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A REVIEW OF ADDU ATOLL'S FISHERY

Aminath Latheefa

1. SUMMARY

This report provides a synopsis of the tuna fishery in Addu Atoll. It is based on a desk study of catch and effort data. The report aims to provide information on Addu Atoll's fishery, in order to assist building and strengthening of the existing development opportunities in the atoll.

Catch and effort data of all the atolls for the period of 1979-2000 were analyzed to understand the overall national situation and to compare Addu Atoll with other atolls. Some more detailed island level data were collected from the atoll office. In addition, a historical perspective of Addu fisheries is presented by reviewing the available literature on the Addu fishery.

Comparing the catch and effort data of the whole country between 1979-1989 and 1990-2000, a higher growth was observed in the Maldives during the period 1979-1989 than in 1990-2000. This national trend of high growth rate between 1979 and 1989 was not observed in Addu Atoll. There was a lack of involvement in fishing in Addu during the eighties when elsewhere in the country the intensity of fishing escalated. The presence of the British in Addu during 1939-1976 had opened up other opportunities, which had reduced the dependency on fishing that existed in the past. The British withdrew in 1976 at a time when tourism, which was introduced in 1972, was growing rapidly in the Maldives (but not in Addu). Consequently, there was large-scale migration from Addu towards Malé during the late 1970s and 1980s, as workers sought employment in tourism, trade and other services; this trend continues to date.

The period 1990-2000 showed a different scenario. Fishing which had existed in a non-commercial nature in the 1980s gradually gained an important place in the economy of Addu Atoll, reaching its height in 1996. Addu Atoll was almost on equal terms with the best fishing atolls during this period. There are several reasons for this delayed development of fisheries in Addu Atoll. After the British left Addu in 1976, people had turned towards trade and the service sector for employment. By the 1990s, accumulated wealth enabled investment in fishing. At the same time, collector vessels were based in Addu, increasing the confidence of the fishermen in their ability to sell their catch. Establishment of the Koodoo

Cold Store in 1996, combined with a generally good fishery during this time, further increased the confidence of the fishermen in South Maldives. The Addu fleet initiated bait attraction using powerful lights. From 1996 onwards, Fish Aggregating Devices (FADs) for tuna fishing have been in place more or less continuously and have proved very successful. From the data available, the proportion of fish caught from the FAD by Hithadhoo fishermen in 2001 was 72%, while in Maradhoo it accounted for 52% in 2000 and 72% in 2001.

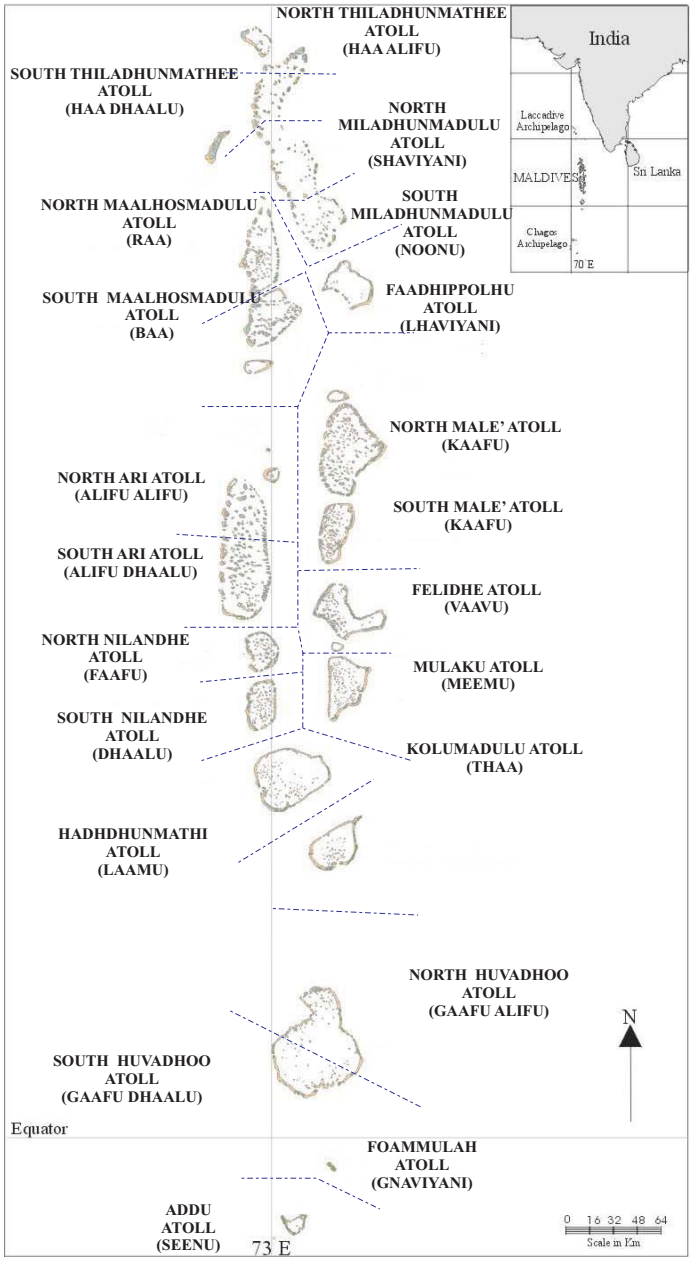
Analysis of fishing within the atoll indicates that in terms of fish catch, fishing vessels and fishermen, the island of Hithadhoo accounts for the major share, followed by Maradhoo, Hulhudhoo, Feydhoo, Meedhoo and Maradhoo-Feydhoo. Hithadhoo accounts for 47% of the atoll's recorded catch, of which 98% is tuna.

Today, the fishing industry of Addu is confronted with the same constraints faced by the tuna industry of the country as a whole. There are two main issues. First, there are fewer men willing to go fishing. This is the main reason why some boats do not go out on some days, and is a problem throughout the atoll, particularly prevalent in Feydhoo. The reasons for this shortage of fishermen include low status of fishermen, widespread education in the atolls leading to increased expectations and increased employment opportunities in other sectors. Partly as a result, boat owners have to build larger and faster boats in order to attract crew. This has resulted in increased searching capacity and larger catches. However, it has also contributed to the second major constraint facing the Addu fishery. With the increase in the harvest, there has not been a corresponding improvement in the handling facilities and support infrastructure. Therefore fishermen are faced with problems in marketing their catch. Furthermore, the new vessels are not equipped to carry ice or other cooling systems, which has resulted in the deterioration of the quality of fish at a time when overseas markets are developing higher quality expectations. This has resulted in rejection in the major markets and imposition of strict buying inspection.

2. INTRODUCTION

Maldives forms the central and the largest part of the Laccadive-Chagos ridge, which extends south from India to the centre of the Indian Ocean (Figure 1).

Fig.1 Map of the Maldives



The whole of Maldives is made up of atolls and associated coral structure. The territorial area is 90,000 square kilometers, out of which approximately 300 square kilometers is dry land. The majority of the islands are small with only nine exceeding 2 square kilometers and three exceeding 4 square kilometers. The country is composed of 26 natural atolls grouped into 20 units for administrative purposes. There are some 1,200 small coral islands, of which 200 are inhabited, including Malé the capital island. 92 islands have been developed as tourist resorts.

Fishing utilizes the most important natural resource found in the Maldives and is a key means of livelihood for the Maldivian people. Historically, fisheries have been the economic mainstay of the Maldivian economy, satisfying the domestic demand of protein supply as well as supplying a major commodity for export. Currently, the sector accounts for 6% of Gross Domestic Product (MPND, 2001). It also provides direct employment for over 16,000 (MOFAMR, 2001) and is the main provider of employment in most out lying atolls and islands. As such, in terms of socio-economic well-being, the significance of the fisheries sector to the economy is far greater than may be suggested by standard macro-economic indicators. The forward and backward linkages from the fisheries sector such as boat building and fish processing contribute significantly as a source of employment and income generation. The overall importance of the sector to rural communities is much more significant than any other sector.

The Maldives was traditionally a tuna fishing nation. The majority of the male workforce was engaged in tuna fishing; tuna provided the bulk of the population's protein; and smoke-dried tuna or 'Maldive fish' was the country's main export product. Pole and line tuna fishing was carried out in the traditional way for centuries, until the early 1970s. Since then, a number of developments have occurred in the fisheries industry. At the same time, the economy has also diversified, notably with the start of the tourism industry in 1972.

Over the years, the tourism industry has expanded and overtaken the fisheries industry in terms of the contribution to GDP. Tourism grew at a much faster rate than the fisheries sector; it provided investment opportunities within the Maldives, and created extra job opportunities as well as trade opportunities. In 1981, fisheries accounted for 22% of GDP while tourism accounted for 10% (MPD, 1988). In contrast, today, tourism accounts for 33.3% of the GDP while fisheries account for 6% (MPND, 2001). Despite the rapid growth of the tourism sector, fisheries remain as an

important earner of foreign exchange, generating 53% of the export earnings (MPND, 2001). Fisheries also remain as the most important source of employment for those living far from the tourism zones.

Within this national context, the status of Addu Atoll's fishery needs to be reviewed in order to understand existing problems and opportunities. Addu Atoll is the southernmost atoll of Maldives, located about 330 miles south of the capital Malé, just south of the Equator. The atoll consists of seven main natural islands located along the perimeter coral reef, which encloses a large deep lagoon. Out of the seven natural islands, four are inhabited and two are uninhabited. The other island, Gan, serves as the major service centre for the atoll and contact point with Malé and other atolls (Fig. 2). There are several other islets, which are uninhabited. Unlike most other atolls, there are no small islands inside the lagoon. The total size of the atoll is 8 miles north to south and 10.5 miles east to west (about 45 sq mile). For a Maldivian atoll, it is relatively small in size. However, in terms of useable land area and population, it is a relatively large atoll.

