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1. Abstract

The pole-and-line tuna fishery is one of the most important fisheries in the Maldives. Although tourism earns the most foreign revenue, the fishery remains the principal livelihood activity in many of the outer islands. Pole-and-line caught tuna length sampling program was one of the first activities of the Marine Research Section (MRS) and later Marine Research Centre (MRC) and remains to this day. Data collection that began from Malé Market in 1984 developed to an island-based civil service supported field officer scheme. As the quality of their work deteriorated leading to the failure of the approach, the island-based samplers were changed to active skipper samplers around early 1990s. The latter mechanism continues to this day but has its limitations. An alternative that is being considered is to base the samplers at the shore-based collection facilities supplemented by active fishermen samplers in few major islands.

2. Introduction

The pole-and-line tuna fishery is the most important fishery in the Maldives. It is a major source of income, employment and protein for the Maldivian people. Although tourism industry is now the major source of foreign exchange to the economy, pole-and-line tuna fishery remains the major livelihood activity in many of the outer islands.

Maldivian pole-and-line fishery exploits four major species of tuna (below). Big-eye tuna (*Thunnus obesus*) is also exploited although their statistics are not well known. However, skipjack and yellowfin tuna comprise the majority of the catch.

Skipjack tuna	*Katsuwonus pelamis*	Kalhubilamas / godhaa
Yellowfin tuna	*Thunnus albacares*	Kanneli
Frigate tuna	*Auxis thazard*	Raagondi
Kawakawa	*Euthynnus affinis*	Latti

3. Tuna length sampling activities: Past and Present

Tuna length sampling program is one of the first activities undertaken by the Marine Research Section (MRS) since its formation in 1984. The objective of obtaining length data from pole-and-line- caught tuna was to provide an average weight to be used as a conversion factor for tuna catches which were reported in numbers. MRS staff then sampled tuna landed at Malé Market regularly on opportunistic basis. The program expanded in 1987 when field officers were hired from major fishing islands under civil service, deployed within their island/atoll offices. Their task was to visit fishing vessels as they land and take length measurements from the catch that was brought. This worked well at the time as most vessels landed daily with their catch.

Several reasons lead to the deterioration and eventual scrapping of the island office based sampling program. Firstly, having been stationed at the island or atoll office detached them from the field which led to a decline in quantity and quality of their work. Second, as fishermen landed late in the day or at night, the samplers did not have any official duties during normal office hours and remained idle in the office. As a result atoll/island chiefs assigned them work which was later used as an excuse for

the lack of sampling. Reasons in addition to the above strained relationships with the field officers and the chiefs of the offices they were based resulting in the government discharging some officers while relocating the others to the Ministry of Fisheries and Agriculture in early 1990.

After the failure of the island based field officer program, came the tuna length and weight sampling component of the World Bank / IDA Third Fisheries project (1994/1996). Under this project a new approach to obtaining length data was used where active fishermen field officers were employed on contractual basis. The arrangement worked well, because the field officer on board (also a fishermen) has access to the catch. His task was to undertake size sampling when the fish is unloaded to the collector vessel or being disposed. The method worked particularly well, because fish are individually handled on board the vessel more than once; first to arrange the fish on deck en route from the fishing ground to home and then to put them in baskets for hauling on to the collector vessels. Combination of the above factors proved to the success of the regional length weight frequency sampling program of 1994/1996. Subsequent to the World Bank / IDA project, the government continued to maintain several fishermen field officers across the country.

Again in 2003, MRC received technical assistance from the Japan Overseas Fishery Corporation Foundation (OFCF) thorough the Indian Ocean Tuna Commission (IOTC) to widen the existing sampling activities in the country. The program was aimed at strengthening the tuna length data collection systems in Maldives as part of a wider program to improve the data collection and statistical analysis of tuna catch in the Indian Ocean. What began as a one year program in 2003 extended into its second year and continued till end of March 2005.

Due to assistance from IOTC/OFCF, MRC was able to hire and maintain 8 field officers for two years. This proved to be successful in two ways. First, MRC was able to expand the program from two sites to 13 sites for a two year period. An enormous amount of length data were collected during these two years. Second, the program convinced the government the importance of a nationwide length sampling program which resulted in allocation of funds for a wider sampling program. As a result, Ministry of Fisheries and Agriculture, MOFA (then Ministry of Fisheries, Agriculture

and Marine Resources, MoFAMR) maintained on average 10-13 length samplers at any given time (Table 1). These include in addition to pole-and-line caught tuna, two, hand-line caught large yellowfin tuna samplers from ADh. Mahibadhoo.

Table 1.Details of length samplers across the country and their representative regions, at the time of this report. Note that the regions represented by the samplers do not reflect the true area of fishing. The two large yellowfin tuna samplers do not represent a given region due to the mode of operation of the fishery.

