etc. are found in waters outside the inshore area as well. Others such as Spanish mackerel, frigate tuna, kawakawa, bullet tuna, some times categorized as large pelagics, have wider distribution. They are found in the coastal areas as well as in the fringes of the offshore range. Assessments available on the level of potential exploitation of various resource groups around Sri Lanka are very limited. The maximum sustainable yield from the coastal zone according to the estimate made through aquatic surveys by R/V "Dr. Fridtjof Nanson" during 1978-1980 was 250,000 t per annum, comprising 170,000 t of pelagic species which include small pelagic, medium pelagic and some large pelagic species inhabiting the coastal areas and 80,000 t of demersal species, mainly finfish.

Both coastal and offshore fisheries in Sri Lanka are in small-scale operations. The bulk of the production comes from coastal fishing, which employs approximately 100,000 people and a fishing fleet of 25,000 vessels, many less than 7 m in length and of which 44% are motorized. Production from coastal fisheries reached a peak in 1983, with a reported production of 180,000 t and then dropped in 1984, as a result of a drop in production from the north and north-east of the country. The coastal fish production has more or less stabilized over the past years (Fig 1). It is now believed that the Sri Lankan coastal fish production has reached optimal levels although there are few identified under and unutilised resources. The mean annual production at present is about 160,000 t, consisting of 125,000 t of pelagics and 35,000 t of demersals which include finfish, sharks, skates, shrimps and lobsters. This shows that the total yield to potential biomass ratio is 74% and 44% for pelagics and demersals respectively. Fishing pressure however, on the multispecies resources is variable and relatively high on more valuable species.

Small pelagics dominate the coastal pelagic catches in Sri Lanka. However, production by species is not available in the national statistics. This type of information is considered important when examining the resources potential. The most common species are *Amblygaster sirm* (spotted sardinella), *Sardinella albella* (white sardinella), *Sardinella gibbosa* (goldstripe sardinella), *Stolephorus spp.* (anchovy). Beach seine and the small mesh gillnet are the major gear used to exploit these resources.

Demersal species are not a major target group, but there are several economically important species in the demersal fish resources, which include large finfish species such as emperors *(Lethrinus lentjan, L. nebulosus, L. mahasena)*, snapper *(Lutjanus spp., Pristipomoides spp.)*, grouper *(Epinephelus spp., Cehalopholis spp.)* etc. and high value crustacean like lobsters and shrimps.

Offshore waters

The principal fish resources outside the coastal area are the large pelagic fish and oceanic squids. Fish resources include tuna, billfish, shark, seerfish, etc. There are two species of tuna, skipjack *(Katsuwanus pelamis)*, yellowfin tuna *(Thunnus albacares)* that dominate the offshore tuna catches in Sri Lanka. They are highly migratory and the resources is shared with the other fishing nations in the Indian Ocean. Bigeye tuna *(T. obesus)* contribute in small quantities. In addition, longtail tuna *(Thunnus tonggol)* and dogtooth tuna *(Gymnosada unicoloar)* have occasionally been reported in the commercial catches. The small tuna varieties, frigate tuna *(Auxis thazard)*, bullet tuna *(A. rochei)*, kawakawa *(Euthynnus affinis)* and bonito *(Sarda orientalis)* occur in mixed school within the coastal areas and near offshore range. Billfish catches are also multi-species in composition. Six species have been identified in the local catches. They are sail fish *(Istiophorus platypterus)*, sword fish

(Xiphias gladius), and three species of marlins, black marlin *(Makaira indica)*, blue marlin *(M. nigricans)* and striped marlin *(Terapturus audax)*. The group of fish commonly called as seerfish consist of four species. Wahoo *(Acanthocybium solandi)* is found in the offshore catches while king mackerel (Somberemorus commerson) found both inshore and offshore, dominate the seerfish catches. Other two species contribute in small quantities and are limited to coastal waters. A total of 44 species of sharks belonging to 16 families have been identified in the large pelagic catches. Silky shark *(Carcharhinus falciformis)* is the dominant species. Preliminary estimates of Sri Lanka's of fshore resources indicate that 50,000 - 90,000 t per year could be taken without risk of over exploitation.