Fig. 2. Map of Addu Atoll

Hithadhoo is the administrative capital island of Addu, and the site of the Atoll Office. Hithadhoo is the largest island in the atoll and home to 41% of the population. However, since 1982, with the establishment of Addu Development Authority, Gan is being developed as the main service centre for the atoll. The airport, jetty, garment factories, power station, bank, post office and other government offices are located in Gan. The British had their military base in Gan from 1956-1976, and developed the physical infrastructure facilities such as the airport, harbour, extensive network of tarmac roads, piped water, electricity and a large number of buildings. Many of these facilities are still in good working order.

The major purpose of this study is to understand the status of the fisheries sector of Addu Atoll through a review and analysis of fisheries catch and effort data. Emphasis is placed on presenting available catch and effort data of Addu Atoll in a countrywide perspective. At the same time, the relative importance of the fisheries sector to each individual island of Addu Atoll is also to be highlighted where possible. More specifically, the study will attempt to:

1. Determine the total catch of Addu Atoll in relation to the productivity of other atolls. The relative importance of fish production to the atoll as a whole over the years will be examined.

2. Review and analyze the fishing effort; the fishing trips and fishing fleet by type. These fishery indicators will be compared with similar indicators of other atolls and for the whole country.

3. Review the individual islands' status for some recent years in terms of catch, catch composition by species and catch from FADs.

3. SCOPE AND METHODS

The original aim of the study was to analyze all available fish catch data of Addu Atoll, which is collected by Ministry of Fisheries Agriculture and Marine Resources. The MOFAMR maintains a database at the atoll level on all catch and effort data. The data are recorded by total enumeration for each pole and line boat, each day by each island. Records from each island are returned to MOFAMR via the Atoll Office on a monthly basis. This system was started in 1959, was expanded in 1966 to include trolling vessels. In 1970 the system was developed to include the different species

of tuna, with reef fish being reported as a single category. From 1979 onwards, the catch by sailing and mechanised *masdhonis* were recorded separately. Later in 1980's, the reef fish were recorded in 3 categories based on sizes - large, medium and small.

MOFAMR publishes and disseminates the summarized atoll level data on an annual basis while the island level data are not published or disseminated. As a result, attempts were made to collect the island level data from the Atoll Office during field trips conducted in March 2002. It was found that the island level data maintained in the Atoll Office were available for a limited number of years. The following data were used in the present study:

1. Total fish catch by atoll 1979-2001
2. Fishing fleet by atoll 1979-2001
3. Fishing trips by atoll 1979-2001
4. Island-wise data for the years 1990-1993 and 2000-2001

Several limitations exist in the data used in this analysis. They include:

1. The atoll-wise data used are secondary data provided by the Statistics and Database Management Section of MOFAMR. Errors, which are inherent in such data sets, include under-reporting and over-reporting as well as errors in the conversion factors used to convert number to weight. Nonetheless, it is also important to highlight that the system of total enumeration has been in existence for years and has produced an invaluable time series. These data have been used for all the fish catch and effort analysis over the years.

2. The data used in the analysis of the individual island status was also from secondary sources. These analyses are based on the data obtained from the daily and monthly forms provided by the atoll office. In a few cases, the data for some months were missing. Due to this, the analysis for individual islands are presented as percentages or proportions, which, would provide some indication of the fishery status of the individual islands of Addu.

3. The data series available at the island level were in the form of raw data. Collecting and entering the data at the island level were time-consuming and tedious tasks. Hence, data at the island level were collected for a few years only, limiting the analysis to a short duration.

4. RESULTS AND DISCUSSION

4.1 Addu Atoll in the National Context

4.1.1 Production

Overview of the total production; 1979-2001

For a detailed understanding of Addu Atoll's fish production trend, it is important to review the overall trend of production for the whole country. The underlying factors which contributed to the national trend are likely to have played a major role in the production trend of the individual atolls and islands, including Addu Atoll.

Fig. 3. Comparison of total national catch and Addu Atoll's catch from 1979-2001.

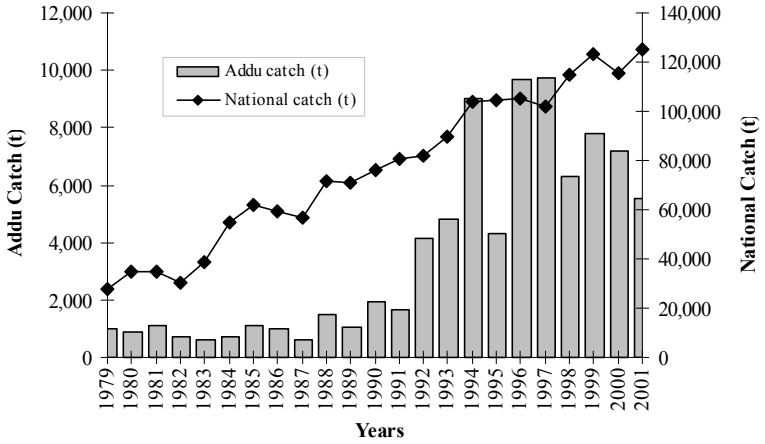


Figure 3 depicts the total catch (excluding the catch from Exclusive Economic Zone) along with the share of Addu Atoll's catch. On a national level, a total of 124 thousand metric tonnes of fish were caught in the year 2001 which is double the amount caught in 1986. An average annual growth rate of 6% was observed from 1979-2001. Within these years, a distinction in growth rate of fish caught is observed for the period 1979-1989 and 1990-2001 with average growth rates of 7% and 4% respectively, indicating that the major increase in catch occurred during the 1980s.

Reasons for such impressive growth during the 1980s are well-known and include:

1. The mechanisation of the traditional fleet of sailing vessels, initiated by the government in 1974.
2. The gradual build-up of a government-owned fleet of fish collector (ice) and mother (freezer) vessels, which increasingly provided the primary production sector with much needed fresh fish marketing outlets in major fishing atolls.
3. The re-opening of the upgraded tuna processing plant at Felivaru in 1987/88, which operates a separate fleet of four collector vessels.
4. Availability of fuel to the fishermen throughout the country both by the mother vessels and collector vessels, and directly at the Felivaru plant.

Fig. 4. Comparison of growth rates of fish catch between 1979-1989 and 1990-2000.

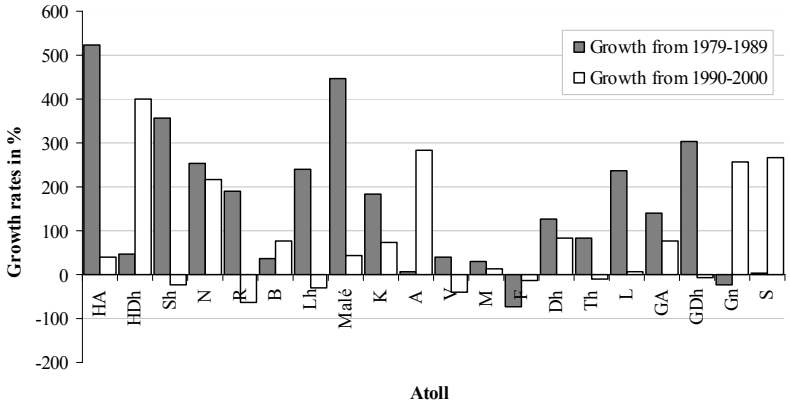


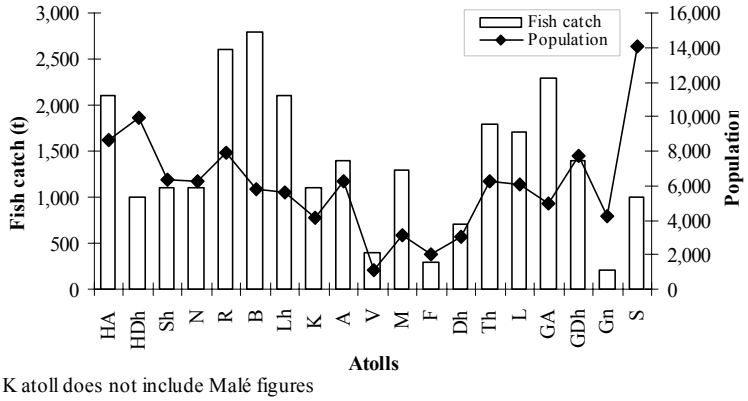
Figure 4 illustrates growth rates for all the atolls for 2 periods: 1979-1989 and 1990-2000. It shows that growth of 14 atolls were higher during the eighties compared to the later period. The exception to this general trend was observed only in 6 atolls. HDh atoll in the North, B, A and F atolls in the central region and Gn and Addu (S) Atoll in the South, which showed minimal growth in fishing activities during this period.

Fish Production in Addu Atoll, 1977-1990

Fig. 3 depicts the weight of fish landed for the whole country and for Addu Atoll for the period 1979-2001. In terms of fish catch, Addu Atoll seems to have some unique characteristics compared to the overall trend prevailing throughout the country during this period. While almost throughout the country fishing seems to have dramatically increased in the eighties, the economy of Addu Atoll seems to have relied more on other sources of income during this time.

