THE MALDIVIAN SHARK FISHERIES

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To most people, fishing in the Maldives means pole and line tuna fishing. Certainly tuna fishing is of paramount importance in the Maldives with the four main species of tuna making up over 90% of the recorded catch. However, many other forms of fishing are also carried out, perhaps the most important being shark fishing.

SHARK PRODUCTS AND EXPORTS

Sharks are not traditionally eaten in large quantities in the Maldives, although there are now regular markets for fresh shark meat for the expatriate population on Male', and for highly priced 'shark steaks' on the tourist resorts. The only shark product traditionally used in any quantity within the Maldives is shark liver oil. Local fishing vessels have always been made from wood (mainly coconut wood) and these require careful and regular maintenance to prevent rotting and to keep boring worms at bay. Boats are normally beached every two weeks for cleaning, and shark oil is regularly applied to the bare wood to keep it in good condition. With a national fleet of over 5000 fishing vessels of various sizes (from about 2 to 15m) there is clearly a substantial demand for shark liver oil.

Almost as a by product of the shark liver oil fishery, shark fins and shark meat were available. As there was no local market for these products they were exported. Sun dried shark fins are exported through Singapore to the Chinese markets of S.E. Asia where they are used in the making of sharkfin soup. Salt dried shark meat is exported to the markets of S. Asia, particularly Sri Lanka.

With the introduction of increasingly efficient methods of shark fishing during the last 30 years, export earnings have become a significant driving force in shark fisheries. Before, shark fishing was carried out primarily for shark oil, and the sale of fins and meat for export was an additional bonus. Nowadays with livers, meat, fins and jaws (as tourist curios) all being used, sharks are extremely valuable to the fishermen.

These products are all obtained from relatively shallow-water sharks (i.e. those generally found in 50m or less) both on the reefs and in the open water. But there is seperate and distinct fishery for deepwater sharks (i.e. 300m and deeper). A variety of species are caught, but the main target is spiny dogfish (*Centrophorus spp.*). The liver oil of these sharks contains very high quantities of squalene, which make the oil particularly valuable to the cosmetic and pharmaceutical industries. It is mainly this oil, not the crude shark liver oil used for dhoni maintenance, that is exported, with most of it going to Japan.

A summary of recent exports of shark liver oil and dried shark fins is given in Table 1. Catch statistics for the shark fisheries are not available, nor are seperate export statistics for dried shark meat (which is lumped with dried reef fish). However, some idea of the magnitude of the shark fishery can be obtained from the available export statistics. Assuming a yield of 1% of dried fins,the annual shark catches in recent years must have been within the range 1000-2500t. On top of this must be added the catch of deepwater spiny dogfish (which do not yield exportable fins). Assuming as a first estimate a yield of about 5% of liver oil, the annual catches of deepwater sharks in recent years must have been of the order of 400-800 t per year. Thus total shark catches may have been of the order of 1500-3000 t per year.

SHARK FISHING METHODS

This quantity of sharks is not caught by a single method. Infact, there are at least ten different fishing techniques are, or have been, employed:

1. Maa keyolhu kan (tiger shark fishing)
2. Madu miyaru keyolhu kan (large deepwater shark fishing)
3. Kashi miyaru keyolhu kan (spiny dogfish fishing)
4. Drift longlining outside the atolls
5. Bottom set longlining inside the atolls
6. Bottom set tangle netting
7. Handlining
8. Trolling
9. Hand catching
10. Harpooning

Waheed (1991, Catalogue of Fishing Gears of the Maldives, MOFA) gives detailed descriptions of the gears employed in these fisheries, so just a brief summary of each method is given here.

Maa keyolhu kan

Maa keyolhu kan is the traditional Maldivian fishery for big tiger sharks. This was a specialized fishery that presumeably dates back hundreds of years, and was developed to fill the need for crude shark liver oil for boat maintenance. The main target was large tiger sharks, since these beasts have enormous livers. Dolphins were the preferred bait, although turtles, manta rays and octopus could also be used. Two or three dolphins would be harpooned and then kept for a day or two to let them start rotting. The fishing boat would then anchor in the chosen place (often in an area of strong currents such as a channel) and the fishermen would suspend the bait just above the water so that blood and decaying flesh would slowly drip into the sea. The fishermen might wait for several days before a large tiger was attracted to the boat. Very heavy fishing gear (massive iron hooks with chain leaders and heavy harpoons) were then used to catch and land the shark. Sharks of 4m in length were commonly caught by this method, but giants of 6m and over were occasionally taken. Fishing for such monsters was not an entirely risk-free occupation, so not

Fishing for such monsters was not an entirely risk-free occupation, so not surprisingly there were many superstitious beliefs and rituals associated with this fishery. Maa keyolhu kan has died out since the introduction of longlining in the early 1960's, but on most fishing islands it is still possible to see the heavy iron fishing gear that was used.

