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Shark ban in its infancy: Successes, challenges and lessons learned

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Original Article

Abstract

The slow growing nature and low reproductive output of sharks make them extremely vulnerable to over fishing. The shark fisheries of the Maldives expanded in the early 1970s. When management measures failed to enhance the declining shark fisheries, with inadequate information on shark stocks, in the face of uncertainty, precautionary approach was adopted and a total ban on all types of shark fishing was imposed. Nevertheless, a fishing ban was not able to halt the import and trade of shark souvenirs. From a socio-economic perspective, insufficient work was done to minimize the impact of the ban on former shark fisherfolk. Lack of broad stakeholder consultations prior to the ban and without providing a phase-out period for the shark fishery and declaring a total ban were some of the major factors contributing to the issues. Inability to impose an explicit ban on the trade, import and export of shark products is another major factor hindering the conservation purpose of the shark ban.

Keywords: *Shark fisheries; over-exploitation; Maldives; implementation issues.*

Introduction

Fishing has been an important activity in the Maldives for centuries and a major source of employment and food. The country has enjoyed a productive fisheries sector for over a thousand years (Anderson and Hafiz, 1996). The principal catch was tuna, and even today, tuna fisheries dominate the fisheries sector. Fisheries used to be the main pillar of the economy, until the tourism industry, with its outstanding growth, replaced fisheries as the main contributor to the country's GDP (Adam, 2006).

In the 1970s, with major developments to the fisheries sector, shark fisheries emerged as one of the most prominent small-scale fisheries. The vast majority of the total catch, an outstanding 90%, is contributed by the tuna fisheries, and all other small-scale fisheries, including the shark fishery contribute 10% to the total catch (Sinan *et al.*, 2011). As shark fisheries had no significant influence on the country's economy, little attention was given to the fishery (Sinan *et al.*, 2011). However in recent decades, the rise in international concern over the increase in exploitation of sharks had increased the awareness on the sustainability of shark populations. Sharks are vulnerable to over-exploitation due to their biological characteristics such as slow growth, attainment of first maturity at a late stage in life, production of few offspring and long life span (Musick *et al.*, 2000). The high revenue generated by country's dive tourism industry through shark watching (Anderson and Ahmed, 1993) and the growing demands from environmentalists, gave rise to concerns over the status of shark stocks of the Maldives

(McAllister and Partners, 2002) and thus gradually brought the shark fishery into the focus of fisheries management in the Maldives. Various management measures were adopted, which culminated in a complete ban on all types of shark fishing in 2010.

This paper aims to provide a historical perspective of the shark fisheries of the Maldives as well as provide a review of the existing issues that are affecting the ability of the Ministry of Fisheries and Agriculture (MoFA) to effectively implement the shark fishing ban. The information presented in this paper was from existing literature on shark fisheries and anecdotal interviews with former shark fishermen including reef fishermen and also from consultations with the tourism sector.

History of shark fishing in the Maldives

A small-scale, but highly targeted fishery for sharks was practiced in the Maldives for hundreds of years (Anderson and Ahmed, 1993). Sharks were first exploited for their liver. In those days, shark liver oil was in huge demand, as it was used to paint the wooden boats to prevent decaying of the wood (Anderson and Ahmed, 1993). This traditional fishery primarily targeted large sharks such as tiger sharks (*Galeocerdo cuvier*) and sometimes the bluntnose six gill sharks (*Hexanchus griseus*). This ancient pattern of shark fishing died out in the 1970s with widespread motorization of boats and with introduction of new fishing methods such as long lining and gill netting. By the early 1980s three types of shark fisheries were established; the deep water benthic shark fishery, oceanic shark fishery and the reef shark fishery (Sinan *et al*., 2011).

The deep water benthic shark fishery

The expansion of deep water benthic shark fishery took place in the early 1980s. The fishery was developed to obtain shark liver oil rich in squalene and the primary target were the gulper sharks (*Centrophorus* spp., using multihook handlines (Anderson and Ahmed, 1993).

Reef shark fishery

With the adoption of new fishing methods, the previously unexploited reef shark resources became targeted and thus began the reef shark fishery in earnest. Gillnets, longline and handlines were used to target reef sharks. Silvertips (*Carcharhinus albimarginatus*), grey reefs (*Carcharhinus amblyrhynchos*), black tip reef shark (*Carcharhinus melanopterus*) and white tip reef sharks (*Triaenodon obesus*) dominated the catch. Reef sharks were targeted for their fins and meat which were sundried and exported to the Southeast Asian markets (Anderson and Ahmed, 1993). Since species-specific catch data was never obtained, it was difficult to estimate the amount of catch contributed by the reef shark fishery (Sinan *et al*., 2011).