During the eighties, in terms of fish caught, the annual catch of Addu Atoll is just above 1,000 metric tons, which is below the average of over 3,000 metric tons per atoll, ranking Addu Atoll as 17th (out of 21 atolls) in terms of catch. Average growth rate of the atoll fish production during this period was just 2%, and the annual contribution towards the total production of the country was also just 2%. During this 10-year period, growth rate of fish catch over the previous year is very erratic, observing declines and growths. The irregularity of the catch is more visible by some extreme high growth rates during certain years, such as value of 146% observed in 1988, and 88% observed in 1990.

Fig. 5 Fish production and population for 1977



K atoll does not include Malé figures

Figure 5 depicts the population figures along with the production figures for each atoll for the year 1977. The population figures reveal that Addu Atoll is the most populated atoll after Malé Atoll. The ratio of population density

to fish landings shows that the relative lack of fish landings in Addu was not a result of shortage of people. Each island in the Maldives has distinctive socio-economic features, which together with more recent investments in social infrastructure have shaped the community into specific activities. In Addu, the development of various semi-skills required by the service and construction sector during the British period moulded the majority of income-earners toward the service sectors.

Beginning from 1939, the political history of Addu was heavily influenced by the British military presence. From 1939 to 1945, during the Second World War, British troops and support personnel were stationed in several islands in Addu Atoll. In 1956, Britain obtained permission to re-establish its war-time airfield in Gan in Addu Atoll. Maldives granted the British a 100-year lease on Gan and some forty hectares on Hithadhoo for radio installations. Under this new accord with the central authorities, the British employed people from Addu Atoll in their facilities. The income from this work and the luxury goods available to the workers seem to have fulfilled their needs and wants. Consequently, the dependency on fishing as an income-earning activity, was reduced.

During the 20-year period of British presence in Addu, many local people underwent training and gained work experience in various services and businesses. Most of the people in Addu Atoll acquired skills and semi-skills required by the secondary and tertiary sectors as employees of the military base. According to Maloney (1980), when the British withdrew from Gan in 1976, 900 people of Addu were left without work. They had to begin re-learning how to fish and cultivate. During those 20 years of prosperity in that atoll, the population increased from 6,000 to 17,000, largely as a result of improved (and free) medical services. The increased population could not subsist in Addu Atoll, for the fish catch was insufficient, and there was no income to buy food.

As a result, when the British left, the people of Addu turned towards tourism, construction and trade for sources of income. Few, if any, investments were made to absorb the redundant workforce within the atoll. Therefore, they migrated to Malé and other areas where there was a demand for their skills. This was a large-scale emigration out of Addu Atoll, and the trend continues to date. This fact is revealed in the employment studies and migration figures during this period.

Analysis of 1992 migration figures reveal that 4,508 people were working in Malé and other atolls. The total number of out-migrants was higher than the total number of households in the atoll. Around 87% of the workers were men. Some migrants took their whole families to Malé to take advantage of better education and social facilities. As a result, 13% of the houses in Addu were vacant. According to the 1990 census on population and housing, 69% of Addu migrants in Malé were in the age group of 15 years and above. They were mainly job hunters (Amarasekara, 1992). According to the 1995 Census, 40% of the population of Malé consisted of migrants from other atolls, out of which Addu, along with two other southern atolls; dominated in comparison to other atolls (MPND, 2002).

This was a time when tourism, which was introduced in 1972, was growing at a faster rate than the fisheries sector. It provided investment opportunities within the Maldives and created extra job opportunities in the trade and service sectors. In contrast to this, investment in fisheries was considered high risk, requiring large amounts of capital to invest. These facts indicate that the existence of fishing in Addu during the 1970s and 1980s seems to be of a non-commercial nature, and more as a supplier of protein than as an income-earning activity in comparison to other atolls.

Fish production in Addu Atoll, 1990-2000

In contrast to the 1980s, the period 1990 to 2000 shows a different scenario. During this 10-year-period, the fish catch increased at an average annual rate of 46%, which was the highest average growth rate observed for any atoll in the country. In terms of production, Addu Atoll now ranks fifth with an annual production of over 7,000 t. The average for all atolls is 4,982 t per year. Catches from Addu Atoll are now comparable to those of other good fishing atolls such as L, K, HA, Malé, and GA atolls.

Fishing which had existed in a non-commercial nature in the 1980s seems to have gradually gained an important place in the economy of Addu Atoll, reaching its height in 1996. With a very low contribution rate to the total national catch of 2% in 1979, the rate peaked to a 10% contribution rate in 1997. In the year 2000, Addu Atoll's contribution was 6%. This value is equivalent to the contribution figures of major fishing atolls such as B, L and GDh Atolls. In the case of Addu Atoll, there seems to have been a lag in the impact of the mechanization program, which was at its height throughout the country during the eighties. A transformation from a non-fishing atoll to a medium fishing atoll is now visible in all the indicators.

Certain factors encouraged the people of Addu to turn towards fishing during the 1990s. After the British left Gan, people turned towards trade and the service sector for employment. The wealth accumulated during the 1980s helped in investing in fishing along with the existing advantage of unexploited fishing resources around Addu Atoll. It is well-known from early days that Addu Atoll is rich in marine resources with upwelling occurring during the North East Monsoon (December to March). Collector vessels based in Addu increased the confidence of the fishermen in the area of marketing. They were able to sell their fish directly to the collector vessels and get immediate cash. At the same time, Koodoo Cold Store was established in 1996. The good fishing during this time increased the confidence of the fishermen of South Maldives in general. With a guaranteed market, larger and higher-powered boats capable of fishing further a field in rough weather were built in the region. Boats equipped with modern electronic equipment such as GPS, fish finders, high-powered engines, and wheel houses which can accommodate a larger number of crew members, were constructed in the South. This had its influence on Addu fishermen, too.

Addu fishermen initiated bait attraction at night using lights. This practice slowly spread to other atolls. It was developed in Addu Atoll because of the scarcity of baitfish in that area (Anderson, 1997). From 1996 onwards, 6 FADs (MOFAMR, 2002) for tuna fishing were installed which proved to be very successful during this period. At present, there is one FAD existing in Addu Atoll, which is being utilized by the fishermen of the region (MOFAMR, 2002). There are now over 12 vessels of length between 12-20 meters equipped with modern equipment capable of fishing further afield in the rough weather (Hassan Latheef, pers.comm., 2002)

Fishing before 1957

The historical existence of tuna fishing in all the atolls of Maldives as a major economic activity is well documented. Dried fish as an export product from Maldives is well known. Fig 6 shows the percentage of males employed in fishing in the year 1911. The seafaring nature of the people is visible in all the atolls of the country.

In 1911, 2,999 boats existed in the country, out of which 1,542 boats were fishing boats and 57% of males employed depended on fishing for their livelihood. In particular, the importance of fishing in Addu Atoll is highlighted, indicating that 44% of the employed population was engaged in

fishing, while cultivators and toddy tappers accounted for 17% and 7% respectively (Denham 1911).

Fig. 6. Percentage of males employed in fishing in 1911.

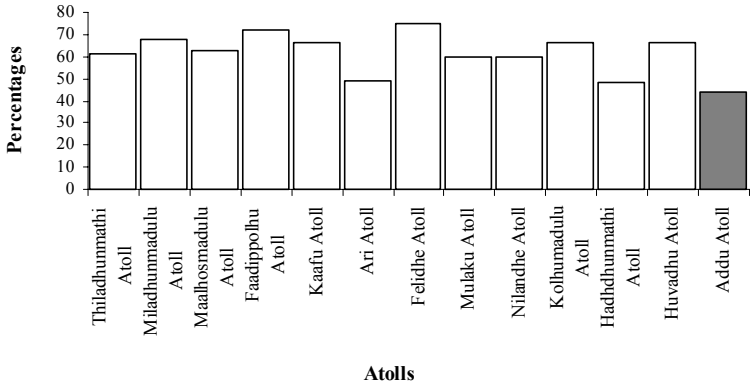
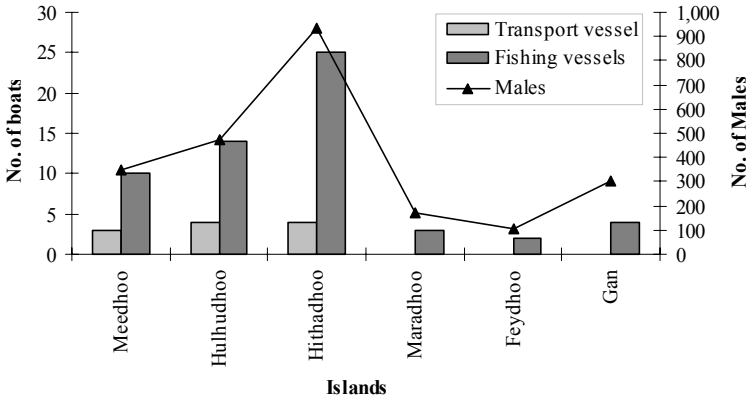


Figure 7 shows the number of males and types of boats existing in Addu Atoll in 1922. 50% of vessels belonged to Hithadhoo, which was followed in importance by Hulhudhoo (22%) and Meedhoo (17%). The graph for number of males also follows a similar trend. Analysis of the Produce Tax or '*Vaaru'* from the islands of Addu Atoll in 1922 reveals that dried fish was collected under this taxation system. Analysis of the statements used to collect these revenue items stated that Addu Atoll had 135 boats of which 124 were some sort of a fishing vessel. In the atoll, the major fishing island was Hithadhoo with 25 boats, which suggests that for every 37 males, there was one fishing boat. Assuming 40% as children, this figure comes to 14 people per vessel, indicating that Hithadhoo was a good fishing island.