The offshore fishery has developed rapidly during the last decade and over 1700 small boats of 32-60 ft range are currently engaged in the fishery. Over the years, the operational area has extended more and more beyond the EEZ. Large mesh drift gillnets and shark longline are the major gear used to exploit the offshore resources. Fish production from offshore has increased from 11,600 t in 1990 to 57,000 t in 1996 and now contribute about 28% to the total fish production. According to the estimates made by National Aquatic Resources Agency (NARA), the large pelagic catch in 1995 consisted of 50% tuna, 35% sharks and 10% billfish. Skipjack and yellowfin were the main tuna species, making up nearly 24% and 10% of the entire large pelagic catch respectively. Sharks occupy a high ranking position in the large pelagic catches. In most instances shark meat fetch a higher price than tuna and fins are an important export commodity. In 1995, 126.9 t of shark fins have been exported, valued at Rs. 162.8 million.

Brackish water

Fish, molluscs, prawns, holothurians and seaweeds are important com-

ponents of Sri Lanka's brackish water fishery resources. A total of 125 fish species belonging to 60 families; 7 species of prawns belonging to 2 families; 2 species of crabs belonging to family Portunidae and 8 species of Mollusus belonging to. 4 families have been identified from the brackish water catches made by a variety of fishing methods (Pillai, 1965). Potential estimates for most of these resources are not available. Pillai (1965) estimated the average production of Sri Lanka's brackish waters at 10 kg km per ha.

Non-finfish resources

A variety of non - finfish resources are also exploited from the coastal sea as well as from the brackish waters. Although target fisheries have developed for most of these resources, information regarding production, potential, etc. are lacking for many of these species.

Shrimp

A total of 32 species of shrimp have been recorded from Sri Lanka (De Burin, 1970). Of these, only four species are of commerical importance. The Indian white, Penaeus indicus contribute about 50-70% to the total annual shrimp catch taken from the coastal waters which is about 6,000-7,000 t. Interest in shrimp farming developed in the late 1970's with the government offering various incentives. A number of small scale entrepreneurs and a few large multi-national companies have ventured into shrimp farming since 1982. In 1981, with technical assistance from the FAO Bay of Bengal Programme (BOBP), shrimp culture trials were initiated by the Inland Fisheries Division of the Ministry. A shrimp culture development project was launched in 1984 to develop suitable shrimp hatchery and culture techniques. Today, shrimp is the most important fishery product exported from Sri Lanka, generating Rs. 2365 million worth of foreign exchange in 1996.

Lobster

Lobsters inhabit the rocky bottom areas and are mostly found in the coral reefs. Six species of economically important spiny lobsters are reported from the coastal waters, of which 80% of the catch consisted of Panulirus homorus. Due to heavy demand from the tourist hotels and export trade, this resources is being intensively exploited. The present production is around 800-1,000 t out of which 356 t have been exported in 1996.

Beache-de-mer

Beach-de-mer or sea cucumber is harvested from large high salinity lagoons in the northwest, north and northeast areas and forms one of the important export products. Out of 70 species recorded from Sri Lanka, 13 species are consumed in many parts of the world. The dominant species Holothuria scabra is selectively harvested. A total of 529.8 t was exported in 1996.

Bivalves

The Pearl Banks in the Gulf of Mannar have been commercially fished for centuries. Successful fisheries were held in 1925 and 1958 while the harvest reported from last two fisheries in 1960 and 1961 were low. Exploitation of other bivalve resources at present is far below potential and is confined to wild stocks. Present utilization of bivalves is limited mostly to some species of clams and cockles. NARA has started studying bivalve resources since 1984 with the assistance of the International Development Research Center (IDRC), Canada, to identify suitable species and areas to promote culture practices among fisherfork. Promising results have been obtained from these studies.

Squids and cuttle fish

Squids and cuttlefish are much in demand in the Far Eastern countries. There has been little directed effort for the exploitation of squid and cuttlefish on a commercial scale. Incidental catches are made from beach seine, scoopnets, shrimp trawling and hand line. Eight species of commercially important squid and cuttlefish are found in the coastal waters.

