Annexure 4

A SUMMARY OF INFORMATION ON THE FISHERIES FOR BILLFISHES, SEERFISHES AND TUNAS OTHER THAN SKIPJACK AND YELLOWFIN, IN THE MALDIVES

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Introduction

Tunas and tuna-like species dominate the Maldivian fish catch. Skipjack and yellowfin tuna are the most important species, but several others make valuable contributions to the catch. These include frigate tuna *(Auxis thazard),* **eastern little tuna** *(Euthynnus affinis),* **dogtooth tuna,** *(Gyrnnosarda unicolor),* **seerfishes (mainly wahoo,** *Acanthocybium solandri),* **and billfishes (mainly the sailfish,** *Istiophorus platypterus).* **A list of local names of these species is appended.**

Frigate tuna

Frigate tuna is the third-most important species in the Maldivian catch, after skipjack and yellowfin. Between 1970 and 1984 frigate tuna accounted for an average of nearly 10% by weight of the recorded catch. This amounts to an annual average of some 3130 MT.

Production trends

Although the average catch of frigate tuna has been about 3130 MT per year it has fluctuated widely about this level (Table 1). During 1970-72 the annual catch was about 3070 MT. In 1973 ii climbed to 6600 MT and in 1974 it was 6000 MT. After these two peak years it declined rapidly to an average of 1640 MT during 1978-81. Since then, catches have climbed back to something over 3000 MT per year. This pattern suggests either gross stock fluctuations through natural causes, or overfishing during 1973-74 leading to a decline in stock size in the late 1970s. This second interpretation is supported by the findings of Anderson and Hafiz (1985), who suggested that frigate tuna in the Maldives has an average maximum sustainable yield (MSY) of about 3700 MT. However, it is difficult to explain why overfishing should have occurred in 1973-74 at what was no more than an average level of fishing effort. In 1973 there were 'peak' catches of yellowfin and little tuna as well as frigate tuna, although not of skipjack, so perhaps unusual oceanographic conditions in that year affected their catchability.

Catch rates

Most frigate tuna (over 90%) are taken by pole and line vessels, but trolling vadhu dhonis do make a small regular contribution to production. As with other tuna species, catches by sailing masdhonis have been almost entirely replaced by those of motorized masdhonis since 1974-75 (Table 1). Stratum-wise catch rates by motorized masdhoni is and vadhu dhonis for the years '1980-83 are presented in Table 2 (see Fig.1 for details of strata).

During 1980-83 the average catch rate of frigate tuna by motorized masdhonis was about 17-18 kg/day, while that by vadhu dhcnis was 2.0-2.5 kg/day. For both vessel types the highest catch rates were recorded in the north of the Maldives, the lowest in the south. There

