

## ECONOMICS OF SHARK AND RAY WATCHING IN THE MALDIVES

Dr. R. Charles ANDERSON and Ali WAHEED  
Marine Research Centre, Malé

### Introduction

The two major economic activities in the Maldives are fishing and tourism. Fishing has traditionally concentrated on oceanic tunas, but over the last two decades the fisheries sector has diversified to include exploitation of other resources, including sharks. Tourism started in 1972, and has grown steadily since then, with some 350,000 tourist arrivals expected in 1998. The main attractions for visitors are the tropical beaches and coral reefs. The reefs are rich in marine life, which makes diving and snorkelling particularly popular. Perhaps as many as 50% of tourists go diving during their stay.

### Shark watching

One of the greatest attractions for recreational divers is observing large marine animals underwater in their natural habitats. Sharks in particular are always a major attraction. The main shark species involved in the Maldives are listed in Table 1, in approximate order of abundance.

Divers might see sharks on almost any dive, but there are certain sites that offer a much higher chance of seeing sharks than others. During a survey in 1992, the number of dives taking place annually at 35 specific shark-watching dive sites was estimated at 76,850. At an average cost of US\$30 per dive, that amounted to an annual expenditure by divers of about US\$2.3 million on shark-watching dives (Anderson and Ahmed, 1993).

**Table 1.** Shark species that are regularly encountered by divers in the Maldives

English name	Scientific name	Maldivian name
Whitetip reef shark	<i>Triaenodon obesus</i>	Faana miyaru
Grey reef shark	<i>Carcharhinus amblyrhynchos</i>	Thila miyaru
Blacktip reef shark	<i>Carcharhinus melanopterus</i>	Falhu miyaru
Scalloped hammerhead	<i>Sphyrna lewini</i>	Kalhigandu miyaru
Tawny nurse shark	<i>Nebrius ferrugineus</i>	Nidhan miyaru
Silvertip shark	<i>Carcharhinus albimarginatus</i>	Kattafulhi miyaru
Whale shark	<i>Rhincodon typus</i>	Fehurihi
Variegated shark	<i>Stegostoma fasciatum</i>	Hitha miyaru

Anderson and Ahmed (1993) further estimated that in 1992 a single grey reef shark was worth about US\$33,500 per year at what was then the most popular shark watching site, 'Fish Head'. For all shark watching dive sites, the average value of a live grey reef shark was estimated at about US\$3,300 per year. Since grey reef sharks can live for at least 18 years, and in the Maldives recognizable individuals have been seen at dive sites for many years in a row, the total value of each shark is several times higher. In contrast, a dead grey reef shark was calculated to have a one-time value of about US\$32 to a local fisherman. Thus, grey reef sharks were worth at least 100 times more alive at a dive site than dead on a fishing boat.

With such large sums of money involved in shark watching, there was (and is) considerable interest among diving operators in preserving 'their' reef sharks. In view of the economic importance of diving tourism, and in particular shark watching, fifteen top dive sites (9 of which were, or had been shark watching sites) were declared marine protected areas in June 1995. This included 'Fish Head'. In addition, the catching of whale sharks was banned (see Table 3).

Despite these measures and increased awareness of the importance of sharks as tourist attractions, fishing of reef sharks continued, even within the central tourism zone. As a result, shark numbers at what was the most popular site (Fish Head) have decreased to such a low level (an average of only one shark seen per dive in 1997, from a high of 20+ ten years earlier) that many dive operators no longer visit. The loss of diving revenue from this one site has been roughly estimated at US\$500,000 per year (Anderson, 1998). A survey of departing divers carried out in late 1997 revealed that 58% saw fewer sharks than expected during their visit, and 83% of repeat visitors thought that there had been a decrease in shark numbers since their last visit (Waheed, 1998).

Recognizing the great economic importance of shark watching in the country, the Ministry of Fisheries and Agriculture has recently introduced a new regulation, banning all types of shark fishing within the tourism zone (from Baa and Lhaviyani Atolls to Meemu and Dhaalu Atolls).

Some shark watching dive sites still have significant number of sharks in residence. Tourist arrivals have increased substantially (from 212,000 in 1992 to about 350,000 in 1998), as has the average cost per dive (to about US\$35 each). Current expenditure by divers on shark watching in the Maldives is therefore likely to be in excess of the US\$2.3 million per year calculated in 1992. In addition, with fewer sharks, and at least as much money being spent on seeing them, the value of each shark for diving tourism must have increased significantly. On the basis of willingness to pay, Waheed (1998) estimated that reef sharks had a nominal value of US\$6.6 million as attractions for tourist divers in 1997. These estimates are of direct diving revenue

only; indirect revenues (including food, accommodation, transport) are several times higher.

### Ray watching

In addition to sharks, other large marine animals are also major attractions to tourist divers. Rays are especially popular. A total of 14 species of ray have been recorded from the Maldives so far. The main species involved in tourist activities are listed in Table 2.

**Table 2.** Ray species that are regularly encountered by tourists in the Maldives

English name	Scientific name	Maldivian name
Manta ray	<i>Manta birostris</i>	En madi
Black spotted stingray	<i>Taeniura meyeni</i>	Naru nagoo madi
Brown stingray	<i>Himantura fai</i>	Naru nagoo madi

Manta rays migrate from side to side of the atoll chain in phase with the monsoons, in order to take advantage of seasonal plankton blooms. They are common on the west side of the atolls during the northeast monsoon, and on the east side during the southwest monsoon. Mantas are most frequently watched by divers when they visit 'cleaning stations' on the reefs. In contrast, stingrays tend to be seen at particular locations year-round. Some dive operators feed stingrays in order to guarantee close encounters. In addition, a few resorts feed stingrays in their lagoons, thereby providing an attraction for all their guests, not just the divers.