Oceanic shark fishery

With the development of more efficient fishing methods, oceanic sharks were targeted using longlines and handlines. Silky sharks (*Carcharhinus falciformis*) and silvertips (*C. albimarginatus*) dominated the catch in some parts of the Maldives (Anderson and Ahmed, 1993). Likewise the reef sharks, oceanic sharks were also targeted for their meat and fins. Massive oceanic sharks' jaws were also taken and dried as they made an attractive souvenir for the tourists (Anderson and Ahmed, 1993).

Conflicts with other stakeholders

Reef shark fishery and tourism

Tourism is the chief contributor to the country's GDP. A survey in 1990 showed that the majority of tourists (70%) reported that the marine environment was their main reason for enjoyment and 38% took part in snorkeling while 18% reported their main purpose of visit was for diving (Sinan *et al*., 2011). There are over 98 tourist resorts most of which have a dive centre and with the number of liveaboards on rise, there is increasing focus on dive tourism. For many tourists, the most significant part of diving is to experience the marine mega fauna; hence there is growing interest among divers in watching larger fish such as sharks and manta rays. Grey reef sharks (*C. amblyrhynchos*), white tip reef sharks (*T. obesus*), and scalloped hammerheads (*Sphyrna lewini*) are among some of the most watched sharks of the Maldives (Anderson and Ahmed, 1993).

Anderson and Ahmed (1993) estimated the total annual revenue from shark watch dives to be 2.3 million US dollars. A single grey reef shark (*C. amblyrhynchos*) living in its habitat generated 3300 US dollars per year as revenue while the same shark killed for its fins and meat generated only about 32 US Dollars. Hence, a reef shark alive can be assumed to be 100 times more valuable than the same shark killed in need of its fin and meat. While the total annual revenue from shark watching was estimated to be 2.3 million US dollars, the total revenue from the reef and oceanic shark fins exports combined was estimated to be 1.7 million US dollars. Anderson and Ahmed (1993) implied that if the annual revenue from the reef shark fishery was assumed to be 0.5 million US dollars, then reef shark fishing generated only a quarter of the earnings generated by reef shark watching per year.

With recognition of the importance of diving to tourism, 15 important dive sites, which included prominent shark watching sites, were declared as marine protected areas in June of 1995. In the same year, the whale shark (*Rhinocodon typus*) being quite a remarkable sight to see, was also declared a protected species. Even with increased awareness

on the importance of reef sharks to the tourism industry, reef shark fishing continued in the central atolls which were important tourism zones. In 1998, to conserve the reef sharks for the tourism sector, a 10 year moratorium on all types of shark fishing was declared in seven atolls which are important tourism zones (Sinan *et al.*, 2011).

Oceanic shark and tuna fisheries

Tuna fisheries dominate the fisheries sector and are the second largest contributor to the economy. Pole and line tuna fishermen believed that sharks, particularly the association of silky sharks (*C. falciformis*) with the tuna schools, increased the tuna catch. Many tuna fishermen complained that taking sharks associated with tuna schools reduced the availability of tuna particularly from the fish aggregating devices deployed around the country. Due to the significance of tuna fisheries to the economy, several management measures on shark fisheries were taken to reduce this particular conflict. Shark fishing was banned during daytime in tuna fishing grounds, as well as around fish aggregating devices. Shark fishing around two seamounts was also banned as these are important tuna fishing grounds (Sinan *et al.*, 2011).

Status of shark fisheries

In the Maldives, as the tuna fisheries dominated the fisheries sector, little importance was given to collecting catch data on shark fisheries. As a result, no specific statistical information on shark catch was reported. As the shark fishery was a multi-species fishery and due to the lack of statistical information on sharks, assessments of shark stocks were never carried out. However, as the shark fisheries were completely export oriented, catch data was estimated from export data.