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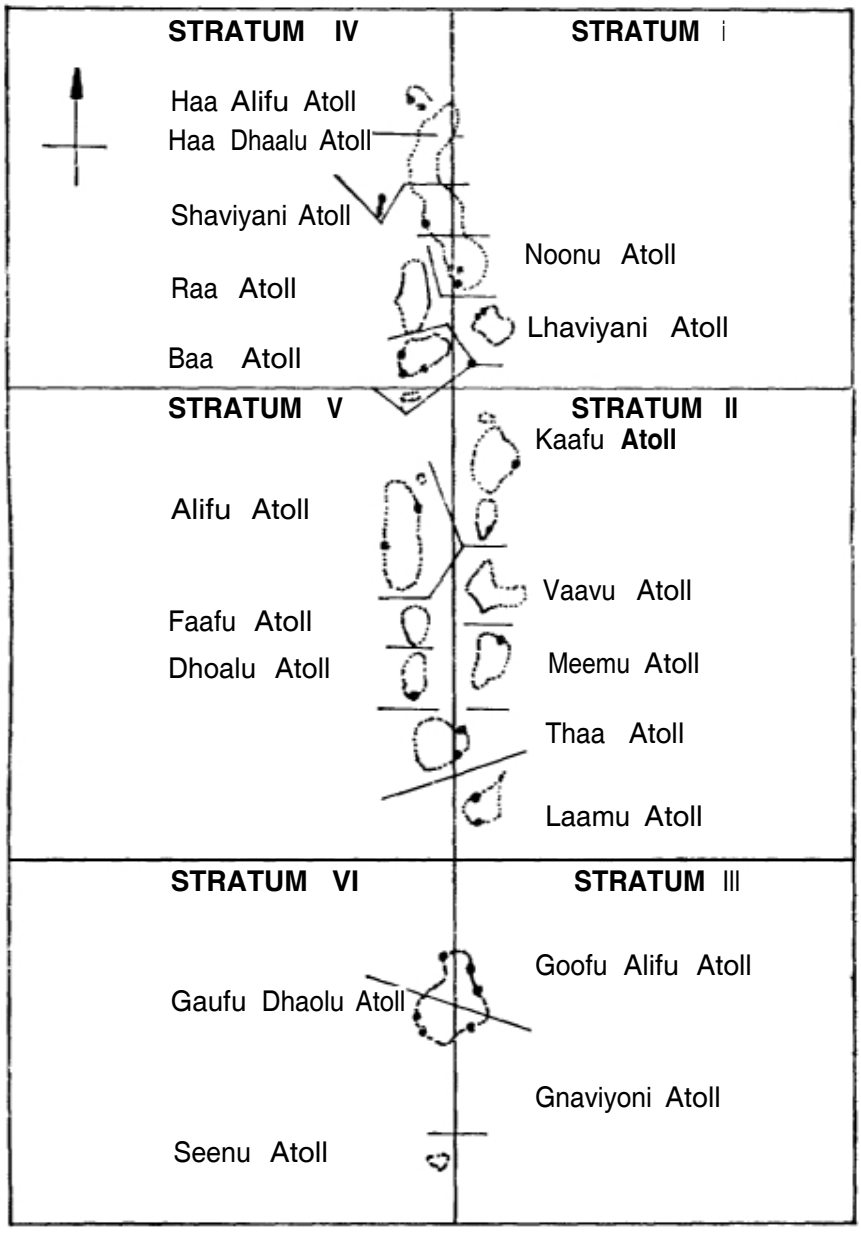

Fig. 1 Map showing the six strata of the Maldive Islands.