Madu miyaru keyolhu kan

Madu miyaru keyolhu kan (literally: soft shark line fishing) is a modification of maa keyolhu kan. The target was again large sharks for their liver oil. However, in this case deepwater sharks, notably six-gill shark, were targeted. The same single massive hook used for maa keyolhu kan was employed but it was set on the bottom in a depth of 300m or more. The hook could be baited with tuna or reef fish, and was sent to the bottom with a large chunk of coral rock. This rock was tied to the hook with a piece of coconut fibre string (roanu) and could be jettisoned once the hook was at the bottom by a sharp tug from the fishermen. Like maa keyolhu kan, madu miyaru keyolhu kan seems to have died out in recent years, but a closely related fishery continues.

Kashi miyaru keyolhu kan

Kashi miyaru keyolhu kan (spiny dogfish vertical longlining) is a direct descendent of madu miyaru keyolhu kan. In the early 1970's Japanese buyers visited the Maldives looking for high quality squalene-rich shark liver oil. Fishermen in the north of Maldives who had been carrying out madu miyaru keyolhu kan earlier were able to modify the technique by changing the single massive hook for 6-8 small circle hooks and to start fishing for spiny dogfish. Fishing is carried out at night, on the bottom outside the atolls in depths in excess of 300m. In most places fishermen will drift while their lines are down. However, in a few places where the outer atoll reef drops away very steeply (e.g. to the east of Laamu Atoll) fishermen are actually able to anchor in 10-20m and fish in about 400m. This fishery seems to have peaked in the early 1980's

men report lower catch rates and having to fish much deeper than when they first started this fishery.

Drift longlining outside the atolls

During the early 1960's longlining (Dhivehi: lenu) was introduced into the Maldives. The main impetus for this introduction seems to have come from Far Eastern tuna longliners that started operating in the waters around Maldives at about this time. Standard yellowfin tuna longline gear was used, and still is used, outside the atolls for pelagic species. The major species caught outside the atolls are the silky shark, oceanic white-tip, silver tip, tiger shark and blue shark. (Table 2 gives a list of sharks recorded from the Maldives with their scientific, English and some Dhivehi names). Shark longlining is much easier and more productive than maa keyolhu kan, so the latter was rapidly replaced during the 1960's.

Bottom set longlining inside the atolls

Slight modification of the pelagic longline allows it to be used as a bottom set longline inside the atolls. The main species caught include grey reef sharks, silver tips and tiger sharks, as well as nurse sharks, zebra sharks and sliteye sharks. A very small and specialized market exists for nurse sharks: a few resort will buy them to stock their 'shark pools' for the amusement of visitors.

Bottom set tangle netting

Bottom set tangle netting started in the 1970's and has been a major factor in the increase in shark catches over the last decade. Discarded pieces of drift nets washed into Maldivian waters from other countries were picked up by local fishermen, who after some experimentation started using them for reef shark fishing. Now fishermen make their own nets, and there may be nearly 100 boats regularly practising shark netting. Boats typically go out for two

weeks' fishing over the new moon period, with fishermen returning to their islands during the time of full moon. Nets are set at night. If set on the reef outside the atoll they are laid perpendicular to the reef, while if they are set within the atoll they are normally laid between reefs. Species caught include the silver tip, grey reef, blacktip reef, spottail, tiger and whitetip reef sharks.

Handlining

Simple one-hook handlining is the main method used for reef fishing in the Maldives. Although targeting for reef fishes this method does catch some sharks, mainly juveniles of species such as the silver tip, grey reef or white tip. In the south, blacktip and spottail sharks are also taken. More sharks are taken by night than by day.A few fishermen practise a skilled form of livebait handlining targeting for large sharks, including both pelagic and reef species.Small tunas are the preferred form of livebait.

Trolling

Fishermen often encounter pelagic sharks (particularly oceanic whitetip and silky sharks) when fishing offshore for tunas. These are sometimes caught with heavy trolling gear.

Hand catching

It is widely reported that tuna fishermen often take small pelagic sharks (probably juvenile silky sharks) by hand. Schools of these small sharks are sometimes encountered, particularly near drifting flotsam. A dead tuna held in the water will bring them alongside, where they can be grabbed by the dorsal fin and quickly swung inboard.

Other methods

Larger sharks that persistently follow and approach fishing vessels (notably oceanic white tips) may be caught with a rope noose. Whale sharks are occasionally taken for their liver oil; they are caught with large hooks thrust in place with poles, or with harpoons. Other large sharks are also occasionally taken by harpoon. Some fishermen who practice hey mas helhun (a specialized lure and harpoon fishery for wahoo and sailfish) report that hammerhead sharks are sometimes taken by this method.

SHARKS AND TOURISM

Sharks are clearly important in the Maldives because of the fisheries that they support. They are also important as a tourist attraction.