Deep water benthic shark fishery

Exploitation of deep water gulper sharks began in the early 1980s (Anderson and Ahmed, 1993; Sinan *et al.*, 2011). Gulper shark catches were highest in the early years of the fishery and reached a peak between 1982 and 1984 (Fig. 1). The sharp rise in the gulper shark catches was due to high price fetched from squalene rich liver oil of gulper sharks, which attracted many fishermen to the fishery (Anderson and Waheed, 1999). After the fishery peaked in between 1982 and1984, the gulper shark catches started showing significant declines (Sinan *et al.*, 2011).

The sudden decline could be because gulper sharks live in deep, cold waters with limited food supply, which makes them have slower growth and reproduction rates than most shallow water sharks. This increases their vulnerability to overfishing (Anderson and Ahmed, 1993). Further the usual depth ranges inhabited by the gulper sharks of the Maldives are very narrow, limited to the deep outer slopes of atolls. With this small habitat, the gulper sharks stocks would be relatively small. Thus, gulper sharks stocks were not able to withstand the increased exploitation rates (Anderson and Ahmed, 1993). From the anecdotal information from fishermen it was deduced that gulper shark catch had reduced to 50% within a few years of starting of the fishery. Fishermen usually fished for gulper sharks at 200-300 m, but with declining catch, they had to fish deeper extending to depths of 600-800 m or even more (Anderson and Ahmed, 1993). By the 1990s, the gulper shark fishery had entirely collapsed, and only after 15 years, gulper shark exports have been noticed again, though at minor levels (MRC, 2009).

Reef and oceanic shark fisheries

Catch information for the oceanic and reef shark fisheries were estimated using the export data of shark fins. As sharks

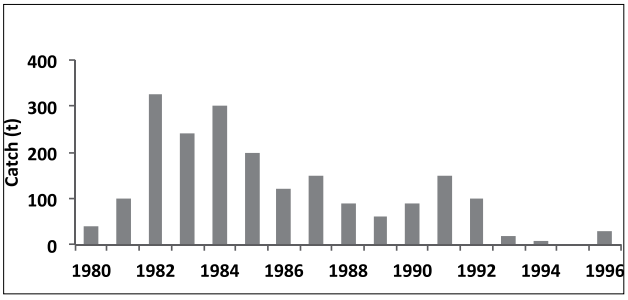

Fig. 1. Estimated annual catches of deep water gulper sharks (Anderson and Waheed, 1999)

were not used for local consumption, it was assumed that the whole shark catch was exported (Anderson and Ahmed, 1993; Sinan *et al.*, 2011)

Shark fin exports came from both oceanic and reef shark fishery. As a result, the catch estimated from export data were for the two fisheries combined. Prior to the late 1970s shark catch exports were approximately about 500 t. By the late 1970s there was steep increase in shark exploitation (Fig. 2). Widespread motorization of boats, new fishing techniques and major developments on trade were the factors that escalated the exploitation of sharks (Anderson and Ahmed, 1993; Sinan *et al.*, 2011).

From 1975, shark catches showed a significant increase, and by 1980 the shark catch reached 1900t. During 1977-2008, the average annual shark catch was about 1400t, with 1000-2000t variations in between the years (Fig. 2). The drop and rise in shark catch could be due to the demand for the shark products in the export market (MRC, 2009).

Due to the reduction in gillnet fleet for reef sharks and the increase in longline fleet for oceanic sharks, after the late

1990s, most of the shark catch was believed to be contributed by the oceanic shark fishery (Anderson and Waheed, 1999). By the early 1980s, reef shark stocks of the northern atolls of the Maldives were reported to be over-fished. Within a few years of starting of the fishery (late 1970s-early 1980s) the reef shark catch had declined significantly (Anderson *et al.*, 2011). Kulhudhu'ffushi, a well-known shark fishing island in the northern Maldives, resorted to offshore shark fishing, after experiencing significant declines in their reef shark catches. And till then, Kulhudhu'ffushi fishermen were exclusively offshore shark fishermen. It was only recently and only during bad weather when offshore shark fishing was difficult, the Kulhudhu'ffushi fishermen started reef shark fishing. Reef shark catch was reported to be poor, in spite of those years of not exploiting the reef shark resources. Divers too reported very few sightings of reef sharks in northern atolls. Therefore, it can be deduced that the reef shark resources of northern atolls have not recovered (Anderson *et al.*, 2011). By the early 1990s, the tourism sector was deeply concerned over the diminishing shark sightings, while a review done by MacAllister and Partners (2002) suggested that reef shark stocks of the Maldives were over-exploited.