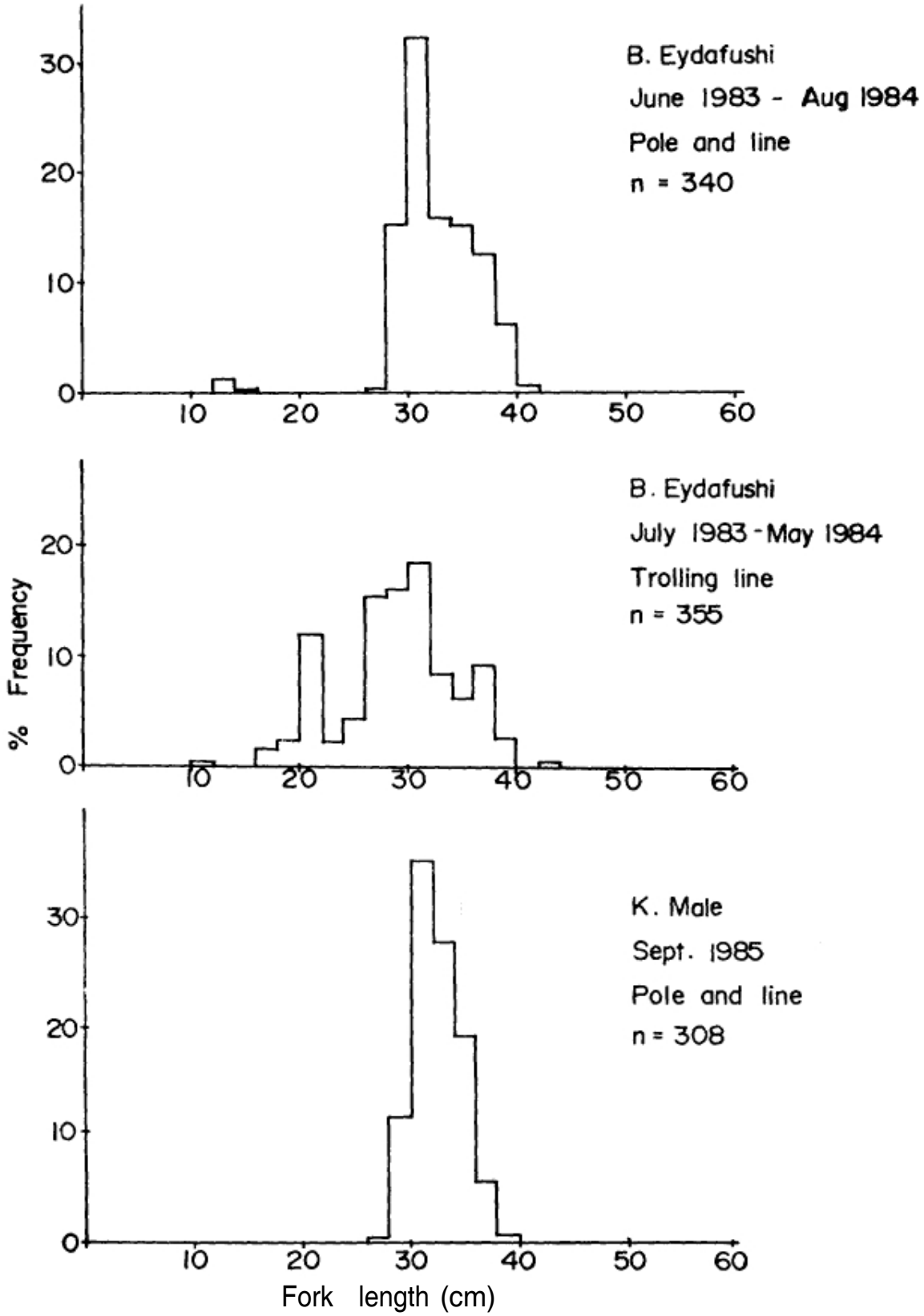

Fig. 2 Length frequency distributions of frigate tuna in the Maldives.