Description of islands of Addu Atoll during 1922 substantiate this interpretation, namely that fishing was conducted in all the islands of Addu. In Meedhoo, it was stated that people, for the most part, lived on a diet of fish and vegetables. Hithadhoo was stated to be the most important and largest island in Addu Atoll with several industries regularly being carried out and with an ample fleet of 58 boats including both fishing vessels and transport vessels maintained for trade. Feydhoo was described as a smaller island with a couple of fishing boats serving the islanders. Gan is also described as an island where fishing was carried out to some extent.

Fig. 7. Number of males and types of boats existing in Addu Atoll in 1922.



With regard to occupations, it was stated, as in other atolls, that fishing was the main occupation of Addu Atoll. Addu's dried fish, prepared from tuna, fetched the highest price in the market, owing to the meticulous care and thoroughness with which it was prepared in the atoll. Large quantities were carried to Malé by the islanders in their own boats and disposed of mostly by barter to the established Borah merchants for export to Ceylon and India (Bell, 1940). Some trade was also carried on directly with Ceylon. It was also stated that one of the reasons for the separatist movement that swept Addu Atoll between 1959-64 was due to the announcement that the dried fish trade had to be traded through Malé. The first bank in Maldives was opened at the same time the trading council was established in Addu, to monopolise the southern fish exports (Maloney, 1980). All these early reports demonstrate that Addu was a major fishing atoll before the British started providing alternative employment opportunities by the establishment of a military base in Gan.

4.1.2 Fishing trips

National trends

Fishing in Maldives is carried out by two main types of vessels. The most important class of fishing vessels are the *masdhonis*. These locally built

wooden crafts are of 12-20 m Length OverAll (LOA). Traditionally they were sailing vessels, but most are now mechanised. The main method of fishing by *masdhonis* is pole and line tuna fishing using live bait. The second major classes of fishing vessels are the *vadhu dhonis* or trolling boats. These are smaller sail-powered boats of 6-8m LOA, which use troll lines within the atolls and along the outer reef edges. They also use handlines, often at night. Their method of fishing is of a subsistence nature compared to the *masdhonis*.

Fishing trips are usually of single day duration. *Masdhonis* leave their islands before dawn, spend some time catching bait, and then proceed to the fishing grounds outside the atoll, returning to their islands sometime in the afternoon or evening.

Fig. 8. Fishing trips made by different types of vessels of the country (1970-2000).

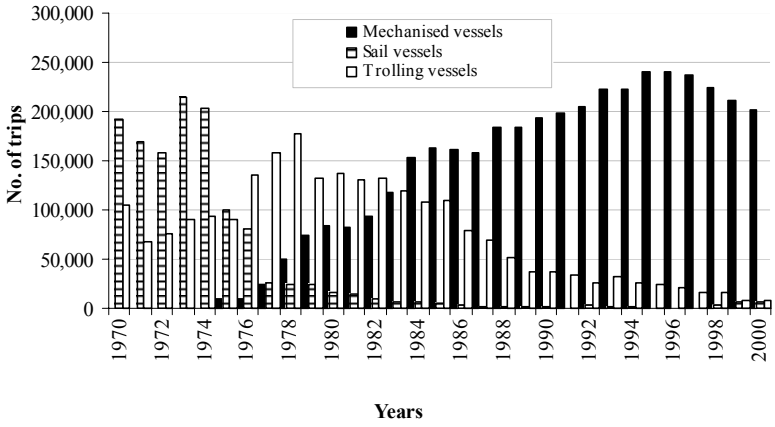


Fig 8 depicts the trend in the number of fishing trips for all types of vessel: mechanised *masdhoni*, sailing *masdhoni* and trolling vessels for the period 1970-2000. The total number of trips shows a decrease of 26% from 1970 to 2000. The increase in catch with fewer trips indicates that the added advantage of mechanization and increased fish collection facilities have increased the productivity with less overall effort.

Since mechanization of the *masdhoni* fleet was initiated in 1974, the number of trips made by mechanised *masdhonis* has increased and

overtaken the fishing effort made by other types of vessels. By 2000, the trips made by mechanised *masdhonis* had increased by 170% since 1974 while the trips made by sailing vessels and trolling vessels had declined by 96% and 92% respectively.

Fig. 9. Comparison of total fishing trips of the atolls (1970-2000)

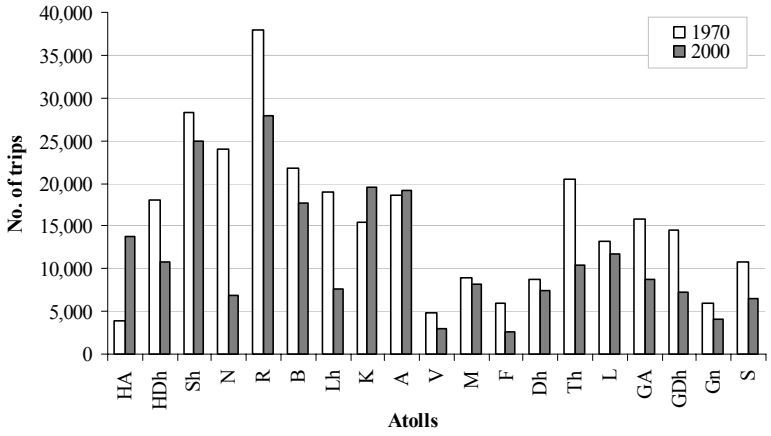


Fig 9 compares the total number of trips made throughout the Maldives by atoll for 1970 and 2000. Except for three atolls (HA, K and A), the number of fishing trips made during 1970 was higher than the number of trips made during 2000

Trend of Addu

In 1970, greatest fishing effort in Addu Atoll was by trolling vessels (over 81% of all trips) in contrast to the national trend of higher effort by sailing vessels (65% of all trips). This situation of Addu, relying on the trolling vessels, continued well after the mechanization program unlike most of the other atolls.

Fig. 10. Distribution of effort by type of vessels of the country (average 1980-1989)

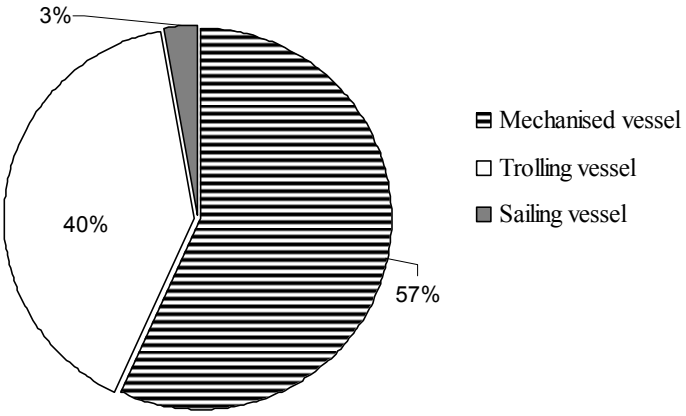
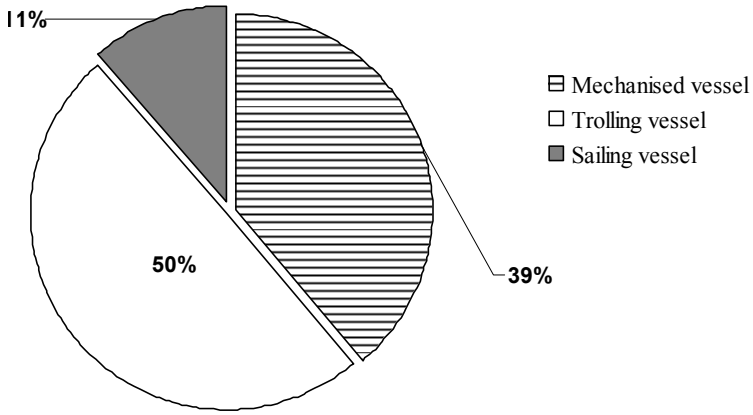


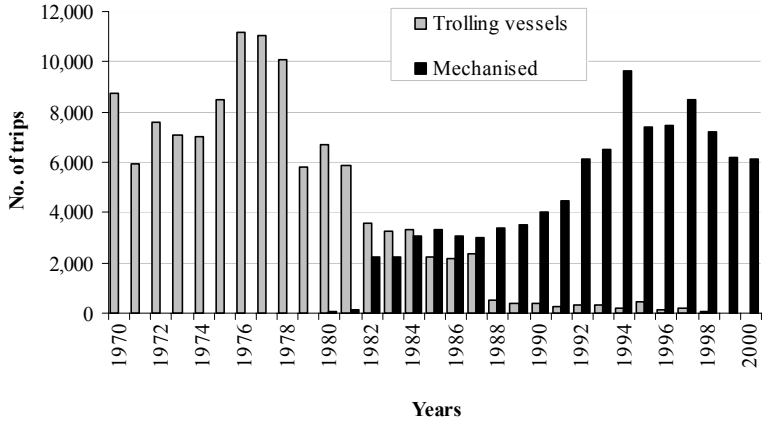
Fig. 11. Distribution of effort by type of vessel in Addu Atoll (average 1980-1989)



Figs 10 and 11 compare the average distribution of the effort by different types of vessels for the period 1980-1989 for the whole country and for

Addu Atoll respectively. In Addu, during this period, 50% of the effort was by trolling vessels while mechanised *masdhonis* accounted for 39% of fishing trips. As seen from figure 10, the national trend during this period shows a higher effort by mechanised *masdhonis*, with a contribution of 57%, while the contribution by trolling vessels was 40%.