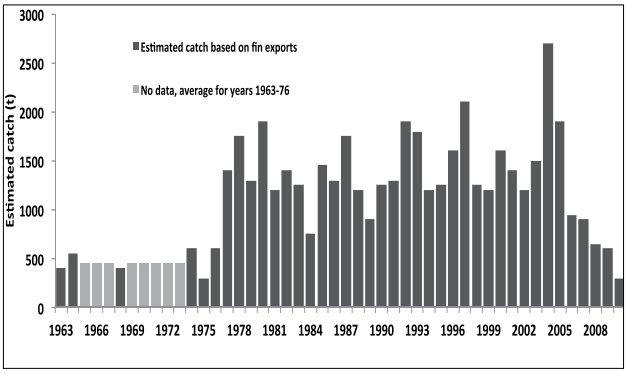

Fig 2. Estimated annual catches of reef and oceanic sharks (Sinan *et al.*, 2011)

After facing declining catches of reef sharks and near shore pelagic sharks within the early years of the shark fishery, the Kulhudhu'ffushi fishermen started to target oceanic sharks. The oceanic shark catch too started showing declines after 2000. The fishermen reported low levels of large silky sharks (*C. falciformis*) in their catch which forced them to venture further out for a reasonable catch (Anderson *et al.*, 2011).

A peak of 2700 t of shark catch was observed in 2004 (Fig. 2). After this, the catch declined considerably and by 2008, the annual shark catch was only about 700 t which approximately equaled to the level of shark fisheries in pre-commercial period. The significant decline after 2004 could be attributed to over-exploitation of shark stocks or could also be due to the reduction in fishing effort (Sinan *et al.*, 2011). The number of fishing vessels engaged in shark fishing from 1992- 2008 is shown in Table 1. For all the islands, the number of fishing boats has decreased over the years. In addition to the declining catch levels, low economic returns and other socio-economic reasons could have driven fishermen away from the fishery (Anderson *et al.*, 2011; Sinan *et al.*, 2011).

Anderson *et al.* (2011) reported that the number of younger men entering the shark longline fishery in Kulhudhu'ffushi was declining, and the shark fishing group was ageing. These issues were not confined to the shark fishery alone, but were affecting the entire fishing industry of the country (Anderson *et al.*, 2011).

Table 1 Shark fishing fleet during 1992-2008 from the major shark fishing islands (Sinan *et al.*, 2011)

Atoll/Island	1992	1998	2003	2008
Hdh. Kulhudhuffushi	10	80	45	10
R.Madduvari	41	22	10	2
R.Meedhoo	46	12	12	7
Adh.Dhan'gethi	12	5	7	6
AA.Himendhoo	20	12	9	9
F.Feeali	24	0	0	1
Th.Vilufushi	8	6	1	3
Total	161	137	84	38

Shark fisheries management

Since the emergence of shark fisheries, the shark fishermen were always in conflict with other stakeholders. Therefore, most of the management measures taken on shark fisheries were to address these conflicts. The measures taken to minimize the conflict with the tourism sector failed greatly as they did not resolve the issue of declining reef shark resources.

After the ten years moratorium declared in 1998 ended, the reef sharks stocks did not show substantial increase in abundance, which prompted new management measures. With huge lobbying from the tourism industry for a complete ban on shark fishing, in 2009 and with research suggesting decline in status of shark fisheries, MoFA took the decision to ban all types of shark fishing within 12 nautical miles from the outer atoll rims on all atolls of the Maldives (MoFA Iu'laan: FA-D/29/2009/20). Due to lack of monitoring, and difficulty in validating whether the shark fin exports were from oceanic sharks, it was decided that the best solution would be to impose a total ban. Moreover, as shark fishing was seen to be detrimental to the pole and line tuna fishery and the tourism industry, on March 2010, a year after the reef shark ban, the MoFA announced an indefinite total ban on all types of shark fishing in the whole Maldivian waters (MoFA Iu'laan: 30-D2/29/2010 /32).

Measures to minimize the impact of the ban

The undesirable impact of the ban on the fishermen had been highly debated even at cabinet level. Few months after the complete ban was announced, the cabinet decided to determine ways to facilitate other alternative income generating options for shark fishermen. Based on the perception that shark fishing was done only at a certain times of the year and the fishermen already had other income generating ways identified for periods of low fishing, instead of identifying and facilitating alternative livelihood options, a lot of attention was given to provide fishermen with compensations in exchange of their fishing gear. Therefore, a few months after the ban, MoFA initiated gear-buy-back schemes where fishing gear was bought at depreciated values. These values were determined based on the price of the fishing gear at the market at that time. From about 200 fishermen who applied for the scheme, 70% had received compensations and for 20% of the fishermen compensations were deposited to the respective island councils. To date only a few islands have not received compensations (Sinan and Ali, 2012).