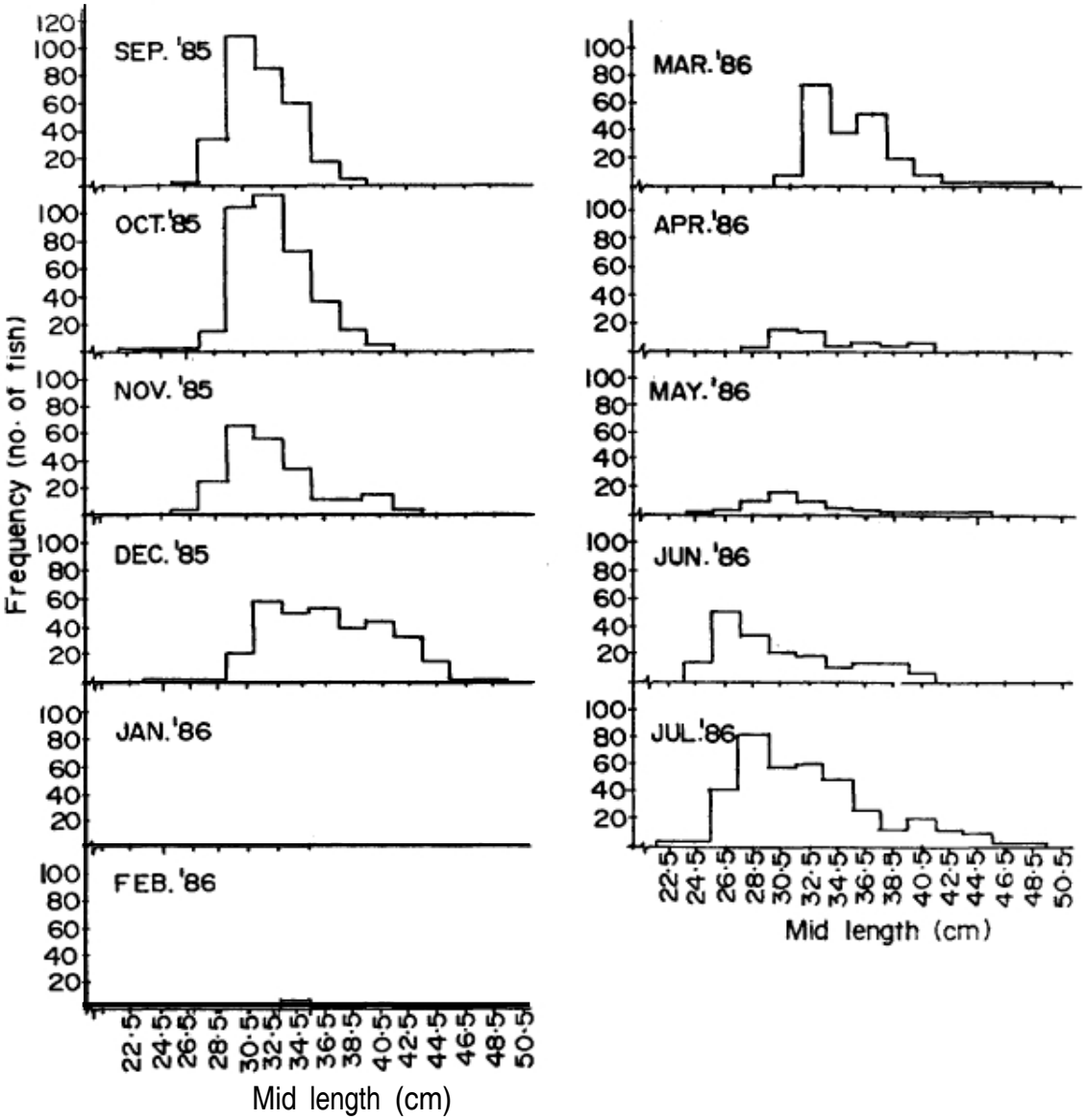

Fig. 3 Seasonal changes in the length frequency distributions of frigate tuna in the Maldives.

is no clear seasonal pattern in catches, although atolls on the west coast of the Maldives appear to achieve their largest catches during the north-east monsoon season (December to May) while those on the east seem to make their best catches during the south-west monsoon season (July to November).

Length frequency distributions

Systematic and stratum-wise length frequency sampling of frigate tuna has not been carried out. Length frequency distributions of three samples that are available are summarized in Fig. 2. The two samples from pole and line vessel catches are very similar, both having single peaks at about 31 cm FL (fork length). The sample from trolling vessel catches shows a much wider range of lengths and includes a greater **proportion** of small fish. Whether this is a real difference reflecting size segregation of frigate tuna or just a sampling artefact is unknown. Length frequency distribution observed during the sampling from September 1985 to July 1986 is shown in Fig. 3.

Little tuna

The eastern little tuna, or kawa kawa, is the fourth most important tuna species taken in the Maldives. Between 1970 and 1984, little tuna accounted for an average of 3% by weight of the national catches.

Production trends

During the period 1970-71 the average annual catch of little tuna was 740 MT. It has increased since then with an annual average catch of about 1600 MT in the period 1980-84 (Table 3). The bulk of the little tuna catch (67% of the total during 1970-84) is taken by trolling vadhu dhonis operating mainly inside the atolls. The rest of the catch is taken by the pole and line fleet, in which motorized vessels have almost entirely replaced sailing vessels in the last few years. The production in 1985 was 2177 t.

Catch rate

Catch rates by vessel type and by stratum for the years 1980-83 are given in Table 4, Overall catch rates by vadhu dhonis are somewhat higher than those by masdhonis. This is the opposite of what happens with the major tuna species and implies that the little tuna leads a largely atoll-associated life. Only in Stratum 5 (which includes Ari Atoll, where much reef fishing is carried out and many masdhonis fish inside the atoll) do masdhonis achieve a higher catch rate than vadhu dhonis. For both vessel types, little tuna catch rates are highest in the north and centre of the Maldives and lowest in the south. Highest catches are taken in May and June, although there is a smaller peak in December and January.

Catch and effort relationship

Anderson and Hafiz (1985) carried out surplus production model analysis on available catch and effort data. Effort was standardized to the level of 'trolling vessel day' (Table 3). Meaningful results were not obtained. A positive correlation of CPUE on E was found, implying that increasing effort will bring ever increasing catches, an impossible situation. The most obvious explanation for this result is that the effort data used do not distinguish between fishing effort directed against reef fishes and that directed against tuna. It is therefore possible that little tuna catch rates are indeed decreasing with increasing effort. However, recorded reef fish catches by vadhu dhonis have in fact increased substantially over the last few years (average 1970-71, 1000 MT; average 1982-83, 3000 MT), while fishing effort has not increased by anything like as much (average 1970-71, 86,000 days; average 1982-83 ; 125,000 days). This, togethet with the overall increase in catch rates of little tuna by both vadhu dhonis and masdhonis, mighr indicate an increase in stock abundance. Possible explanations include reduced competition from decreased stocks of frigate tuna (see above), or reduced predation from decreased stocks of such intra-atoll predators as sailfish and wahoo. These latter may have declined as a result of increased fishing to supply the tourist market.