Anderson and Hafiz (1997) suggested that the economic value of ray watching in the Maldives 'must run into many hundreds thousand dollars per year'. This is likely to be a gross underestimate. From a survey of departing tourists, and on the basis of willingness to pay, Waheed (1998) estimated that manta rays alone had a nominal value of US\$7.8 million as attractions for tourist divers in 1997.

The value of rays as attractions for divers has been recognized by the Government of Maldives. At present, few fishermen catch rays and there is minimal local demand for ray products. A fishery is only likely to develop in response overseas demand. To forestall the development of an export-oriented fishery the export of rays was banned from June 1995. The export of ray skins was specifically banned from January 1996.

### Resolution of conflicting interests

There appear to be few problems afflicting ray resources in the Maldives. However,

the reef shark resources are seriously threatened by over-fishing. Related to this, there is a major conflict of interest between reef shark fishermen and diving tourism operators.

The problem for fishermen is that tourism does not necessarily bring them any direct benefits. They are therefore inclined to continue fishing for sharks, whatever the costs to diving operators. Nevertheless fishermen do benefit from tourism. Tourism is the Maldives' greatest source of income, and thus contributes enormously to social development from which all Maldivians benefit, even though fishermen do not normally recognize this indirect benefit to them. In addition, as new resorts are developed, more and more fishermen are finding employment in tourism. As one example, there were 19 shark fishing boats on the island of Dhangethi in south Ari Atoll in July 1991, just before the development of several resorts in the area. By August 1992 seven boats had left shark fishing to take employment at newly opened resorts nearby (Anderson and Ahmed, 1993). By August 1998, there were 22 boats involved in tourism, and only 4 engaged in shark fishing.

The problem for sharks is that they are highly prone to overfishing. Sharks grow slowly, mature late, have small numbers of young and live for many years. Because they are top predators, their initial population sizes may not be very high. It does not require a lot of fishing to reduce their populations to very low numbers. There is little demand for shark products within the Maldives. The fisheries are driven by the high price of fins in the east Asian market. As long as the demand for fins is high, there will be a strong incentive to continue shark fishing, even though stocks are overfished, and despite the value of sharks for tourism.

The problem for divers and diving tour operators is that reef sharks numbers have declined significantly in recent years, as a direct result of fishing. Divers are leaving the Maldives disappointed because they have seen so few sharks. As a direct result, some of these divers will not come back to the Maldives, thus reducing future revenues. Dive operators cannot offer special shark diving excursions to sites such as Fish Head (and thereby increase their revenue) now that shark sightings cannot be guaranteed.

The problem for the Government of Maldives is how to balance the demands of the tourism industry with the rights and needs of the fishermen. Recognizing the great economic importance of shark watching in the country, it has introduced regulations aimed at promoting shark and ray conservation. This culminated in the ban on all types of shark fishing within the main tourism zone (defined as Baa, Lhaviyani, Kaafu, Alifu Alifu, Alifu Dhaalu, Vaavu, and Seenu Atolls, and the waters within 12 miles of the atolls). This ban should go a long way towards conserving reef shark resources, although it may not be entirely effective, given the limited ability to

police and enforce it.

The various regulations (iulaan) relating to the conservation of reef sharks and rays are listed in Table 3. These regulations have been gazetted under the Environment Law (Law 4/93) by the Ministry of Planning, Human Resources and Environment; the Fisheries Law (5/87) by the Ministry of Fisheries and Agriculture; and the Import-Export Law (31/79) by the Ministry of Trade, Industries and Labour.

**Table 3.** Summary of regulations relevant to the conservation of reef sharks and rays in the Maldives

Regulation No.	Effective	Details
E-95/32	5 June 95	Creation of 15 marine protected areas (dive sites)
FA-A1/29/95/39	24 June 95	Whale shark fishing prohibited
A-23/95	25 June 95	Export of rays prohibited
A-26/95 (of 15.7.95)	1 Jan 96	Export of ray skins prohibited
FA-A1/29/98/39	8 Sept 98	All shark fishing in tourism zone prohibited

There is no doubt that reef shark resources have been overfished in recent years. There is also no doubt that the revenue from shark watching far outweighs that from the export of reef shark products. From a macro-economic point of view it would make sense to ban all shark fishing and all shark product exports. Since reef shark stocks appear to have been reduced to very low levels, such complete bans would have little financial impact on reef shark fishermen, many of whom have already switched to other occupations. However, such bans would have a major impact on the large and completely separate oceanic shark fishery. It remains to be seen whether reef shark populations can recover to their former abundance under the current regulation regime, or if a total ban on shark fishing and exports will be required.

## References

- Anderson R.C. (1998) Sharks mean business. *Scientific American Presents*, 9(3): 70-71.
- Anderson R.C. and H.Ahmed (1993) Shark fisheries of the Maldives. Ministry of Fisheries and Agriculture, Maldives and FAO, Rome, 73pp.
- Anderson R.C. and A.Hafiz (In press) Elasmobranch fisheries in the Maldives. Proceedings of the International Seminar and Workshop on Shark and Ray Biodiversity, Conservation and Management. Sabah, Malaysia, July 1997.
- Waheed A. (1998) Economic value of marine ecotourism to the Maldives. Unpublished B.Sc. thesis, Institute of Marine Studies, University of Plymouth, UK. 68pp.