



A global overview of shark sanctuary regulations and their impact on shark fisheries



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ABSTRACT

Due to rapid declines of shark populations across many species and regions of the world, the need for large-scale conservation measures has become widely recognized. Some coastal states have opted to implement ‘Shark Sanctuaries’, which prohibit commercial shark fishing and the export of shark products across large areas, typically their entire Exclusive Economic Zones. Although shark sanctuaries cover almost as much area globally as marine protected areas (MPAs), their success has yet to be evaluated. Here, key features and regulatory details for eleven shark sanctuaries (covering 3% of global ocean area) are summarized, highlighting their commonalities and differences. Catch data are then used to shed light on the impact current shark sanctuaries could have on shark catch, foreign fleets, trade and abundance. Based on this comparative analysis, recommendations are made to implement program evaluation measures within existing and future shark sanctuaries that would explicitly outline goals and measures of success or failure. In summary, although shark sanctuaries may have the intended effect of reducing shark mortality, there appears a need to address bycatch within shark sanctuary regulations, and to collect baseline data that can be used to monitor sanctuary effectiveness.

1. Introduction

Many shark populations have undergone rapid declines [1–3], leaving numerous species threatened with extinction [4] and large areas depleted of sharks despite former abundance [5–7]. The primary cause of these declines is overexploitation [4] – both targeted and incidental, i.e. via unintended bycatch, such that present rates exceed population rebound rates in many regions [8,9]. Other substantial drivers of decline include habitat degradation, persecution and climate change [4]. Slow life history characteristics also mean that recovery can be slow, even where strong conservation strategies exist, and few depleted populations show signs of recovery [10]. Although the type and degree of threat differs by region and species, the primary driver behind targeted shark fishing has been for fins, which fetch a relatively high price [11]. Because fins are more valuable than carcasses, there is economic incentive to keep only the fins and discard the rest, called ‘shark finning’. In this way, even small boats catch and land a large number of shark fins before having to offload their catch, which exacerbates overexploitation. Although fins remain highly valued, expanding markets for shark meat have also contributed to an increase in targeted shark fishing [12].

In response to this myriad of issues, a number of conservation strategies have been implemented to curb overexploitation. For exam-

ple, shark finning prohibitions are widely used, but often lack enforcement, or contain loopholes [13–15]. Shark fin bans make it unlawful to possess, sell, trade, or distribute shark fins (e.g., in Hawaii, Oregon, California; regulations available at <http://www.sharkdefenders.com/p/shark-conservation-laws.html>) but have limited spatial extent and do not address shark bycatch or transshipment. More multifaceted rules, such as quotas, trip limits and size restrictions, aim to protect sharks for long-term sustainable use, but these are generally part of more complex rules, and compliance can be a challenge (http://www.fisheries.noaa.gov/sfa/hms/compliance/guides/documents/rec_sharks.pdf). Protected areas (e.g., marine protected areas) that protect many species, including the special case of shark reserves (e.g., Fiji's Shark Reef Marine Reserve and the Raja Ampat Shark Sanctuary) provide ecosystem-based approaches to conservation that can protect sharks [5,16], but are not typically large enough to cover the movement of many shark species through their lifetimes [17]. And, very recently, the Port State Measures Agreement went into force, which aims to tackle all forms of illegal, undocumented and unreported (IUU) fishing, including for sharks (<http://www.fao.org/port-state-measures/background/en/>).

To be effective, conservation strategies such as those mentioned above, require dedicated resources. At a minimum, educational programming (e.g., of the regulations, spatial boundaries, and species identification), monitoring for compliance on- and offshore, and

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enforcement, including the time to follow through with penalties in the case of non-compliance are essential [18,19]. As well, to enable sustainable shark fishing, adequate in-situ species-specific population data, scientific expertise, and complete and accurate reporting amongst fishers are needed to set science-based sustainable catch limits. Establishing each of these can be a challenge for many states, especially for those with expansive and remote ocean territories, small human populations, or significant fishing by foreign fleets.

Additionally, some individuals in the commercial shark fin business have been found to be persistent in their search for unexploited and unprotected shark populations to meet demands and will exploit policy loopholes, as well as fish illegally [8,13]. Some fin distributors have readily acknowledged their role in the diminished status of shark populations, admitting that these declines increase profit margins – stating that they still hold on to basking shark fins despite their current value because “they’ll be worth more when they are extinct” (CWP personal observation). As such, global exploitation and threat risk to sharks remains high [4,8] and IUU shark fishing remains a global threat [12].

In light of these challenges, alternative shark conservation tactics may be needed to match local threats and needs, as well as available data and resources. The details of these policies may also encompass community values and traditions, which can determine whether more or less severe rules and penalties are implemented. As a prominent example, a number of jurisdictions have implemented bans that specifically prohibit the targeting and retention of sharks and shark parts within entire Economic Exclusive Zones (EEZ). These so-called ‘Shark Sanctuaries’ vary in detail (Table 1, 2), but all prohibit targeted commercial shark fishing at a minimum, and intend to make it unlawful to possess, sell, or trade sharks or their parts (<http://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2016/03/shark-sanctuaries-around-the-world>).