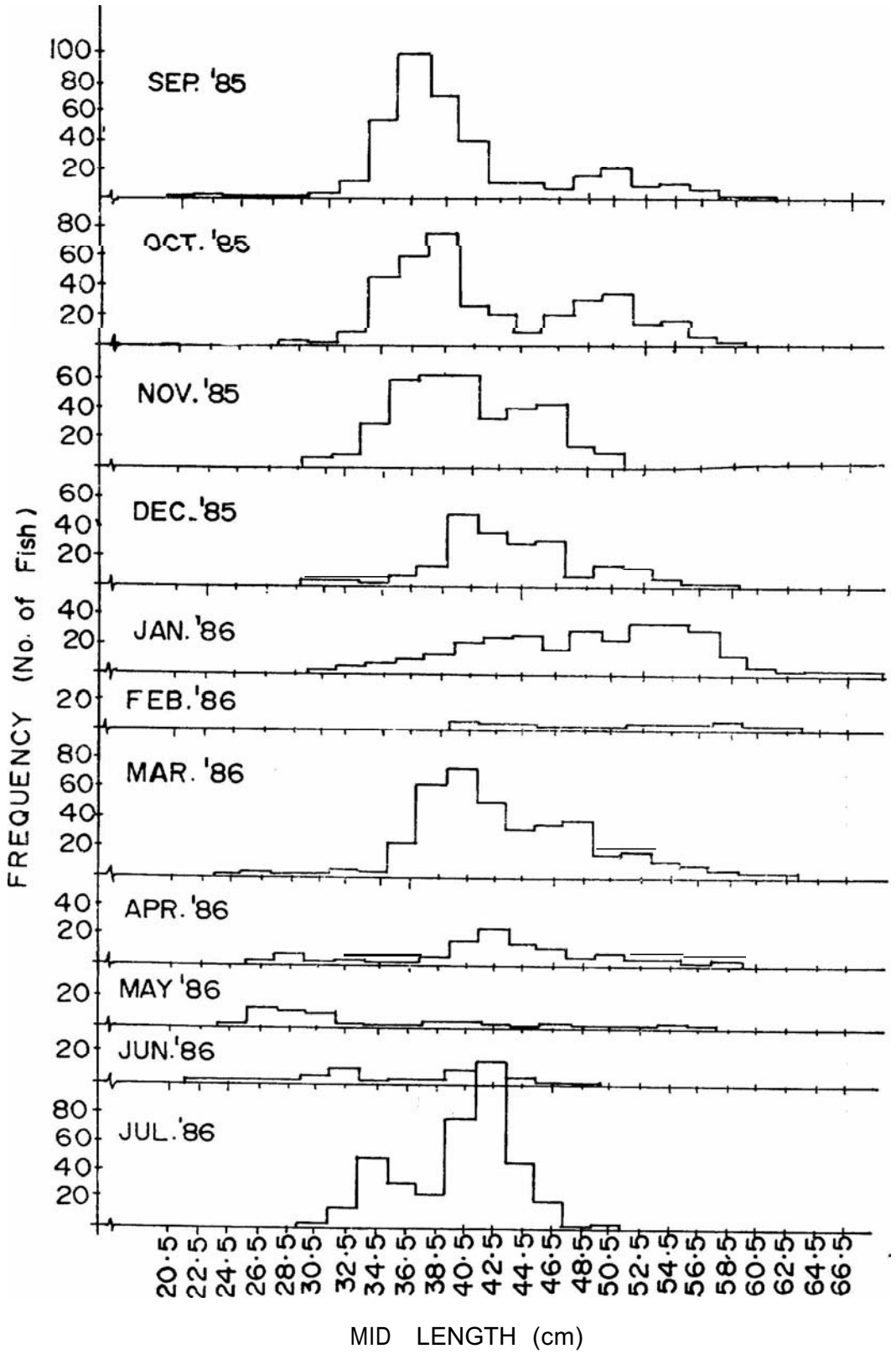

Fig. 4 Seasonal changes in the length frequency distributions of kawakawa in the Maldives.