Despite the generally poor 'man-eating' image that sharks have worldwide, few sharks live up to this ill-deserved reputation. Certainly, the sharks encountered on Maldivian reefs by visiting tourist divers are not aggressive. As a result shark-watching is very popular among divers. While few tourists visit Maldives just to watch sharks, as part of a diving package most visitors expect to see sharks a few times. There is no doubt that the ability of tour operators to guarantee safe but exciting shark sightings is a major selling point. As a result shark-watching produces considerable financial benefits for the Maldives. The main species involved are:

White tip reef shark:	Normally seen singly on the reef edge and slope. Sometimes seen 'resting' under large corals or in the open on deeper sand patches.
Blacktip reef shark:	A shallow water species perhaps seen more often by snorkelers than divers.

Grey reef shark: Fortunately this species is not aggressively territorial as it can be in the Pacific. It is seen in groups of up to 15 or more at a few specific dive spots. Some divers hand feed the sharks at such 'shark circuses', but most are content just to sit and watch.

Scalloped hammerhead shark: A large more-or-less permanent aggregation of these sharks can be seen off Rasdhoo.

MANAGEMENT OF SHARK RESOURCES

Sharks are very valuable to the Maldives. They provide the bulk of the oil used for treating the wooden hulls of the entire fishing fleet; high quality shark liver oil, shark fins, and salt dried shark meat contribute significantly to export earnings; and sharks provide a major attraction for visiting divers. There are two, interrelated management issues that need to be addressed if the income generated by shark resources is to be maintained.

First, shark stocks are notoriously easy to overfish, largely as a result of their low reproductive capacity. It seems that there has been a steady increase in shark fishing activity in recent years. There is already evidence that the deep water spiny dogfish stocks have been overfished, as mentioned above. There is concern now that the same may be happening to reef shark stocks. Management measures are required to maintain fished stocks at optimum levels.

Secondly, there is growing concern from the tourist industry about the effects of fishing, particularly tangle net fishing, on reef sharks. The species targeted by reef shark fishermen are the same as those that are watched by tourist divers. There are already some complaints of reductions in numbers of

certainly have a significant negative impact on diving tourism in the Maldives. There is little doubt that ten grey reef sharks are worth far more alive at a dive site than they are dead on a fishing boat. The problem now is how to balance the desires of the tourism sector, with the needs of the local fishermen.

Tabel 1 RECENT EXPORTS OF SHARK PRODUCTS FROM THE MALDIVES.

	Shark Liver Oil		Dried Shark Fins	
	Quantity (Litres)	Value ('000 MRf)	Quantity (kg)	Value ('000 MRf)
1979	N/A	N/A	19,260	573
1980	9,600	60	27,702	1,363
1981	27,200	349	15,374	889
1982	87,400	1,106	19,988	1,373
1983	63,400	1,796	17,403	1,887
1984	79,400	2,412	10,600	1,015
1985	53,400	1,891	20,785	2,103
1986	33,400	1,242	18,434	2,346
1987	40,000	1,040	24,383	5,925
1988	26,000	641	15,576	5,105
1989	19,000	724	13,094	3,856
1990	21,800	1,203	17,826	1,799

Source: Customs
Compiled by: Ministry of Fisheries & Agriculture

Tabel 2 NAMES OF SOME MALDIVIAN SHARKS.

Scientific Name	English Name	Dhivehi Name
Hexanchus griseus	Six-gill shark	Madu miyaru
Centrophorus spp.	Spiny dogfish	Kashi miyaru
Echinorhinus brucus	Bramble shark	Berabedi miyaru
Nebrius ferrugineus	Nurse shark	Nidhan miyaru
Stegastoma varium	Zebra shark	Hitha miyaru
Rhincodon typus	Whale shark	Fehurihi
Isurus oxyrinchus	Mako shark	Woshimas miyaru
Alopias spp.	Thresher shark	Kandhi miyaru
Carcharhinus albimarginatus	Silvertip shark	Kattafulhi miyaru, Vaadhili miyaru
Carcharhinus amblyrhynchos	Grey reef shark	Vah boa miyaru
Carcharhinus falciformis	Silky shark	Oivaali miyaru, Aadhaige miyaru, Mas miyaru, Ainu miyaru
Carcharhinus limbatus	Blacktip shark	?
Carcharhinus longimanus	Oceanic whitetip shark	Feeboa Miyaru, Fee miyaru
Carcharhinus melanopterus	Blacktip reef shark	Uraha Kalhu miyaru, Gondu miyaru
Carcharhinus sorrah	Spottail shark	Dhon miyaru, Thila miyaru ?
Galeocerdo cuvier	Tiger shark	Femunu
Loxodon macrorhinus	Sliteye shark	Hikandhi thun miyaru, Oashi miyaru
Mustelus mosis	Hardnosed smoothhound	?
Negaprion acutidens	Lemon shark	?
Prionace glauca	Blue shark	Andhun miyaru
Triaenodon obesus	Whitetip reef shark	Faana miyaru
Sphyrna lewini	Hammerhead shark	Kalhigandu miyaru