Although the first shark sanctuary was only established in 2009 in Palau, shark sanctuaries have already been criticized as a conservation tactic. These concerns include being limited to states with certain socioeconomic features (e.g., dependence on dive tourism), insufficient enforcement, overexploitation and degradation of other resources not included in the shark sanctuary regulations, and diversion of resources from other fisheries management and conservation measures [20–22]. In response to these criticisms, it has been argued that this type of moratorium can in fact be more easily be enforced than other conservation tactics through trade export monitoring, and effectively prevents overexploitation [23].

Here, the key features of eleven current shark sanctuaries and the regulations that comprise them are summarized, highlighting commonalities and differences. The impact these sanctuaries may have on shark catch, foreign fleets, trade and abundance are then investigated using historical reconstructed catch data obtained from the Sea Around Us Project [24], which include officially reported catch data with best estimates of both landed and discarded catch. Finally, recommendations are made for improved program evaluation within existing and future shark sanctuaries.

2. Current shark sanctuaries

At the time of writing, eleven EEZs were considered ‘Shark Sanctuaries’ (Tables 1, 2, Fig. 1). These large-scale regulations have been enacted as independent laws, amendments to national fisheries acts, or as declarations – herein called ‘regulations’. The first national shark sanctuary was declared in 2009 by Palau. Since then, ten others have followed, with the most recent being enacted by the Federated States of Micronesia in 2015. Although St. Maarten, the Cayman Islands, Curacao, and Grenada have also recently (June 2016) declared that they will close their EEZs to commercial shark fishing, details have not yet been made public. The total area covered by existing shark sanctuaries is 15,610,219 km², which equates to about 3% of the

world’s ocean area. The total shelf area is 345,466 km², representing about 2% of the total shark sanctuary area. The vast majority (88%) of shark sanctuary area is in the tropical Pacific, covering a total of 13,742,401 km² including the Republic of Palau, the Marshall Islands, French Polynesia, the Cook Islands, New Caledonia, and the Federated States of Micronesia. The Caribbean has the second largest area including Honduras, the Bahamas and the British Virgin Islands, covering 951,807 km². The Indian Ocean has a total of 916,011 km² sanctuary area, all within the Maldives.

Current shark sanctuaries occur across a wide range of geographic, social and economic settings (Table 1). For example, two sanctuaries were declared by sparsely populated island nations – with < 25,000 people in the Cook Islands and Palau – while Honduras has more than 8 million people, and the Maldives have one of the highest population densities in the world [25]. The number of people per square kilometre of ocean territory ranges from fewer than 0.1 in half the sanctuaries to almost 40 in Honduras [25]. Although diverse in many aspects, sanctuaries have so far been enacted in coastal states with medium to high inequality-adjusted human development indices [IHDI; [26]] and developing economies [27]. These states tend to have relatively high life expectancy, education, and income per capita, but often have only limited resources for science, monitoring, and enforcement.

Important industries across shark sanctuaries include fishing, fish processing, transshipment, and tourism, and shark meat is listed as a top commodity in French Polynesia (as of 2013, Table 1). Tourism ranks among the most profitable industries for most shark sanctuaries, except for Honduras and New Caledonia. The type of tourism is not specified; however, an Internet search showed that there are dive shops in all sanctuaries, but that there are fewer than 10 in most (Table 1). Although shark dive tourism is economically valuable [see [28]], the prevalence of dive tourism does not appear to be a strong common thread, suggesting that each state has unique motivations for implementing a shark sanctuary.

3. Details of shark sanctuary amendments

The details of shark sanctuary policies importantly determine the extent to which a shark sanctuary may protect, or rebuild shark populations. With the exception of making commercial shark fishing illegal and banning the sale of shark products, the details vary widely (Table 2). Some of the regulatory documents are extensive (47-pages in the Marshall Islands), while others are short 2-page summaries (French Polynesia and New Caledonia). There are differences in the reasons provided for implementing a shark sanctuary, specification or severity of penalties, exemptions for some species or some fishers, inclusion of rays and chimaeras, treatment of bycatch or transshipment, among others. Differences in the details of the regulations may be due to the government’s priorities, individuals within the government organization, existing fishing regulatory structure, political realities (e.g., corruption, stakeholder influence), difference in perceived regional need, social and cultural considerations, among others. Ideally, the language and details also evolved to incorporate knowledge of lessons learned from previous sanctuary designations.

Table 2 summarizes details of the regulatory documents, highlighting some of the commonalities and differences. Below, is summary of each descriptor listed in Table 2, with a few excerpts to provide context to what may or may not be included. Note that these comments and quotes are not exhaustive and readers are referred to the original sources for details (found at <http://www.sharkdefenders.com/p/shark-conservation-laws.html>).

3.1. Reasoning

Reasons for choosing a shark sanctuary as a conservation strategy are outlined in five of the regulatory documents, and these vary from general terms regarding global concern for sharks, to local concerns for

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