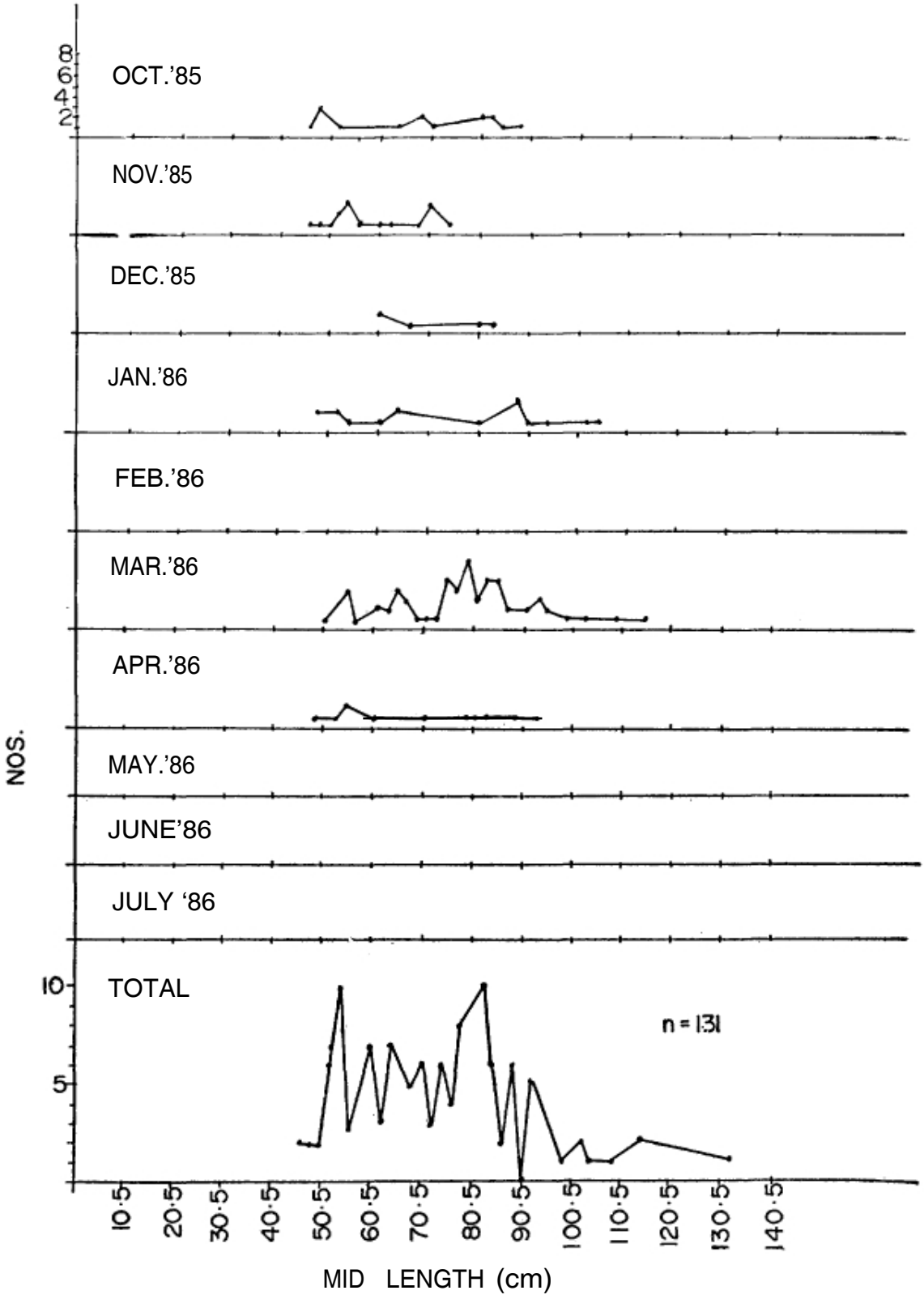

Fig. 5 Monthly length frequency distributions for dogtooth tuna landed at Male.

Length frequency distributions

Systematic and stratum-wise length frequency sampling of little tuna has not been carried out. Length frequency distributions from the sampling from September 1985 to July 1986 are summarised in Fig. 4. There appear to be two or three size classes in each sample. The smallest individual measured was 11 cm FL, the largest 60 cm FL. Samples from catches of masdhonis and vadhu dhonis at Eydafushi (Baa Atoll) showed similar length frequency distributions. This suggests that little tuna in this area show little size segregation. However, these samples were not taken over the same time period, so this interpretation may not be valid.