In addition to the gear-buy-back scheme, to facilitate alternative income generating ways for the shark fishermen, MoFA opened a Shark Trust Fund on 2nd of June 2010. The tourism industry, the main beneficiary of the total shark ban was asked to contribute for the fund. In spite of more than 98 resorts located in the Maldives, only 2 resorts contributed to the fund (Sinan *et al*., 2011.)

Further, to assist the shark fishermen in establishing other income generating activities, the government decided to give priority to former shark fishermen in soft-loan schemes. At the time of the total shark ban in 2010, the Ministry of Economic Development implemented a MRF 5 million scheme, to provide compensations in exchange of shark products from the primary traders. (Sinan *et al*., 2011).

Issues affecting the implementation of the ban

Governance issues

Lack of trade - import and export ban on shark products

After the complete fishing ban, the most controversial issue was the lack of a trade ban as well as an import and export ban on shark products. Despite declaring sharks as a protected species, sale of shark jaws was still ongoing in most souvenir shops. The Fisheries Law of the Maldives (Law no. 5/87) provides for the conservation of living marine resources for a special purpose, but does not have provisions against trading of any marine species or protected marine species. Hence, albeit having announced a total ban on exploitations of sharks, this still did not ban the import, export and trade of shark products.

Following the announcement of the total shark ban by MoFA in 2010, in 2011 the Ministry of Housing and Environment (MoHE) announced a ban on capture, keeping, trade and harming of sharks under the Environment Protection and Preservation Act (EPPA). This manifested major conflicting issues between the laws and mandates of the ministries. Although biodiversity protection is well provisioned under the Environment Law, the responsibility of regulating the trade of any commodity and hence imposing trade bans on commodities comes under the mandate of the Ministry of Economic Development (MoED) under the Maldives Export and Import Law (Law no.37/79). Conflicts between the mandates of Ministries and the respective governing laws have greatly hampered the goals of management decisions and this was very evident in the case of shark fishery ban. Hence, in spite of having bought back MRF 5 million worth shark products from primary traders, even after four years of shark fishery ban, trade of shark products was still taking place. When species are protected for conservation purposes, it is essential that their trade be banned as well. In New Zealand under their fisheries management system, the laws that provide for bans have key statutory tools that ensure the conservation of protected species. The Wildlife Act of New Zealand provides ban of taking, trading and possessing all or parts of the marine protected species (NPOA NZ, 2007). Further, the Maldives is now a member of Convention on International Trade in Endangered Species of wild fauna and flora (CITES) and four species of sharks found in the Maldives, namely, the oceanic white tip (*Carcharhinus longimanus*), scalloped hammerhead (*Sphyrna lewini*), smooth hammerhead (*S. zygaena*) and great hammerhead (*S. mokarran*) are in Appendix 2 of CITES. For specimens in Appendix 2, an export permit is required by the relevant management authority and the permit is issued on the basis that the specimen was obtained legally (CITES, 2008). As the Maldives now has a fishing ban on sharks and is a member of CITES, there is an obligation to ban the export of shark products as well.

Lack of monitoring

Illegal shark fishing activities have been brought to MoFA's concern, but reported events are few. Complaints from the tourism industry on illegal shark fishing activities have been brought to the attention of MoFA, but so far most incidents have not been officially reported. Divers claim that illegal fishing for sharks was happening on a large scale, but such

claims are difficult to validate, as a large number of gear owners have sold their gear to the government under the gear buy-back scheme. Sharks caught and taken on board as dead are to be reported to a fisheries observer under the tuna longline fishery regulation. As the country does not have a fisheries observer programme, the fate of sharks caught dead as by-catch cannot be validated.