Island	Representative region	Date of hire	Current Status
Hoarafushi	Upper north	Oct-06	Active
Maduvvaree	Middle/lower north	Nov-06	Discharged in Nov-2009
Kudahuvadhoo	Lower central	Jan-09	Active
Naifaru	Lower north	Feb-08	Active
K. Maafushi	Central	Oct-10	Active
Th. Hirilandhoo	Lower central (west)	Sep-09	Discharged in Jan-11
L. Maavah	Lower central (east)	Jul-08	Active
GA. Villingili	Upper south	Mar-07	Active
GDh. Thinadhoo	Upper south	May-07	Active
Adh. Mahibadhoo	-	Aug-07	Discharged in Sep-11
Adh. Mahibadhoo	-	Sep-07	Discharged in Sep-11

The outcomes of these sampling programs have been the revised conversion factors/average weights that the Ministry of Fisheries and Agriculture uses for publication of its annual fisheries statistics. Over the years, a number of conversion factors (average weights) have been derived from different sampling programs. Data collected from these length sampling programs have also been submitted to IOTC on a regular basis. Table 2 below gives the numbers of fish sampled from 2000 till end of 2009. Data for 2010 is being compiled at the time of this report.

Table 2. Summary of sampling effort from 2000-2009. Islands marked with * are islands whose samplers were funded by IOTC-OFCF Regional Tuna Length Sampling Program. Those marked with + are hand-line large yellowfun tuna samplers.

Island	Small SKJ	Large SKJ	Small YFT	Large YFT	FGT	KAW	Total
2000							
Hoarafushi	11,949	12,982	3,023	440	-	-	28,457
Maduvvaree	7,753	182	3,311	-	1,999	185	13,430
Male'	1,219	1,256	252	60	374	114	3,491
Villingili	18,399	5,527	3,703	-	96	-	27,725
Thinadhoo	10,028	17,491	2,055	-	113	-	29,687
2001							
Hoarafushi	13,458	5,849	4,193	100	358	-	24,187
Male'	347	-	-	-	379	-	726
Villingili	6,561	652	1,784	-	-	-	8,997
Thinadhoo	14,680	11,219	3,549	-	168	-	29,616
2002							
Hoarafushi	21,119	6,382	9,169	515	949	-	38,952
Male'	460	686	605	118	307	11	2,263
Thinadhoo	19,852	8,940	168	3,398	-	-	32,358
2003							
Ihavandhoo*	14,614	818	7,589	-	2,645	-	25,666
Hoarafushi	19,700	5,024	10,237	844	350	62	36,947
Kandholhudhoo*	5,705	1,386	1,009	-	74	-	8,174
Male'	16,040	1,356	3,835	-	1,933	184	23,402
Veymandoo*	1,221	-	491	-	-	-	1,712
Villingili*	13,372	-	880	152	-	-	14,404
Gaddhoo*	9,724	1,700	635	-	134	18	12,410
Kolamafushi*	3,572	376	1,780	-	40	-	5,768
Thinadhoo	11,449	12,394	6,729	-	168	-	30,740
Hithadhoo*	16,254	176	91	-		-	16,521
Maradhoo*	7,922	10,029	1,001	-	-	-	18,952
2004							
Ihavandhoo*	34,022	4,996	19,692	467	8,875	-	68,052
Hoarafushi	14,936	2,479	7,669	1,587	413	-	27,141
Kandholhudhoo*	9,571	22	3,348	-	946	-	13,887
Male'	10,440	1,054	2,040	-	683	58	14,417
Veymandoo*	13,168	990	-	-	51	-	14,209
Maabaidhoo*	4,415	1,092	1,948	-	-	50	7,505
Villingili*	28,257	9,260	2,350	454	-	-	40,321
Gaddhoo*	18,696	20,466	2,074	-	94	39	41,708
Kolamafushi*	11,561	594	697	-	-	-	12,852
Thinadhoo	9,897	11,860	1,237	-	-	-	22,994
Maradhoo*	13,765	13,865	155	-	-	-	27,785