Bullet tuna

Observations in Male fish market carried out approximately once every two weeks from January 1984 to February 1985 revealed only one specimen of the bullet tuna, *Auxis rochei.* This species may therefore be considered to be very rare in the central region of the Maldives, although it is possible that it is more common in the northern region.

Dogtooth tuna

Dogtooth tuna is caught in relatively small numbers throughout the Maldives. Separate statistics for dogtooth tuna catches have been kept only since the beginning of 1984. Recorded catches by vessel type during 1984 and 1985 are given below:

	1984	1985
Motorized masdhoni	92 MT	32 MT
Sailing masdhoni	3	4
Vadhu dhoni	25	23
Rowing boat	1	?
Total	121	59

Dogtooth tuna are reef-associated fishes. Most are caught by vessels operating within, or just outside, the atolls using trolling or droplines. Occasionally live frigate or little tuna may be used as bait to catch large individuals. There is no obvious regional pattern to fish catches, althovgh it may be that dogtooth is less common in the south than elsewhere in the Maldives. The highest catches are achieved in atolls that concentrate on reef fishing (notably Ari Atoll), and the lowest catches in those atolls where there is little reef fishing (e.g. Lhaviyani Atoll).

Length frequency sampling conducted in Male between October 1985 and July 1986 was incomplete and insufficient. The results presented in Fig. 5 suggest that most dogtooth tuna landed are in the range 40-130 cm FL. There are occasional reports of catches of larger individuals, over 1.5 m in length.

Underwater observations by the authors reveal that dogtooth tuna are most often seen in small groups of two to six individuals, although single fish and larger groups are also seen. This is compatible with other observations on dogtooth tuna summarised by Silas (1963).

Bigeye tuna, albacore and longtail tuna

Bigeye tuna *(Thunnus obesus),* albacore *(Thunnus alalunga)* and longtail tuna *(Thunnus tonggol),* are probably all taken in small quantities in Maldivian waters. No separate statistics for these species are maintained. Maldivian fishermen recognise these species as varieties of yellowfin tuna *(Thunnus albacares)* and any catches are probably recorded as such.

Juvenile bigeye tuna are apparently present among the large catches of juvenile yellowfin taken off the north-west coast of the Maldives during July and August. Larger bigeye tuna constitute nearly a half of all tuna longline catches in the area around the Maldives (Klawe, 1980). There are rare reports of longtail tuna caught in the northern atolls, and some albacore are taken by longline, especially in the south.

Seerfishes

Observations of landings at Male fish market suggest that catches of seerfish are composed almost entirely of the wahoo. Occasional specimens of the narrow-barred Spanish mackerel, *Scomberomorus commerson,* are also landed. Landings of wahoo are not separately recorded, so it is **not** possible to give accurate catch statistics. As a very crude first estimate it is suggested that something of the order of 400 MT (± 100 MT) are landed annually. Catches might have increased over recent years to meet the growing demand **for** tourist resorts and the expatriate population in Male.

Wahoo are usually caught within or immediately outside the atolls by trolling line from masdhonis or vadhu dhonis, or from bokkura (rowing boats), Fishermen in these skate a wooden model of a flying fish held at the end of a pole and line across the sea surface to lure the wahoo within reach of their harpoons.

Billfishes

The following species of billfish are caught in the Maldives : sailfish, swordfish *(Xiphias gladius)* blue marlin *(Makaira maazara),* black marlin *(Makaira indica),* and striped marlin *(Tetrapterus audax).* By far the greatest billfish catch is that of sailfish. These are usually taken within the, atolls by vadhu dhonis trolling with lures, or by rowing boats using droplines with live tuna bait. Swordfish and marlin are occasionally caught outside the atolls by masdhonis using trolling lines. They are also taken by longliners operating in the waters around the Maldives. Klawe (1980) estimates that Far Eastern longliners operating in what is now the Maldives EEZ during 1972-77 took an annual average of 106 MT of billfish. Of this 37% was blue marlin, 19% sword-fish, 19% sailfish, 18% striped marlin, and 7% black marlin. There are no records of Maldivian catches of billfishes. However, in recent years commercial tuna purchasing companies have bought about 15-20 MT of billfish annually for export. As a crude first estimate it is suggested that something of the order of 80-100 MT of billfish are caught each year.

Reference

Anderson, R.C. and A. Hafiz (1985) — The state of Maldivian tuna stocks: analysis of catch and effort data and estimation of maximum sustainable yields. Ministry of Fisheries, Male; 21 pp.