Ornamental fish

The marine ornamental fish export industry in Sri Lanka has been in existence at least for a period of four

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decades. It has been estimated that the total value of marine and fresh water ornamental species exported from Sri Lanka amounted to approximately Rupees 300 m in 1996. In the recent past the bulk of exports consisted of marine species although this trend in now rapidly changing to include more fresh water species. Nearly all marine ornamental species are wild caught due to difficulty in breeding them under captivity. As a result the industry is dependent on natural stocks to obtain the required species. This has resulted in excessive exploitation in many areas where ornamental species are being collected. In most instances destructive fishing techniques are being applied for collection, causing damage to the habitat. Marine ornamental species are collected from a wide range of habitats at various locations. The main habitats are coral reefs, sandstone reefs, sandy and sea grass beds. A limited number of species that occur in brackish water environments are also collected for export. Collecting sites are located mainly in the western, southern and eastern coastal waters. Several other locations in the northwestern, northern and eastern coastal waters are inaccessible due to security reasons. Recently, Sri Lanka has taken steps to protect several species of marine and fresh water ornamental fish. Invertebrates and molluscs through the Fauna and Flora Protection Ordinance. Further new regulations have been included in the New Fisheries Ordin ance of 1996 which has and also made it mandatory to obtain permits to export several additional species of marine fish.

Brine shrimp

Artimia has been located in Palavi, Hambantota and Bundala slatterns, in association with the salt pans. NARA has estimated a potential annual yield of 24 kg/ha from Palavi slatterns which cover an area of 243 ha, and an average

production in Hambantota slatterns of 3.1-3.7 kg/ha. In terms of food value, the Sri Lankan strain of artimia is said to possess a high nutritional quality for aquaculture. Over 2000 ha of land suitable for salt production in Sri Lanka could be utilized for artimia culture in future.

Sea weeds

The type, extent and the potential of the sea weed resources in Sri Lanka have not been adequately investigated. Some 260 species belongs to green, brown and red algae has identified in the coastal waters. Among them only 20 are of commercially important (Durrairatnam, 1961). Two varieties of Gracillaria are commercially exploited in Sri Lanka (Jayasuriya, 1989). they are found in large quantities in the northern coast (Puttalam Lagoon, Dutch Bay, Portugal Bay and Jaffna) and near Tricomalee in east. The BOBP started an experimental Gracillaria farming project in 1988. The research component of that project has been carried out in cooperation with the Inland Fisheries Division, of NARA and the extension component has been conducted in cooperation with Sarvodaya Sangamaya, a non-governmental organization. Encouraging results were obtained from this study. Sargassum is one of the commercially important species found in Sri Lanka. It is found in large quantities in the northern coast. A potential harvest of 800t has been estimated by Durairatnam (1966), only from south-west and south areas. Sargassum is still not exploited at a commercial scale.

Potential in the un-exploited range of the EEZ

Since production from the coastal sector has reached optimum levels, further development is largely dependent on the exploitation of resource in the outer continental shelf, slope and oceanic range. Potential resources in this un-exploited ranges of the EEZ have been identified basically as deep-sea fish, myctophids, shrimps and lobsters. As the continental shelf is narrow and rocky, the demersal fisheries resources available for exploitation is limited. At present fishing activities hardly extend beyond 100 m depth.

Bottom longline fishing for spiny sharks is the only fishery that is carried out in the deeper waters (150-350 m). The preparation of shark liver oil was started by the Department of Industries in 1945, with the shortage of vitamin oils imports to Sri Lanka. Production began on a small scale, using shark liver. Experiments had shown these species have liver rich in oil and which separated easily on warming the liver. Output was increased gradually and in 1951 the plant was handed over to the Department of Fisheries. The Fisheries By-products Factory at Mutwal took over production of oil in 1957 but failed to maintain consistence production. A small quantity of oil was made by the fishermen in crude manner by decomposing fish liver in the sun, but this oil is used only for waterproofing the boats. During early 1980's the Pharmaceutical Department purchased oil from collectors and exported to Japan. The high prices of liver oil influenced rapid development of spiny shark fishing during mid 1980's. High demand led to quality deterioration of oil. Squalin percentage of oil was reduced due to mixing with oil of other shark species. Export orders were cancelled.