Socio-economic and ecological issues

No alternative livelihood options identified for former shark fishermen

When the 10 year moratorium on shark fishing in various tourism zones ended in 2008, divers were still unsatisfied with the number of reef sharks. Even with the moratorium in place, the divers complained about the declining number of reef sharks. There was huge pressure from the tourism sector to completely ban reef shark fishing. This called for an immediate management decision, where reef shark fishing got banned very abruptly. Hence, when the reef shark ban came into effect, neither were formal stakeholder consultations held, nor were alternative livelihood options identified for shark fishermen. And with the lack of monitoring of the ban and lack of awareness on conservation of sharks, many fishermen continued shark fishing even after the declaration of reef shark ban in 2009 (Sattar, 2010).

After the total shark ban, except for the gear buy-back scheme, little work was done to secure the livelihoods of fishermen. Most of the fishermen pursued other types of fishing. Most shark fishermen reported that shark fishing was easy and generated more income, while other types of fisheries such as reef fisheries, required more effort for the same level of income. In some islands, shark fishing was done seasonally, during calm weather periods, while in other islands, the fishermen were full-time shark fishermen, carrying out shark fishing throughout the year. From the interviews with former shark fishermen, it was found that in a few islands, shark fishing was their main livelihood. In the islands, there are very little employment opportunities, and as most islanders are engaged in some type of fishing activity, it was not easy for the shark fishermen to give up their livelihoods. Many shark fishermen after the ban went to reef fishing right away. For many, reef fishing generated lower economic returns compared to shark fishing. Being exclusively involved in fishing for years, most are reluctant to take up any other activity than fishing. Many oceanic shark fishermen's concerns were that the oceanic sharks such as the silky shark (*C. falciformis*), which should not have had any conflict with the tourism sector, still got banned, forcing them to give up their livelihood. Some former fishermen claimed that at the time of the ban, the government promised some sort of commission for the fishing islands from the tourism sector but no such thing manifested after the ban. A lot of fishermen felt they were neglected after the ban, and the compensation provided by the government for the gears they owned, were insufficient to start a meaningful alternative income generating activity. The majority of the fishermen interviewed reported they were not aware of soft-loan scheme by government where the shark fishermen were given priority.

Complaints of increasing shark nuisance by reef fishermen

During interviews with former shark fishermen who have now taken up reef fishing, complaints were received on increasing interactions with sharks. Fishermen complained on depredations caused by sharks. Many complained that sharks were becoming a nuisance to them, as along with their catch, hooks and weights were lost. Similar complaints were received during interviews with reef fishermen. Contrary to fishermen's sayings, divers still report that sharks have not shown a significant increase in abundance. Further, as sharks in general are slow growing with low reproductive output, it is hard to perceive that sharks could show such an increase in abundance within four years into the ban. Fishermen's complaints are based on the increasing nuisance of sharks, hence this may not necessarily imply an increase in abundance of sharks. Nevertheless, such complaints cannot be neglected and needs validation, hence further studies need to be carried out to determine the cause of increasing interactions with sharks in the reef fishery

Conclusion

The shark fisheries were a minor fishery and had only a minor impact on the economy of the country. The country's economy is heavily dependent on the tourism sector, and reef sharks were seen to be an invaluable asset to the dive tourism industry. Although stock assessments on sharks were lacking, the declining status of shark fisheries and concerns over the decreased shark sightings, prompted the government to take the precautionary approach to conserve the shark stocks and announce a total ban on shark fisheries.

One of the greatest issues undermining the effective implementation of the shark ban, was due to the fact that all necessary institutional arrangements were not in place when the fishing ban was declared. A fishing ban proved to be insufficient in preventing the trade of shark products. Lack of ban on import and trade of shark products could also be taken as incentives for illegal shark fishing, hence, when a species is given full protection for an indefinite period, it is essential that its trade, export and import be banned as well. Another major issue was the lack of formal stakeholder consultations prior to the ban. When such a complete ban is imposed, it is

imperative that stakeholders are well consulted, to provide negotiations on conflicting matters and identify and agree upon strategies prior to implementation, in order to to protect the rights of all parties involved. If this had been carried out, the Shark Trust Fund would have seen more ownership from all stakeholders. Prior to declaring the complete ban, to secure the livelihoods of fishermen, a formal analysis of alternative livelihood options should have been done or a longer phase out period should have been given for the fishery which would have provided ample time for the fishermen to move to another livelihood.

For such total indefinite ban to be successful, commitments are needed from all stakeholders including the government. Without regular monitoring of the ban, the shark ban cannot be a success. Monitoring work like the observer programme is very essential, in terms of verifying the shark by-catch. Furthermore, this would also meet international obligations.

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