Klawe, W.L. (1980) — Longline catches of tunas within the 200-mile economic zones of the Indian and Western Pacific Oceans. Dev. Rep. Indian Ocean Programme (48) : 83 pp.

Silas, E.G. (1963) — Synopsis of biological data on dogtooth tuna *Gymnosarda unicolor* (Ruppell) 1838 (Indo-Pacific). FAO Fisheries Biology Synopsis No. 75.

Table 1

Frigate tuna catches in the Maldives by vessel type, 1970-84

	Catch (MT)					Standardized catch rate (kg/motorized masdhoni day)
	Vadhu dhoni	Sailing masdhoni	Motorized masdhoni	Total masdhoni	Total	
1970	248	2,775	-	2,775	3,203	27.5
1971	166	2,849	-	2,849	3,015	31.9
1972	182	3,004	-	3,004	3,186	37.9
1973	186	6,440	-	6,440	6,626	59.8
1974	202	5,804	-	5,804	6,006	57.1
1975	163	3,713*	181*	3,894	4,057	43.1
1976	289	1,971*	448*	2,419	2,707	20.6
1977	264	1,863*	953*	2,816	3,080	23.1
1978	206	720*	735*	1,455	1,661	13.4
1979	272	435	994	1,429	1,701	13.3
1980	304	207	1,084	1,291	1,595	13.0
1981	309	141	1,156	1,297	1,606	13.8
1982	231	80	1,750	1,830	2,061	18.0
1983	351	141	3,048	3,189	3,540	26.0
1984	338	66	2,701	2,767	3,105	22.5

* Estimated

Table 2

Average catch rates of frigate tuna by motorized masdhonis and vadhu dhonis in the six regional strata of the Maldives, 1980-83

Vessel type	Area	1980	1981	1982	1983 (kg/day)
Motorized masdhoni	1	30.3	30.4	33.1	61.8
(Pole Et line)	2	7.1	11.9	17.3	22.9
	3	1.7	2.2	2.9	2.1
	4	21.5	21.8	34.3	36.1
	5	12.8	3.9	5.4	6.9
	6	5.0	2.6	6.1	4.7
	Overall	13.0	13.8	18.0	26.0
Vadhu dhoni (Trolling)	1	3.0	5.3	2.2	2.5
	2	0.2	0.3	0.4	0.2
	3	0.1	0.0	0.0	0.2
	4	3.1	3.0	2.3	4.1
	5	1.4	1.2	0.9	0.9
	6	0.1	0.2	0.2	0.1
	Overall	2.2	2.4	1.7	3.0

Table 3

Little tuna catches in the Maldives by vessel type, 1970-84

Year	Catch (MT)					Standardized catch rate (kg/vadhu dhoni day)
	Vadhu dhoni	Sailing masd honi	Motorized masdhoni	Total masdhoni	Total	
1970	402	242	—	242	644	3.9
1971	253	220	—	220	473	3.8
1972	343	253	—	253	596	4.5
1973	514	574	—	574	1,088	5.7
1974	433	397	—	397	830	4.6
1975	268	140*	7*	147	415	3.0
1976	762	157*	34*	191	953	5.6
1977	767	112*	48*	160	927	4.9
1978	634	78*	55*	133	768	3.6
1979	548	94	79	173	721	4.1
1980	768	104	191	295	1,063	5.6
1981	871	119	284	403	1,274	6.7
1982	1,044	172	671	843	1,887	7.9
1983	1,094	98	895	993	2,087	9.2
1984	1,019	49	646	695	1,714	9.3

* Estimated.

Table 5

Local names of tunas and tuna-like fishes caught in the Maldives

Latin name	English name	Dhivehi name
Katsuwonus pelamis	Skipjack	Kalubilamas Godhaa (Large)
Thunnus albacares	Yellowfin	Kanneli
Thunnus obesus	Bigeye tuna	Loabodu kanneli
Thunnus alalunga	Albacore	Kanfaiydhigu kanneli
Euth ynnus affinis	Little tuna	Latti
Auxis thazard	Frigate tuna	Raagodi
Acanthocybium solandri	Wahoo	Kurumas
Istiophorus platypterus	Sailfish	Fangaduhibaru
Xiphias gladius	Swordfish	Thungaduhibaru
Mackaira and *Tetrapturus*	Marlin	Mashibaru