The surveys conducted with R/V vessels "Optimist" in 1972 and R/V "Dr. Fridtjof Nansem" in 1978-1980 have located a few potentially rich offshore areas mainly on the north-west and north-east coasts capable of sustaining trawling operations for fish, lobsters and shrimp. The area covered and the information gathered by these vessels were limited as these surveys were not specifically directed to carry out studies on deep sea resource. For optimum exploitation of these resources as well as for optimum investment in the industry, it is essential to know the resources distribution and the potential yield from the Sri Lankan seas. The above studies were restricted to depths of 100-600 m. It was found that the abundance of fish species in deeper waters (300-600m) is significantly less than in the 100-300 m depth range. Further, most of the fish stocks discovered during these deep water trawling trials were low value species and more suitable for incorporating into fish meal.

There is no estimate of the potential yield of the surface and sub surface oceanic tunas and allied resources in

the EEZ of Sri Lanka. Except the surface inhabiting tunas and allied resources, exploitation of sub-surface components is at a very low level at present. The exploitation of these resources around Sri Lanka is being carried out by the industrial longliners, mainly in the international waters.

In addition certain resources, mainly in the coastal waters not subjected to full exploitation by any fishery. They show potential for increased contribution to coastal fish production. The catches of small tuna (frigate tuna with bullet tuna and kawakawa) has been quite significant in 1960's and 1970's. These resources were exploited by the troll line, pole and line and gillnets. With the expansion of the fishing area to the fishing grounds further offshore and the increase in offshore multi-day fishing by the 3.5 ton boats, the production of small tuna has declined. However in the recent past, an efficient gear, the ringnets has been developed in the southern, southwestern and eastern coastal waters to exploit these resources. Hence it is necessary to re-assess resources potential to determine whether the resources can withstand this increasing fishing pressure. There are other under exploited resources such as barracudas, dolphin fish, rainbow runners, half beaks, gar fish, cuttlefish, squids, etc. in the coastal areas. In view of the low exploitation rates and high rates of the above resources, substantial increase in fish production can be achieved by exploiting these resources to the optimum level using appropriate fishing strategies.

Dolphin fish (Coryphaena hippurus) and rainbow runners (Elegatis bippinulatus) do not generally make significant contributions to the catches in any fishery and represent underutilized resources. Considering their behavior, inshore Fish Aggregation Devices (FADs) were deployed in

1980's with technical and financial assistance of FAO/BOBP to promote these resources. However, the work with FADs has not gone beyond the experimental stage.

Half beaks (Hemirhamphidae) and gar fish (Belonidae), also do not make significant contributions to the catches in any fishery. These resources are presently exploited using traditional methods such as small mesh gillnets and handline and also with the nearly introduced ringnets. With this development, there been many fishing conflicts between the fishermen using traditional gears and those using the ringnets.

Traditional methods are still used for the exploitation of cuttlefish and squids in the coastal waters. They are believed to be underutilized at present. Introduction of more efficient exploitation methods can increase their catches. Indian mackerel (Rastelger kanagurta) and scads (Decapterus sp.) are reported seasonally in the gillnet, beach seine or ringnet catches. They are not available to any gear used in nearshore surface waters in the other seasons. Studies conducted with midwater trawling in other neighboring countries; India, Bangaladesh, Thailand and Philippines have yielded high catches of these species from the bottom depths. This may probably be due to the migration from pelagic zone subsurface depths.

Potential in the brackish water

Despite the considerable potential coastal and brackish water fish framing has not yet developed in Sri Lanka. In the resent past, experimental trials to culture milkfish in brackish water pond has shown promising results. This augurs well for the development of this type of farming in the brackish water areas. Sri Lanka has the seed of many culturable species such as milkfish (Chanos chanos), moonies (Monodactylus spp.) and groupers (Epinephelus spp.). The resent success achieved by the Inland Fisheries Division in breeding the giant freshwater prawn, Macrobrachium rosenbergii under limited field facilities has opened up the possibility of raising seed of this commercial species for culture along with fish in brackish water/freshwater ponds.