2005							
Hoarafushi	17,350	5,358	5,848	1,559	1,030	144	32,009
Male'	9,940	1,991	3,382	43	3,500	701	19,631
Thinadhoo	8,729	19,776	448	-	-	-	28,953
2006							
Hoarafushi	17,414	14,631	2,924	2,414	54	-	37,437
Kulhudhuffushi	672	672	15	-	223	-	1,582
Maduvvari	992	-	545	-	100	-	1,637
Male'	7,458	3,341	2,694	-	2,787	238	16,980
Thinadhoo	2,016	10,976	522	-	-	-	13,514
2007							
Hoarafushi	16,350	5,103	7,001	856	2,606	1,511	33,463
Kulhudhuffushi	3,609		1,263	-	-	-	4,872
Naifaru	17,804	4,737	8,768	-	4,390	2,279	39,787
Mahibadhoo+				583			583
Maduvvari		1,080	3,651	-	2,431		7,162
Kudahuvadhoo	8,886	250	619	170	1,203	29	11,543
Male'	6,428	1,180	2,729	-	3,100	896	14,815
Maavah	5,649	566	-	-	-	-	6,215
Villingili	8,063	6,943	3,242	2,912	-	-	21,160
Thinadhoo	8,037	11,876	1,009	-	-	-	20,922
2008							
Hoarafushi	12,450	1,646	7,253	1,403	459	-	23,405
Naifaru	8,920	-	5,703	259	4,855	473	20,259
Mahibadhoo+	-	-	-	2,404	-	-	2,404
Maduvvari	8,380	350	5,452	-	1,695		15,877
Male'	2,392	71	1,587	10	1,552	125	5,747
Maavah	2,964	1,299	-	-	-	-	4,263
Villingili	10,752	3,808	2,912	1,344	-	-	18,816
Thinadhoo	8,008	9,947	362	-	195	-	18,512
2009							
Hoarafushi	15,037	-	6,714	-	460	140	22,351
Naifaru	4,435	-	3,724	-	3,806	2,586	14,551
Mahibadhoo+	-	-	-	2,063	-	-	2,063
Male'	2,333	-	1,056	-	1,734	338	5,477
Maavah	8,018	-	-	-	-	-	8,018
Villingili	8,078	-	5,601	-	-	-	13,679
Thinadhoo	14,729	-	3,819	-	-	-	18,548

As mentioned, two main approaches have been employed to collect the length data from the pole-and-line caught tuna in the Maldives. In the beginning, data collection was carried out by employing field officers from selected islands, who were based at the island offices. This method was successful only for a short while after which the

quality of their work declined and had to be dismissed. Later, active fishing skippers were employed; who would sample their own catch, on their boat, at the end of the day's fishing and send the data sheets to MRC through the island offices.

Both strategies have their limitations. Island based samplers had the issue of not sampling enough fish, as the amount of fish brought to the islands decreased due to fishermen selling the catch to collector vessels and ports. On the other hand, advantages of collecting data through the fishermen were that they got more access to fish, the help available from their crew and in most cases, their high motivation. Disadvantages of using fishing skippers are their tendency to sample rather few catches (even though the total numbers of fish sampled may be high), and the fact that sampling stops when fishing stops (Anderson et al., 1996). However, this method appear superior over the land based sampler as currently, only a proportion of the catch is brought back to the island. While the majority of catch is generally sold to fish collector vessels and ports, any catch that is brought back to the island are mostly those that are rejected due to poor quality and size. Hence, if the sampler were to be based on the island, there is a tendency for the size data to be biased.

Though active fishing skipper oriented length sampling programs have yielded a considerable amount of data, the quality of these data, especially after extended durations have been questioned. The decline in quality could be attributed to several reasons such as:

- Difficulty in allocating time to take length measurements.
- The need for extra handling of the fish: fishermen no longer handle the catch as much as they used to and therefore leave little opportunity to carryout length sampling.
- Difficulties in monitoring and keeping regular contact and hence unavailability of close monitoring as they are out at sea during office hours.
- Difficulties in sending the data sheets regularly also due to the reason above.

These issues in general could be addressed by restructuring the program. Currently, MRC is proposing a mechanism to collect length data from fish collecting facilities

located across the country. These facilities comprise of land based collection ports and mobile collector vessels that operate throughout the country. As fish purchasing companies receive catch from different locations of the country, such a sampling strategy would address the issues mentioned above and would also improve the quality of the data collected in terms of areas of coverage and sizes sampled. Such a strategy would also eliminate the problem of breaks in data flow during days of non-fishing by the field officer fishermen.

At the moment, there are three fish landing ports in operation. They are, Lh. Felivaru, GA. Kooddoo and L. Maandhoo (Figure 1). In addition, several fish purchasing vessels operate throughout the country. The proposed samplers would be based on these ports/collector vessels and would sample fish brought in by the fishermen. Administratively, the sampler would be a staff of the fish purchasing company and sampling would be an additional duty with an incentive. This way, the sampling activities can be effectively monitored through the administrative department of the company. Discussions have taken place with some companies and have received positive feedback. However, several points need consideration for the effectiveness of this method.