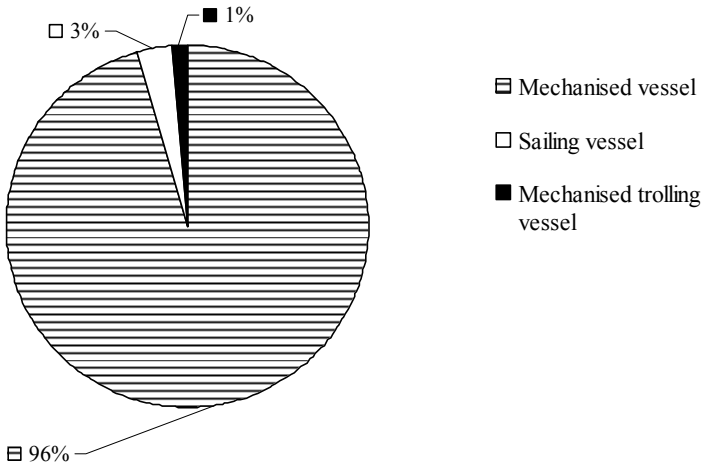
Fig.12. Fishing trips by the mechanised and trolling vessels of Addu Atoll- 1970-2000



Separate statistics for the mechanised *masdhoni* fleet was recorded from 1979 onwards. According to Fig 12, from 1979 to the end of 1990, fishing trips made by the mechanised vessels of Addu Atoll were under 4,000 trips, one of the lowest throughout the country. The national average for each atoll by the end of 1989 was over 9,000 trips per year.

From only 4 trips in 1979, the fishing effort by mechanised *masdhonis* gradually increased to a peak of nearly 10,000 in 1994. This was just below the national average of 11,000 trips per atoll. During this time, comparing the effort, Addu Atoll was at the same rank or higher than well-known fishing atolls such as Lh, Malé, M and GDh. The transformation of fishing from a subsistence type to a more commercial type of fishing during the 1990s is also visible in Fig 13.

Fig.13. Distribution of effort by type of vessels of Addu Atoll (average 1990-2000)



This figure depicts the distribution of effort by type of vessels in the 1990s. It shows that over 96% percent of the trips were by mechanised vessels during this period in contrast to the previous period.

These figures again indicate that fishing in Addu during the 1980s was more of a non-commercial nature. Also the figures reinforce the previous trend revealed by the production analyses which indicate the lag in the impact of the mechanization program which was at its height throughout the country during the 1980s. A transformation from a non-fishing atoll to a medium fishing atoll is visible in the above analysis.

4.1.3 Fishing Fleet

National situation

The statistics of the fishing fleet include the number of vessels reported as fishing vessels and the number of fishing vessels engaged in fishing by year. Reported numbers of vessels could be defined as the number of vessels each island reports as fishing vessels. They may not be actively engaged in fishing. These vessels might include older vessels, which are no longer used for fishing. Fishing vessels engaged in fishing are the number

of vessels which have gone out fishing during a particular period. Consequently, the numbers of vessels engaged in fishing are less than the reported number of vessels. Figs. 14 and 15 depict the reported number of mechanised and sailing *masdhonis* for the country as a whole and for Addu Atoll respectively.

Fig.14. Registered mechanised and sailing vessels of the Republic (1970-2001)

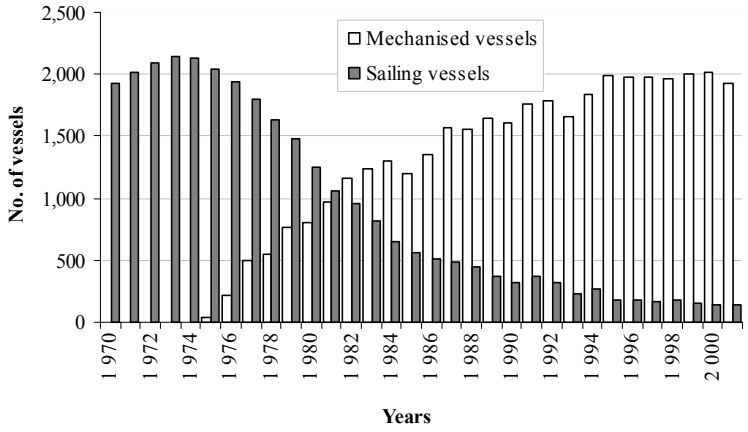
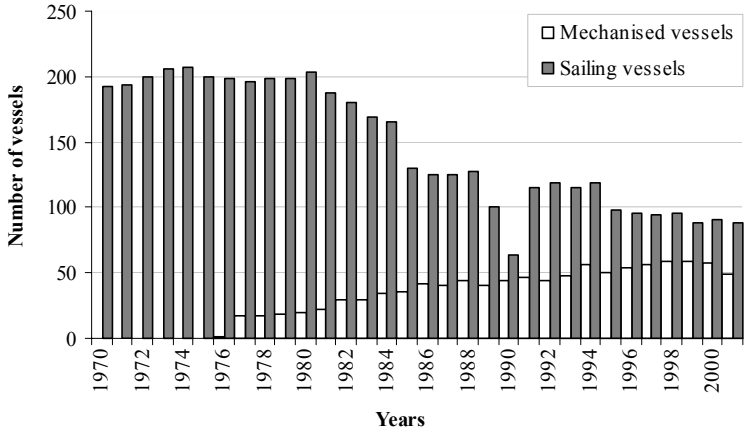


Fig.15. Registered mechanised and sailing vessels of Addu Atoll (1970-2001)



These figures show an increase in the numbers of mechanised *masdhonis* and decline in the number of sailing *masdhonis* over the 21-year period. The first mechanised vessel was registered in 1974 in Male'. Since then, the number of mechanised vessels increased steadily up to 1995. The registered mechanised fleet overtook the sailing fleet for the whole country in 1982. By the year 2001, the total number of mechanised fishing vessels reported stands at 1,929, while sailing vessels totaled to 135. In 1996, the total number of vessels registered for fishing started to decline. Possible reasons include the rising costs of such vessels; the increasing difficulty of finding crew; and the expansion of other investment opportunities within the country (Anderson, *et al*, 1996).

Table 1. Timeline showing the developments of the mechanisation program in the different atolls of the Maldives.

Year	Program initiated in the atoll	Atolls in which mechanised *masdhonis* exceeded *sailing dhonis*
1974	Malé	
1975	HA, HDh, Sh, R, Lh, V, Dh	
1976	N, B, K, M, L, GDh, S	
1977	A, F, Th, GA, Gn	Lh
1978		
1979		B, V
1980		R, GA
1981		HA, M, Th, L
1982		N, Dh, GDh
1983		K
1984		
1985		
1986		
1987		HDh, A, Sh, Gn

Table 1 presents a timeline showing the years in which the mechanisation program was initiated in each atoll and the year in which number of registered mechanised *masdhonis* overtook those of registered sailing *masdhonis* in each atoll. As shown in the table, mechanization was implemented in all the atolls between 1974 and 1977. The first mechanised vessels were built in Malé in 1974. In 1975, seven atolls initiated mechanization of their fleets. In 1976, another seven atolls, including Addu

Atoll, started mechanizing their fleets. In 1977, the rest of the atolls adopted the program.

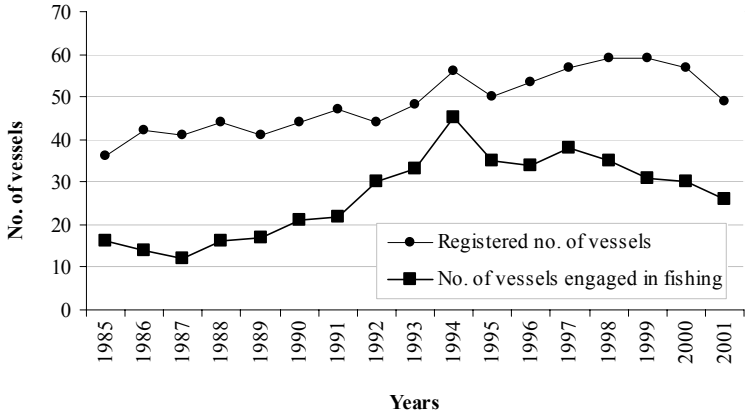
Table 1 also shows the years in which the number of mechanised vessels overtook the number of sailing vessels. This could be taken as a crude index of the development of the mechanization program throughout the country. However, it is important to note that number of vessels actually engaged in fishing would have been a more useful indicator for this analysis than the reported number of vessels. Fishing vessels are estimated to last 20 years and it often happens that island offices report the number of vessels including old vessels which are no longer used for fishing. This results in over-reporting. This bias would be present throughout the country and not in a particular atoll nor for a particular type of vessel. Nevertheless, despite this shortcoming, as a crude index, the reported numbers of *masdhonis* are used. Number of fishing vessels engaged in fishing have been recorded since 1985, but the major developments within these lines took place in the late seventies to early eighties. Therefore, although the preferred data sets for this analysis are the vessels engaged in fishing, the present analysis had to be based on the reported number of vessels.

From Table 1 it can be noted that, with the single exception of Addu Atoll, the number of registered mechanised *masdhonis* exceeded the number of registered *masdhonis* during the period 1977-1984. Lh Atoll was the first atoll where the event took place, followed by Malé, then by B and V Atolls in 1979, and R and GA Atolls in 1980. In most of the atolls, the event took place in the early eighties. The lag in the impact of mechanization in Addu Atoll is evident from this table, too. Even at present, the number of reported mechanised *masdhonis* in Addu Atoll stands at 47 while sailing vessels total 88. Improper reporting is the main cause for this anomaly; nonetheless, the lag in the impact of the mechanization program is visible in Addu Atoll, again reinforcing the previous result from the production and trips analysis.