Past development activities

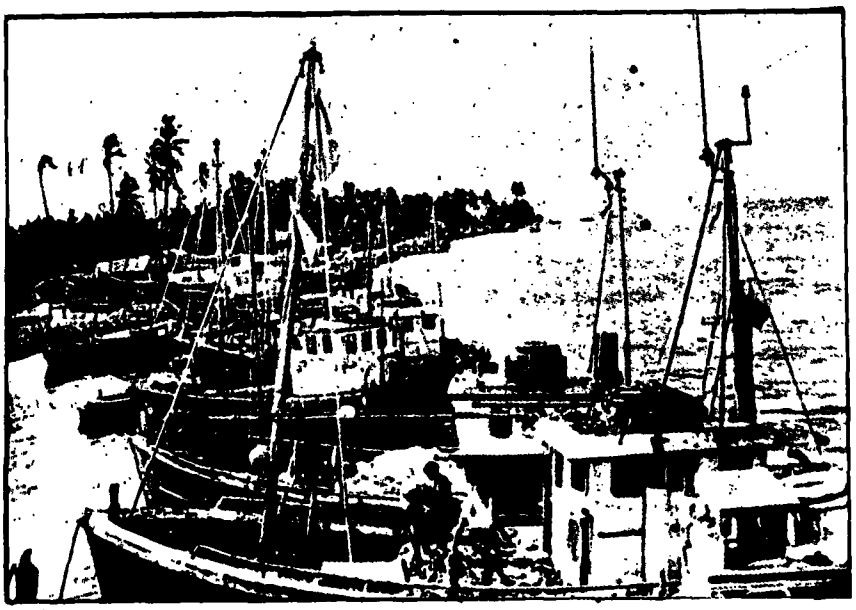
The development of fisheries in the country has been a slow and gradual process. Prior to 1940's state assistance was extended mainly towards development of revenue generating fishseries such as those for pearls, chank and window pane oyster and the conduct of trawl surveys. With the discovery of wedge Bank trawl grounds in mid 1920's, the Government became actively involved in the development of trawl fishing. Until the Department of Fisheries was formulated in 1941, with the objective of concentrating activities on fisheries development and research, very little attention has been paid on general fisheries development. A series of schemes for fisheries develpment have been implemented since 1940's by the Department, the most significant activities were the promotion of motorization of traditional crafts and the introduction and extension of new types of fishing crafts and nylon nets in 1950's. These activities received considerable assistance from FAO and Colombo Plan countries. These development led to a rapid increase in fish production until 1970's. The rate of development was slower during the period of 1965-1977, owning to insufficient replacement of fishing craft and shortage of fishing gear and engine spare parts caused by import restrictions. This position has changed very drastically since 1977. With the liberalization of the economy, substantial quantity of nets, engines, spares have been imported. In addition, local production of nets too has increased considerably. This period has been characterized by very substantial increase in the total production of fish in the island.

Prior to 1980's, offshore fishing was dominated by bottom trawling conducted on the Wedge Bank. This fishery ceased in late 1978, as a result of the demarcation of EEZ boundary with India. During 1980-1985 period, the most important change in the fishing effort has been the development of offshore fisheries. This change has been pioneered since the mid 1960's with the introduction of 40 vessels of 34 ft by CFC. It failed and the next attempt was the introduction of a fleet of 30 boats of 38 ft under an ADB loan in the mid 1970's. The most significant

phase of fleet development started in early 1980's with the introduction of the "Abu-Dhabi" boats built under the North West Coast Fisheries Development Project. Since then the expansion of the offshore fleet has been essentially done by the private sector. About 1250 multiday boats of 32-60 ft have been built between 1986-1996, by entrepreneurs and boatyards. Most of the large boats of exceeding 45 ft entering the fishery in resent years have better facilities, improved crew accommodation, navigation and communication facilities and deck equipments. On board refrigeration facility is the area requiring urgent attention.

In order to ensure supplies for the growing demand for fish by the expanding population all avenues were exploited to boost fish production. Greater attention was devoted to the development of inland fisheries. More important among these were the establishment of several inland fish breedling stations. About 14 exotic edible fish had been introduced between 1898 and 1969 and during the period 1969 to 1983, four species had been introduced into Sri Lanka's fresh water. With a view to assisting the fishermen in effective capture of fish, the ministry came to their aid with a 90% subsidy scheme under which they were issued fishing gear and boats. The response to the scheme has been tremendous and the assistance received by fishermen is reflected in the dramatic increase in the fish catches from reservoirs which rose from about 16,500 t in 1978 to about 35,000 t by 1983. In the 1980s, culture fisheries, especially shrimp culture in the Puttalam District developed fast. Many private sector companies invested in prawn farms and production increased. However due to unplanned development, many problems set in affecting the environment in the area.