- Time of sampling: as the catch is unloaded from the fishing vessels, it is imperative that the best time to take length measurements be identified. This is to minimize or eliminate the disruption of the normal flow of operations.
- Routine sampling: the sampler has to have time to take daily length samples in addition to his/her assigned duties.
- Regular flow of data: the sampler will need to send the data regularly (at least once a month) to MRC

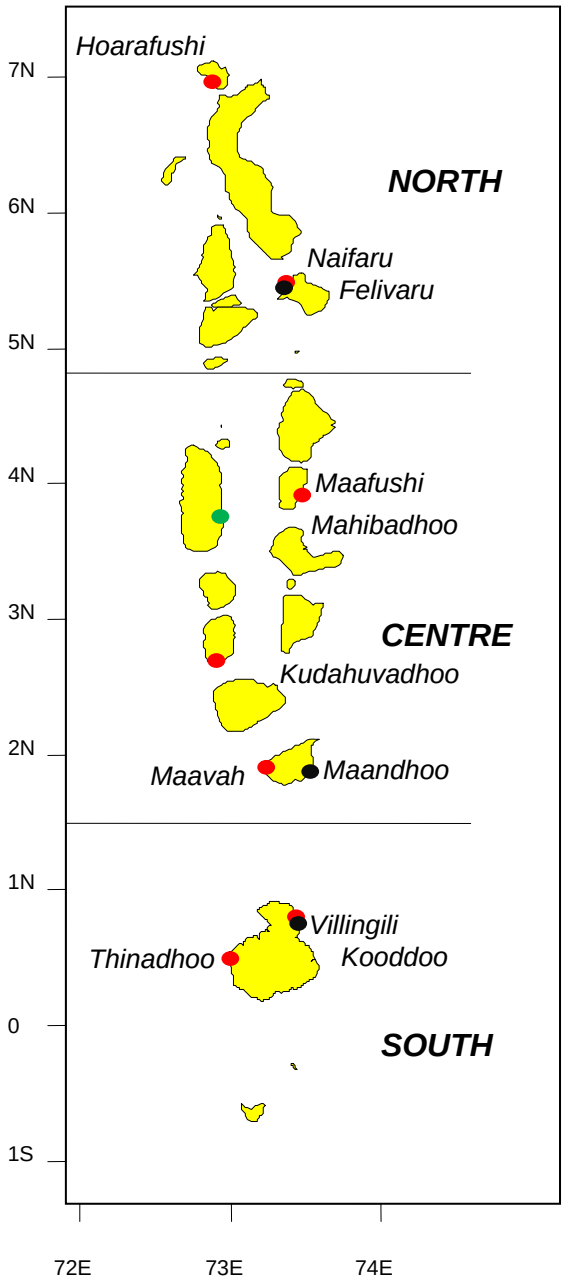

Figure 1.Map of Maldives showing the location of pole and line tuna samplers (red), hand line large yellowfin samplers (green) and fish landing ports (black).

4. Limitations

While the proposed length sampling mechanism has advantages over the existing method, there could be some limitations to this approach. First of all, only three major fish collection ports are in operation at present, limiting the number of samplers that could be put into operation. There is no port in operating in the North of the country

and hence, any data from the upper north will need to be collected through a sampler based on fish collector vessels. The major obstacle of a collector vessel based sampler would be the possible unavailability of manpower and time during the process of unloading. This could prove to be severe at times such as when several boats are in line to unload their catch. Field visits to a fish landing port are to be conducted in the near future to identify and study the feasibility of the proposed method.

5. Conclusions

Employing active skippers to collect length data has been a successful method of operation for the tuna length sampling programs in the Maldives. However, it has been observed that the quality of data produced by such samplers is at times low due to the aforementioned reasons. A change in mode of operation, to collect data through samplers based on the collection ports/vessels could alleviate this issue to a certain degree. However, this method has its limitations due to the restricted number of fish collection ports in the country and the limitations that exist on fish collection vessels. Therefore, a system that combines data collection through fishing skippers as well as port based samplers could be the best approach.

The hand-line fishery targeted at the large yellowing tuna (>80cm fork length) has flourished over the years. Therefore, such a program needs incorporate a mechanism to obtain data from this group as such data is in a very limited amount at the moment.

Currently, the size frequency database is being analyzed to create a time series of conversion factors for improving and reviewing the Maldives tuna catch data. This analysis is also aimed at compiling all the size data in an easily accessible format

6. References

Anganuzzi, A., O'Brien, C., Herrera, M., Poisson, F., Garcia, M., Sakonju, K. and Fujiwara, S. (2007). Comprehensive Report; IOTC-OFCF Project. Available at wwww.iotc.org.

M.S. Adam (2004) IOTC – OFCF tuna sampling program, March 2003 – March 2004

Anderson, R.C., M.S. Adam and I. Nadheeh. (1996) Final Report of tuna length and weight frequency sampling activities, 1994-95.