Fishing fleet of Addu Atoll

The general trend prevailing throughout the country with decreasing trend of sailing *masdhonis* and increasing trend of mechanised *masdhonis* is also seen in Addu (Fig 15). Fig. 16 depicts the reported number of mechanised *masdhonis* and their utilization pattern.

Fig.16: Registered mechanised fishing vessels and its utilisation pattern-Addu Atoll (1985-2001)



What is striking is the substantial growth in the number of mechanised *masdhonis* engaged in fishing during the early 1990s. From 1987-1992, an average of 40% of the total boats were utilized for fishing. Within these years, during 1987, it was as low as 29%, gradually increasing to 47% in 1991. The increasing trend continued in the 1990's rising to 68% in 1992, and reaching a peak of 80% in 1994. This corresponds to the year in which the production was also highest. By 2000, the percentage of vessels utilized for fishing was around 53%. The reported number of vessels existing in the atoll increased throughout the period while the rate of utilization was highest between the period 1992-1997. This again shows that the amount of fishing increased during the 1990s in Addu while the general pattern prevailing throughout the country was an increase in fishing during the eighties.

The graphs of sailing *masdhonis* (Fig.17) and the sailing *vadhu dhonis* (Fig. 18) show that numbers of vessels and their utilization pattern are on a continuous declining trend since the start of the mechanization of the fishing fleet in the 1970s. The same pattern is seen in the country as a whole. In Fig. 18 the dip in 1990 could be due to the under-reporting of the registered vessels in the Atoll.

Fig.17. Registered trolling vessels and its utilisation patterns in Addu Atoll (1985-2001)

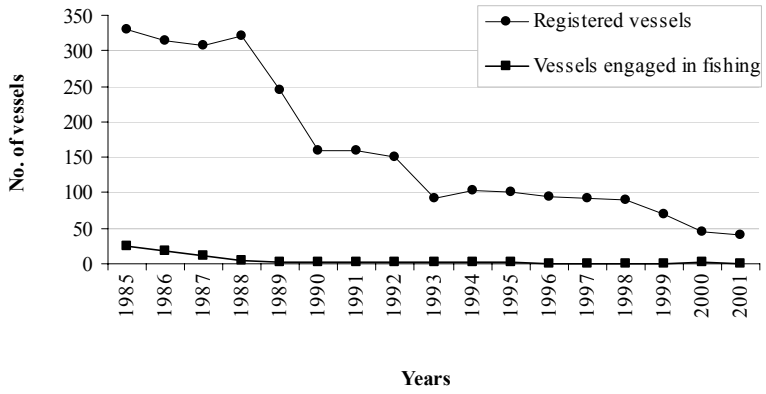
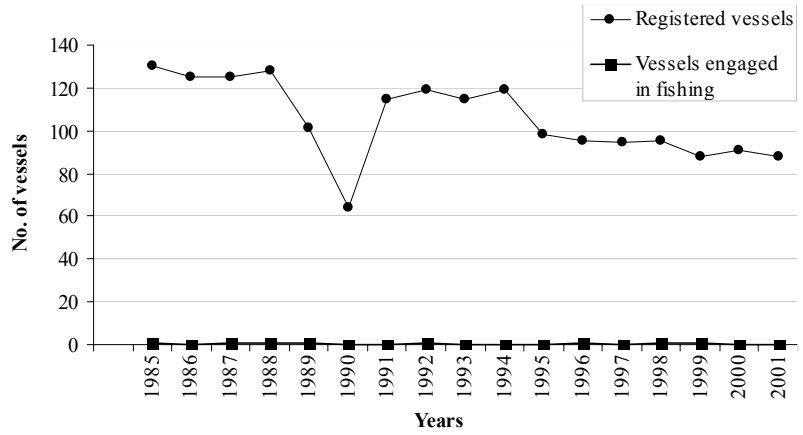


Fig.18. Registered sailing vessels and its utilisation pattern in Addu Atoll (1985-2001)



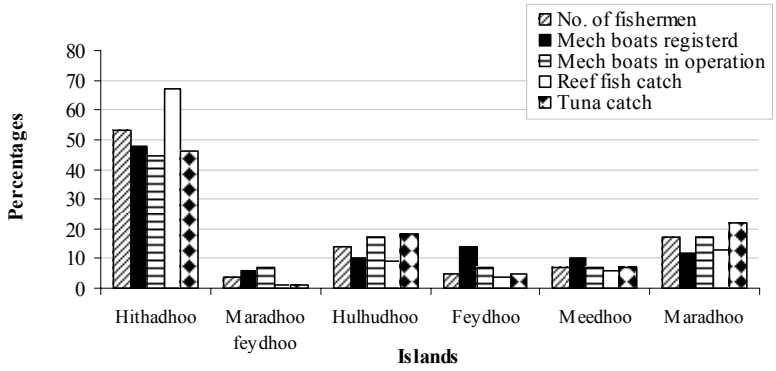
4.2 Fisheries within Addu Atoll

This section examines the fishery status of individual islands of Addu Atoll. Data were collected for the years 1990 (Feb missing), 1991, 1992, 1993

(August to December), 2000 (June missing) and 2001. The statistics for these years were collected from the monthly report forms and in some cases the daily sheets available in the Atoll Office. These figures are in numbers and the analyses are presented in percentages. The data compiled included total catch, catch from FADs, number of registered vessels, number of vessels engaged in fishing, and reasons for not fishing. As these data are available for a limited number of years, the data are presented as percentages or proportions, which would provide some indication of trends and current fishery status of the individual islands of Addu Atoll for this period.

4.2.1 Fishery status island-wise

Fig. 19. Comparison of some fishery indicators between islands of Addu Atoll



Averages calculated based on figures of 1991-1993 and 2000-2001

Figure 19 gives a picture of distribution of some of the fishery indicators of the islands of Addu Atoll. This figure depicts the tuna catch and reef fish catch composition, the number of vessels in operation, and the number of fishermen in each island. Hithadhoo accounts for the largest share, for all of these indicators, followed by Maradhoo, Hulhudhoo, Feydhoo, Meedhoo and Maradhoofeydhoo. Out of the total catch, 47% is taken by fishermen from Hithadhoo. 46% of the tuna catch and 67% of the reef fish catch are from Hithadhoo. Hithadhoo has the largest fishing fleet in the atoll, which comprises of 27 registered mechanised *masdhonis*, 2 mechanised trolling

vessels, 2 rowboats, and 2 sailing troll vessels. Of these vessels, over half are active in fishing throughout the year.

The number of fishermen in Hithadhoo is 238 which is 53% of the fishermen in the atoll. For each active fishing vessel, the statistics suggest a potential of 18 crew members. This is on the high side compared with the national average of 14, perhaps reflecting one or more of the following: under-reporting of the number of vessels engaged in fishing; presence of larger sized vessels; over-reporting of number of fishermen. The number of fishing days for each boat is, on average, 15 days per month. On average, 5 poles were used by each *masdhoni* for fishing. The majority of the catch from Hithadhoo comes from the mechanised pole and line fishing vessels. In some cases, trolling boats have gone out and caught large skipjack and large yellowfin tuna using longlines.

Fig. 20. Fishing fleet and fishermen in Hithadhoo (1990-2001)

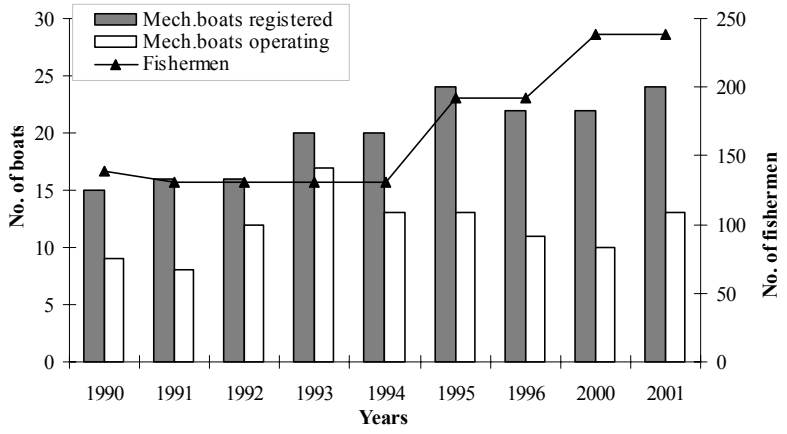


Fig. 20 shows the trends in registered mechanised boats, those operating and the number of fishermen from 1990-2001. An increase in the number of fishermen and number of boats operating is visible over the 9-year period. The most number of boats were active in 1993 where 85% of the boats were utilized for fishing. This coincides with the period when fishing was at its highest in production terms.

Comparing Hithadhoo with the next best fishing island of the atoll, Maradhoo, shows a marked difference in all indicators. Differences of 25% in total catch, 24% in tuna catch, 54% in reef fish catch, 36% in registered mechanised *masdhonis*, 28% in actively engaged mechanised *masdhonis*, and 36% in the number of fishermen are seen in favour of Hithadhoo. Maradhoo contributes 18% of the total catch with its share of tuna production being 22%, while its reef fish production accounts for 13% of the atoll's total. The fishing fleet of the island consists of 6 mechanised vessels and 3 rowboats. The mechanised fleet is active throughout the year. The number of fishermen is 75, which is 17% of the total fishermen of the atoll. Fishermen of Maradhoo on average, carry out on 20 days of fishing per month and on average they use 10 poles.