During the past decades the fisheries sector has also developed into an important source of foreign exchange



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earnings for the country. The products exported are prawns. lobster, chank shells, beach-de-mer, shark fins and live acquire fish.

Institutional development

The Department of fisheries was established in 1940. The Department was under the Ministries of Local Administration (early 1940s), Industries, Industrial Research and Fisheries (late 1940s to early 1950s), Industries and Fisheries (from 1956), Agriculture, Land, Irrigation and Power (1960s) until a separate Ministry of Fisheries was established in 1970.

Many institutions were established in promoting fisheries development activities during 1960s to 1980s. The increase of fish production spurred the Government to organize a scheme for fish distribution, marketing and storage. Fish catch was dried in most rural areas due to lack of transport and storage facilities.

The Ceylon Fisheries Corporation (CFC) was established in 1964. The main purpose for which it set up was to catch, purchase and sell fish but the original objectives also included fish processing, construction and operation of fishery habours and associated facilities, import and sale of fishing gear, construction, repair and maintenance of fishing boats. In 1972, most of the functionns concerned with fishery habours were transferred to a new Corporation, Ceylon Fishery Habour Corporation (CFHC). The tasks assigned to CFHC were the establishment, construction, maintenance, operation and management of fishery hourbours, anchorage and shore facilities and the provision of repair and maintenance facilities for fishing crafts. In 1991 the "Open-gate system" (access to harbours without any charge) was introduced and the role of CFHC was changed from provider to facilitator. Functions of the CFHC were limited to planning, design, maintenance of infrastructure and maintenance dredging. All commercial activities were privatized. This resulted in mismanagement of fisheries harbours and neglect of shore facilities. "Open-gate system" was abolished in 1996 and CFHC is in the process of introducing the harbour management programme in six major harbors.

Introduction of village level cooperatives to organize fishermen was started in 1940s. State assistance were mostly channelled through these cooperatives. The re-organization of small, village level fisheries cooperative societies in 1972 into large primary societies which were re-defined as being the organization of fishermen for improvement of the efficiency of small scale sector of the industry in the catching, handling and marketing fish. The Sri Lankan fishermen as universally the case are slow to respond to changes. The very slow progress of the mechanization programme and the change over to synthetic gears reflect this very luridly. An Extension Department was established in 1955 to train field officers for educational and demonstration work among fishermen. The year 1970 was the turning point in the history of fisheries development. For the first time in Sri Lankan fisheries, a separate Ministry for fisheries was established to centralized all administrative and policy making. Since 1970s. Government has devoted greater attention to the development of inland fisheries. A separate division of Inland Fisheries was set up within the Ministry to implement development in this sector. In 1979, the Ministry of Fisheries was reorganized and it took over the function of the Department of Fisheries under the Marine Fisheries Division. The demand for enhanced research inputs increased after introduction of mortarization and synthetic fiber nets and exotic species to the irrigation reservoirs. The setting of Fisheries Research Division in 1950 within the Department of Fisheries, Inland Fisheries Division in 1973 and the Institute of Fish Technology in 1978 in the Ministry of Fisheries have been aimed at meeting this increased demand on fisheries research. The Research Division of the Department of Fisheries was then upgraded and a new organization called the National Aquatic Resources Agency (NARA), was created in 1981. It undertakes and co-ordinate research activities relating to living and non-living aquatic resources. NARA took over the research function of the Fisheries research Division, Inland Fisheries Division and Institute of Fish Technology. The demand for training fishermen and mechanics in fishing methods and engine repair and maintenance was increased with the introduction of new technology to fisheries. The first Fisheries Training center at Negombo was established with Japanese assistance in 1962 and another three centers were opened in 1973 at Tangalle, Batticaloa and Jaffna. The Sri lanka Fisheries Training Institute was established in 1975 with Japanese assistance to impart theoretical and practical training

for the improvement and development of offshore and deep-sea fishing techniques.