Among the islands of Addu Atoll, Hulhudhoo ranks third in fishing. The island's share of the total catch is 18%. Tuna production accounts for 18%, while reef fish accounts for 9% of the atoll's production. The island's fishing fleet consists of 5 mechanised *masdhonis*, which are active throughout the year. Out of the total active vessels of the atoll, the share of Hulhudhoo stands at 17%. Hulhudhoo has 57 fishermen, which is equal to 14% of all the fishermen in the atoll.

Feydhoo produces 5% of the atoll's total catch. In terms of tuna production, they produce 5%, while reef fish accounts for 4%. Their active fishing fleet includes 2 mechanised *masdhonis*. However, they report that their registered fishing fleet also includes 40 mechanised trolling vessels, 26 rowboats and 88 sailing vessels. This is not consistent with the number of fishermen, which is reported to be just 24. This indicates that over-reporting of the fishing fleet is very high in Feydhoo. Looking at the figures of 2001, each active vessel has around 12 members as crew. Feydhoo fishermen go out for fishing on an average of 18 days per month. The data for the year 2001 indicate that the two vessels were active throughout the year.

Maradhoofeydhoo ranks last in terms of fishing in Addu Atoll. All of the fishing indicators reveal that the people of the island are more involved in other activities than fishing. In terms of total catch, the island contributes only 1 % of the catch. Share of tuna production and share of reef fish production are each 1%. The island has a registered fleet of 5 mechanised *masdhonis*, while their active fleet stands at 2-5, with an average of 3 vessels at the end of the year. Each boat averages 10 days per month of active fishing. The number of fishermen is 16, which comes to an 8-member crew for each vessel.

4.2.2 Catch composition by species

Fig.21 Distribution of catch by species in Addu Atoll

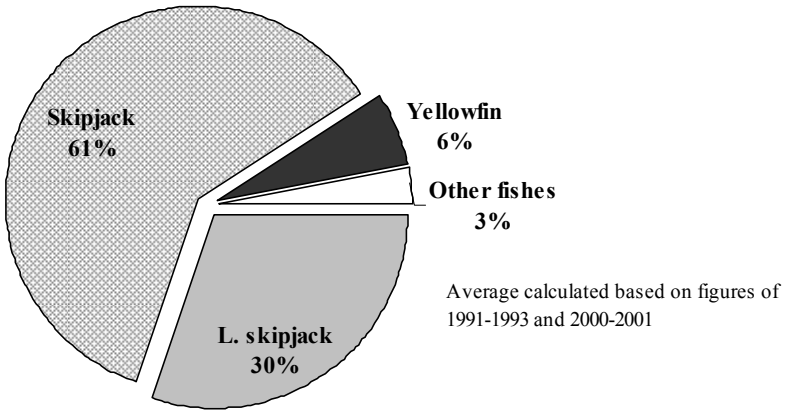


Figure 21 depicts the catch composition for the period under analysis. 98% of the total reported catch consists of tuna species. Distribution of the catch by species indicates that 61% of the catch is small skipjack tuna, 30% is large skipjack and 6% is Yellowfin tuna. Other species include Kawakawa, Frigate tuna, Marlin, Wahoo, sharks and other reef fishes, which together account for 3% of the total catch. Analysis of the catch composition of each island within the atoll reveals that this pattern of catch composition is observed. This trend in catch composition is seen throughout the country.

In Addu Atoll, reef fish comprise less than 3% of the total catch. Among the reef fish groups, the highest reported catches are of the larger sized fishes such as Giant Trevallys (*Caranx ignobilis*) and Wahoos (*Acanthocybium solandri*). This group accounts for 41% while fishes such as Rainbow Runner (*Elagatis bipinnulata*), Bluefin Trevally (*Caranx melampygus*), and Two Spot Red Snapper (*Lutjanus bohar*) account for 33%. The smaller sized fishes such as Mackerel Scads (*Decapterus macarellus*), and Big Eye Scads (*Selar crumenophthalmus*) account for 25%. The highest reef fish catch is from Hithadhoo, followed by Maradhoo, Hulhudhoo, Meedhoo, Feydhoo and Maradhoofeydhoo.

The data reveals that this pattern in reef fish composition with greater catch in the large size category is seen only in Hithadhoo. In other islands' reef fishing is concentrated on smaller size fishes, more than the larger size fishes. This highlights the subsistence nature of the fishing in other islands in contrast to Hithadhoo. Small size fish such as mackerels are caught within the lagoon using pole and line, and are usually caught for family consumption. Larger size reef fish are caught outside the reef edge using drop lines or caught while in the open sea using troll lines.

This indicates to a certain extent that the development of the tuna fishery often facilitates the development of other fisheries. Hithadhoo being the major fishing island in Addu has the facilities and means of fishing for large size fishes, and the capability to go further out to the open sea. Today in Hithadoo, a private company is trying to develop marketing of frozen fish by buying and exporting yellowfin tuna and some species of reef fish, including groupers. During February 2002, samples were collected to initiate this work. Plans are underway to start buying fish from Addu Atoll and to expand operations to GA and GDh, for export to European countries (Mohamed Zahir (STEP company), pers. comm., 2000).

4.2.3 Catch from FADs

Table 2 summarizes details of the FADs installed in and around Addu Atoll. Seven FADs had been installed by the Ministry of Fisheries, Agriculture and Marine Resources up till the end of 2001. The duration of the FADs, range from a few days to over 4 years. According to fishermen FADs are very useful and have proved to be successful in attracting tuna.

The present survey attempted to analyze the percentage of catch caught from the FADs using the available figures from the Atoll Office. Island offices are required to records the number of fish caught from FADs. The data used for the analysis shows that 12 mechanised *masdhonis* from Hithadhoo fished from the FAD during 2001. Fig 22 depicts the proportion of the catch caught by the fishermen during this period. According to the figure 76% of the large skipjack, 80% of the small skipjack, 41% of large yellowfin, 82% of the yellowfin and 32% of the other fishes out of the total catch of Hithadhoo were caught around the FAD.

Table 2: Details of Fish Aggregating Devices installed in Addu Atoll upto 2001

Island	Location	Latitude	Longitude	Date deployed	Date Lost	Lifespan
Gan	3.2 mls NE of Gan	00^0 38' 25" S	73^0 10' 45" E	11 Nov 91	NA	NA
Hithadhoo	13.5 mls NW of Hithadhoo	00^0 32' 00" S	72^0 51' 30" E	15 Mar 96	29 Nov 96	259 d
Hithadhoo	13.5 mls NW of Hithadhoo	00^0 32' 00" S	72^0 51' 30" E	16 Jul 97	30 Aug 01	1,642 d
Gan	12 mls S of Ganmuli	00^0 54' 15" S	73^0 08' 55" E	10 Dec 97	NA	NA
Hithadhoo	13.5 mls NW of Hithadhoo	00^0 29' 54" S	72^0 55' 00" E	21 Nov 99	13 Dec 01	784 d
Gan	13 mls SW of Gan	00^0 54' 30" S	73^0 08' 53" E	23 Jul 00	25 Nov 00	125 d
Gan	13 mls SW of Gan	00^0 54' 42" S	73^0 08'50" E	08 Aug 01	Existing	120 d

Source: MOFAMR, 2001

Fig.22: Proportion of catch from Fish Aggregating Devices by the fishermen of Hithadhoo (2001)

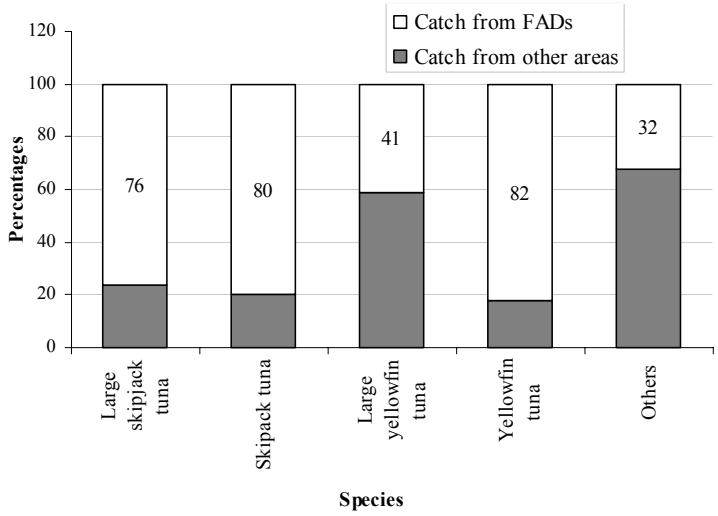


Fig.23. Proportion of catch from FAD by the fishermen of Maradhoo (2000)

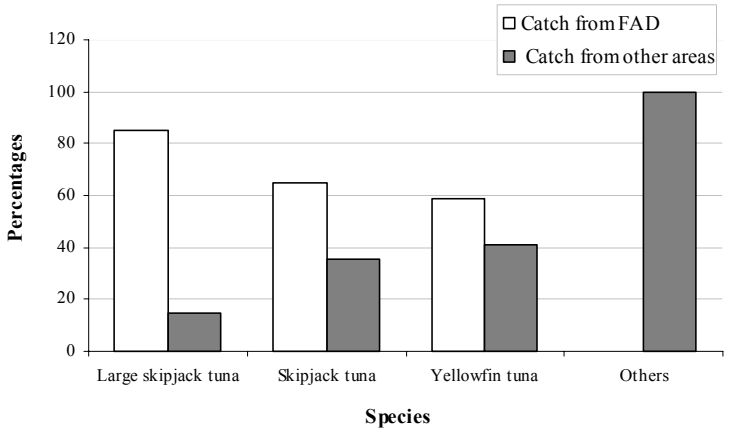


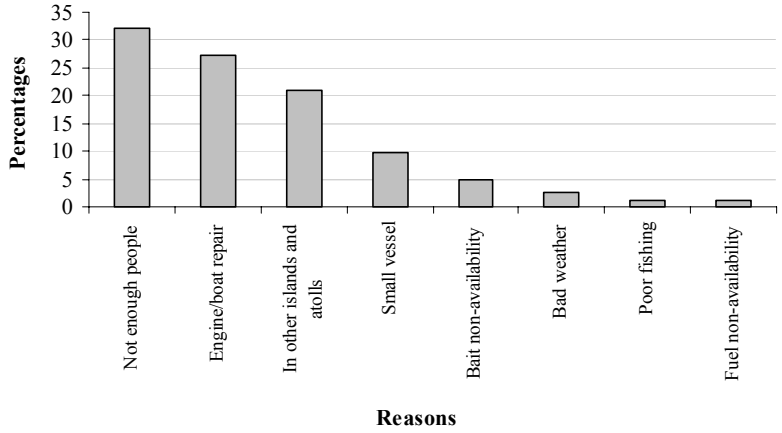
Figure 23 depicts that the fishermen of Maradhoo have made use of three of the FADs installed around Addu Atoll in the year 2000.

Overall, in the year 2000, 52% of the fish catch was from the FAD, while this figure was 72% in 2001. Of the total catch from Addu in the year 2000, 85% of large skipjack, 75% of small skipjack and 59% of yellowfin were caught from FADs.

4.2.4 Reasons for not fishing

In order to understand the problems encountered by the fishermen of Addu Atoll, attempts were made to analyze the reasons as to why they do not go fishing. The reasons reported in the 2001 monthly fish reports are summarized in Fig 24.

Fig.24: Reasons for not fishing in Addu Atoll-2001



The most commonly mentioned problem was lack of crew to go fishing. This problem is most particular in Feydhoo. According to the Island Fact sheet compiled by the Atoll Office, 562 people of Feydhoo work in other islands. Fishing seems to be considered as the last resort occupation, with most people preferring to work in easier and better-paid jobs. Shortage of fishermen is one of the main problems facing the fishery today throughout the country and one that is almost certainly going to become much more serious in the future. Few young men are now entering the fishery. Reasons for this include: the low perceived status of the fishermen; widespread education in the atolls leading to increased expectations; increased

employment opportunities in other sectors; and high reliance on remittances in some islands (Anderson et al., 1998).

Larger and faster boats mean that they can travel further for live bait, fish and markets, and they can return quickly to sell their catch before other boats. Consequently, it is easier for owners with larger boats to attract crew, than it is for owners of more traditional boats, which seems to be the case in Feydhoo. This problem was also mentioned by the fishermen of Hulhudhoo, Meedhoo and Maradhoo. In Feydhoo, presence of smaller vessels was mentioned as another major reason for not going fishing; this again reflects the importance of larger vessels for attracting crew. Feydhoo stands out as a typical case where the existence of smaller vessels has resulted in shortage of fishermen, which is one of the major problems facing national fisheries today.

The next reason mentioned by the fishermen of all the islands is engine and boat repair. Often the boats were held up for several days due to repair work of either the engine or the boat. This was mentioned as a major problem by the fishermen of islands where fishing is most common such as Hithadhoo followed by Meedhoo and Hulhudhoo.

Other reasons mentioned included difficulty in getting bait, poor fishing and bad weather.

When enquired as to why some fishermen do not report their catch to the home island, it was stated that when fishing is poor around the home island, the fishermen head to other islands or atolls. This could implicate that the fishermen spend a period of time away from their islands making it difficult for them to report their catch to their island office. Most often, people of Maradhoo and Meedhoo go to the neighbouring Huvadhu Atoll for fishing.

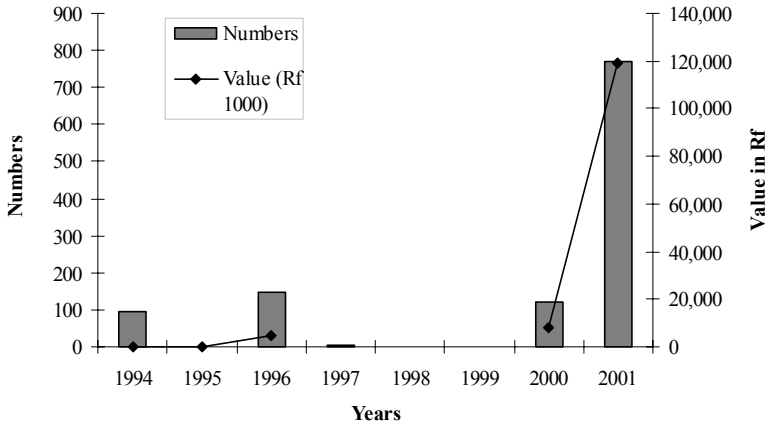
4.2.5 Miscellaneous fish catch

Miscellaneous fishing methods include those which do not involve the active use of a boat, e.g. beach seines, cast nets, pole and line fishing from shore and other similar methods of fishing. Sometimes a rowboat is needed to set and haul these types of fishing gear. These methods of fishing are usually resorted to during times of inclement weather, when the fishermen cannot go out to fish offshore and the catch is generally for local consumption. Data collected from the Atoll Office showed that the

fishermen of Meedhoo often engaged in catching parrotfish using nets. Reported figures for a 2 year period show that from a total catch of 22,000 fish, 15,000 belonged to the parrotfish family.

4.2.6 Lobster catch

Fig.25: Number and value of lobsters caught from 1994-2001.



Lobster fishing is an activity which has been developing in Addu Atoll during recent years. Fig 23 depicts the number lobsters caught from Addu Atoll which has been recorded by the Atoll Office.

It is believed that these figures are grossly under-reported, with most of the reported figures being from Meedhoo (Hafsa, Addu Atoll Office, pers. comm., 2002). Despite this under-estimation, an increasing trend is visible from the figures. In 1994, 95 lobsters were reported with no earning recorded. By the year 2000, the figure reached 120, and by the year 2001, the figure increased to over 700, recording earnings of over MRf 118,000. In the year 2001, Addu Atoll ranked 7th in terms of lobster catch and value. The average price of a lobster recorded was around MRf 150. Without detail analysis of adequate data, it is difficult to confirm the seasonal pattern of lobster fishing. However, it is felt that lobsters are abundant throughout the year (Ahmed Hafiz, pers. comm., 2002; Hussein Naeem, pers. comm., 2002). The usual method of lobster fishing is labor-intensive: lobsters are

hand-collected whilst reef-walking and free-diving on the reef crest, reef slopes and within the lagoon at night

In Hithadhoo today, lobster fishing is undertaken at a semi-commercial level. Two groups of people equipped with diving gear actively engage in lobster fishing. The main species caught are the double spine lobster (*Panulirus penicillatus*), long-legged spiny lobster (*Panulirus longipes fermoristriga*) and the painted lobster (*Panulirus versicolor*). Lobsters are sold to Malé after freezing, while to a lesser extent, it is sold to the Equator Village in Gan (Hussein Naeem, pers. comm., 2002). This activity is being undertaken in other islands of Addu Atoll as well.

The increase in number of lobsters caught along with corresponding increase in earnings from lobster fishing reflects the growth in the demand for lobsters. This is due to the growth of tourism within the Maldives. It is expected the local demand will also rise with the establishment of Vilingili as a new resort in Addu Atoll in the near future. According to national regulations (Fisheries Law, Number 5/87), lobsters less than 25 cm in total carapace length and berried female lobsters should not be fished. Lobsters are a difficult species to overexploit because the reef topography provides a natural habit protection. Hence if the above regulations are enforced properly the future of the lobster fishery would be a promising one.

4.3. Future Challenges

The fishing industry in Addu Atoll is now confronted with many of the same opportunities and constraints faced by the tuna industry of the Maldives as a whole. In brief, a shortage of men willing to go fishing is driving boat owners to build larger vessels with more powerful engines. This in turn has increased the search and fishing capacity of the local fleet, with a resulted increase in harvest. This increase in catch for Addu Atoll is clear from the production figures

With the increase in the harvest, a corresponding increase was not seen in the fish-handling facilities and support infrastructure. As the collecting facilities were not expanding to cater for a larger harvest, fishermen were faced with the problem of marketing their catch. The existing collecting facilities are designed to receive smaller landings, causing problems to the fishermen in the disposal of catch. Often, Addu fishermen have to process the fish into dried fish as an alternative. However, this is time-consuming

and labour-intensive, often with low returns due to poor quality control. According to fishermen, on some days when they are unable to sell their "excess" catch, they have to dump their catch back into the sea.

Furthermore, the vessels are not equipped with facilities to prolong the freshness of the catch and thus have resulted in the deterioration of the quality of fish landed. An increase in catch coincided with expectations for higher quality products from the outside market. This has resulted in imposition of strict buying inspection and rejection in the major markets (Shukoor, 2000).

Today, the fishermen of Addu Atoll are at a stage where they are aware of the requirement to install cooling mechanisms in their vessels. They need assistance to build on their developments of the last 10 years. They need support to increase their production, and to utilize their increased capacities of the larger fishing crafts capable of going further out. The phase of growth experienced during the last few years is showing signs of weakening. Over the last three-year period, a declining trend was observed in the production figures. To sustain the fishery, a more conducive environment, with handling facilities and marketing opportunities, is urgently required by the fishermen of Addu Atoll.

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