Legislation

Measures established for the management of traditional fisheries date back to the latter part of the 19th century. The Municipal Councils Ordinance, the Village Communities Ordinance of 1889, the Small Town Sanitary Ordinance of 1982, Local Board Ordinance of 1898, Game Protection Ordinance of 1909 and Local Government Ordinance of 1920 contain legislation for the management of area specific fisheries. The colonial Government in 1920s was interested in extracting revenue from fisheries. With a view to collecting revenue, the first direct piece of fisheries legislation; Peal Fisheries Ordinance was enacted in 1925. A permit system was introduced with the opening of the pearl fishery. With the development of general fisheries, laws were necessary to settle or avoid disputes. The scattered array of fishery regulations found in practice were inadequate or vague in character. A new set of laws was drafted and enacted as the Fisheries Ordinance in 1940 to regulate or stop all type of abuses of fishery resources and interest of fishing groups. The provisions of the Fisheries Ordinance was enforced till 1996, with some amendments. In addition to Pearl Fisheries Ordinance, there are other related ordinances; the Whaling Ordinance and the Chank Fisheries Act, but they are no longer enforced fully because they are obsolete. The Fisheries Act of 1979 for the management of resources exploited by foreign fishing vessels, is also enforced. In the early 1980s several permits were issued. During the last few years, because of opposition from small scale fishermen and as a result of the development of the local offshore fishery over the last decade, no more permits have been issued under this Act.

During the last two decades, there has been substantial fisheries development. Production increased to 228,550 t in 1996 from 40,000 tons in the 1940s.

It was found that the provision of the Fisheries Ordinance of 1940 were not adequate to meet the demands of this development. Therefore a new Fisheries and Aquatic Resources Act of 1996 was enacted. It has given emphasis to management of fisheries and sustainable development with due recognition of conservation measures. Some of the most important new provisions are; licensing of all major fishing operations, declaration of areas for fisheries management and conservation. For violation of provisions, enhanced fines and jail terms have been included with a view to introducing strict management discipline.

Fisheries development plans

Sri Lanka has had a short history of fisheries planning. Up to mid sixties the fisheries department had only a collaborative role in planning, which was then the function of a central planning secretariat and the first plan for fisheries was prepared by the latter as part of the National ten year plan of 1957. All strategies and target for fisheries development in this plan were to increase fish production. The main strategy to achieve this target of production was mechanization of craft and introduction of new crafts and gear. The plan further recognized the importance of inland fisheries development. This was followed by the first fishery development plan prepared in 1965 by the Ceylon Fisheries Corporation, the main objective of which was the increase of fish production by 65% over a period of 10 years. It was based on the assumption that the involvements in all major areas are to be undertaken by the public sector. This plan was not implemented. The second plan was prepared for the period 1972-1976. This plan also envisaged a production increase of 52%, from 115,000 t in 1970 to 175,000 t by 1976. This increase in out put was expected to realize through the introduction of more new boats. As in the ten year plan, this plan also did not achieve the desired results. Since then, there have been several plans formulated to develop some aspects of the fishing industry but few were implemented. An integrated plan covering all aspects of fisheries was formulated in terms of a Master Plan for the period 1979-1983. The most important strategy underlining the Master Plan was to promote the private sector involvement on commercial activities, state involvement being limited to providing administration investment

incentives and relief measures, infrastructure, research and other common services. The major objectives were; increased fish production and socio-economic upliftment of fishing community with generation of employment. More emphasis was paid to the development of inland and offshore fisheries. It further encouraged export of high value fish including ornamental fish. The implementation of the "Abu Dhabi Project", was one of the key projects under this Master Plan, which laid a solid foundation for the development of offshore fishing. The objectives of the 1990-1994 National Fisheries Development Plan were similar to these of the pervious plans. This plan has ignored inland fisheries development as state assistance to promote inland fisheries was then suspended. However, shrimp aquaculture developed rapidly as a result of strong private sector initiative. The plan relied upon fisheries cooperatives societies to make a substantial contribution towards making the fisherfolk self-reliant. State assistance to the fisherfolk was channeled through these societies. An attractive business climte for the private sector was initiated through tax release, credit, incentives and by selected market interventions by CFC. The anticipated target production was expected from private sector through the expansion of offshore fleet operated by entrepreneurs and through the traditional small scale coastal activities.

Private sector participation

Entrepreneurial interest in the fisheries sector began with the commencement of shrimp and finfish trawling in 1920s, but really gained momentum with the introduction of motorization and new fishing crafts, new fishing methods and technology, culture practices and in resent years with the liberalization of imports, provision of subsidies and substantial tax

incentives. All harbours and anchorages are owned and operated by the public sector but private sector enterprises are involved in the establishment and operation of workshops and slipways. CFC and private sector are involved in the establishment and operation of ice plants and cold storages. The bulk of the ice required for fish preservation is supplied by the plants owned by the private sector.

More than 95% of the boats are owned by private sector individuals and the rest is owned by cooperative societies. Majority of vessels are built by private sector boat builders. The supply and servicing of engine spare prate are also private sector ativities. Fishing nets and other materials for fishing gear, both imported and local by producted, are carried out exclusively by private companies. The fish marketing system in Sri Lanka is also controlled largely by private traders who purchase catches at landing centers from the fishermen. CFC's marketing activities never had a positive impact on the fisheries sector. Their share of the market was less than 3% of the production. The export of fish and fishery products is also an activity of the private sector.

Foreign investments

Over the years Sri Lankas fisheries sector has benefited from programmes of assistance carried out by several multilateral and bilateral donor agencies, Governments and international development finance institutions. During early 1990s, two major fisheries projects were launched in Sri Lanka, which are bound to make significant and far reaching contribution to the development of the marine fisheries industry. The six year (1993-1998) Fisheries Sector Development Project, implemented by the Ministry of Fisheries and Aquatic Resources Development is funded by the Asian Development Bank. This project has six main actions to be carried out over period : 1) improvig facilities in fishing ports and anchorages for the offshore fleet, 2) construction of coastal conservation measures for small scale fishing communities,3) developing marine fishing by increasing the offshore fishing fleet and investigating deep sea fishing possibilities, 4) modernizing ice plants 5) supporting small scale fisheries by replacement of parts of boats and engines, and by diversifying fishermen's activities, and 6) providing institutional support to the NARA, Ministry of Fisheries and Aquatic Resources Development and Provincial Councils to the development of their fisheries activities. The components that support fisheries management include the survey of fish resources within Sri Lanka's EEZ beyond the continental shelf, conducted by NARA over 24 months (September 1995 to September 1997) and which will result in a better understanding of the resources situation in the area. The survey should also throw light on the feasibility of further diversifying the fisheries, specially to exploit sub-surface tuna resources and thereby reducing the pressure on the coastal fish stocks. The component which support fisheries community development provide credit for non-fishery income generating activities of fisherfolk.

The Marine Fisheries Management Project assisted by the UNDP was also started in 1993 for strengthening of the Department of Fisheries and Aquatic Resources as an institution for the management of fisheries resources aimed for a sustainable utilisation and development of fisheries and aquatic resources in Sri Lanka. The project has three main objectives: 1) establishment of an institutional machinery for the management of fisheries, 2) strengthening of the field staff capabilities of the Department of Fisheries in the management, and 3) obtaining of active participation of fishermen, fisheries organizations and other sections who are engaged in the fishing industry, in the management of fisheries.

Government policy and strategies for fisheries development

The first half of the 1990s has witnessed several important developments concerning fisheries in Sri Lanka. Among these are the rapid expansion of the offshore fishery into extensive areas of the EEZ and beyond, receipt of UNDP assistance for fisheries management, resurgence of fisheries cooperative societies and their utilization for fisheries and fisherfolk development, the implementation of an investment programme with financial assistance from Asian Development Bank to upgrade the physical and social infrastructure to support fisheries and assistance to cary out resource survey in the offshore area in the EEZ and the change of policy in regard to inland fisheries. Fisheries sector is now being developed through the implementation of the Fisheries Development Plan (1995-2000) which accords high priority to the management of coastal fisheries and development of offshore, inland fisheries and aquaculure. The emphasis of the National Fisheries Development Plan upon the private sector reflects exactly the national objectives policy of economic liberalization and its reliance upon private entrepreneurial initiative. The plan is following a target production of 294,000 t in the year 2000. To protect the resources from over exploitation and prevent conflicts, management measures are being introduced to coastal fishery. Meanwhile the plan provides for a substantial increase in the existing fishery by developing offshore and inland aquacultrue. The government promotes active participation of private sector both local and foreign in the development. Therefore, offers very attractive package of incentives for investment in the fisheries sector. All commerical activities in the fisheries sector such as fish catching, boat building, marketing, exporting, etc. are being left to the private sector while public sector concentrates on the provision of infrastructure, support services and incentives.

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