

Sawfishes: Can We Save One of the World's Most Endangered Group of Marine Fishes from Extinction?

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Introduction:

In today's rapidly changing world, hearing about a species on the precipice of extinction is no longer news. Anthropogenic impacts, from climate change to habitat destruction, has put species across the globe on a rapid trajectory towards mass extinction (Ceballos et al., 2015). Of particular susceptibility is sharks and rays, a group whose often slow-growing populations are subjected to explosive fishing pressures and overexploitation that have only increased over the past few decades (Pacoureau et al., 2021). About three quarters of species within the sharks and rays are facing extinction, with a 71% decline in abundance since 1970 (Pacoureau et al., 2021).

Sawfishes (not to be confused with the sawshark) are rays and are considered to be one of the world's most threatened group of oceanic fishes (Dulvy et al., 2016; Poulakis & Grubbs, 2019). The sawfish family consists of 5 distinct species: the largetooth sawfish (*Pristis pristis*), the smalltooth sawfish (*Pristis pectinata*), the green sawfish (*Pristis zijsron*), the dwarf sawfish (*Pristis clavata*) and the narrow sawfish (*Anoxypristis cuspidata*) (Yan et al., 2021). The first three of these species are considered critically endangered by the International Union for Conservation of Nature (IUCN), while the latter two are listed as endangered (Yan et al., 2021).

What is a Sawfish?

Sawfishes are easily recognizable fishes. As can be seen in Figure 1, the sawfish's most iconic feature is their long saw-like rostrums that are studded with sharp teeth (Dulvy et al., 2016). The rostrum is designed to detect and locate prey electromagnetically, and once targeted, incapacitate them by slashing, striking or impaling prey using the saw (Wueringer et al., 2012). Sawfishes are also large-bodied, and are known to be one of the largest groups within the rays (Dulvy et al., 2016).

Sawfishes are distributed across the globe and spend most of their time in shallow, coastal regions as can be seen in Figure 2 (Dulvy et al., 2016). Consequently, sawfishes are also typically found within threatened ecosystems like seagrass beds, estuaries and mangrove forests, all of which are associated with coastal habitats (Dulvy et al., 2016). Telemetric data has also shown that some young sawfishes often use habitats like estuaries and mangrove forests as nursing grounds (Dulvy et al., 2016; Poulakis et al., 2013).

In terms of life history, most of the sawfish species have slow rates of population growth and sexually mature at later ages (Dulvy et al., 2016). Furthermore, they can have anywhere from 1 to 20 young per reproductive event depending on the species (Dulvy et al., 2016). These characteristics are why the sawfish is particularly susceptible to high fishing pressures, as their populations are very slow to recover from overfishing (Yan et al., 2021).

The Impact of Fishing Pressures on the Sawfish:

As hinted at previously, the major threat facing the sawfish is human exploitation and high fishing pressures (Yan et al., 2021). Firstly, the long rostrum of the sawfish is easily entangled in fishing wire and fishing nets, thus making them vulnerable to bycatch (Hossain et al., 2015; Seitz & Poulakis, 2006). Once caught, many fishers are incentivized to keep and sell them because sawfishes are one of the most valuable fishes in the wildlife trading market, despite the fact that international trading of the sawfish has been banned since 2007 (Dulvy et al., 2016; Yan et al., 2021). For example, their fins are commonly harvested for shark fin soup, their rostrums desired as a collectable item, and their rostral teeth used as spurs for cock-fighting (Dulvy et al., 2016; Yan et al., 2021).

One study in Bangladesh surveyed local fish markets, sawfish specialists, fishers, traders and other locals to determine the frequency of sawfish encounters, how they were caught, if they were retained and if so, for what reasons (Hossain et al., 2015). From this information, they hoped to understand what sawfish species were present along the coast of Bangladesh, particularly because the country has many estuarine and mangrove habitats suitable for sawfish juveniles, and whether those sawfish species were in decline (Hossain et al., 2015). From the data they collected, it was determined that sawfish were most frequently caught as bycatch in drift gillnets by fishers, although sawfish encounters within the past 25 years had declined (Hossain et al., 2015). Furthermore, despite the fact that sawfish are protected under wildlife legislation in Bangladesh, their high market value prevented many fishers from returning them to the water once caught (Hossain et al., 2015). In rural communities, many people believe that the sawfish has medicinal properties, and thus buy sawfish to make medicines, and some sawfish fins were found to be illegally traded to China (Hossain et al., 2015). Sawfish fins, amongst other parts of their body, can be priced anywhere from \$300 to over \$1000 USD (Dulvy et al., 2016; Hossain et al., 2015). In other regions of the world, sawfish can be caught in larger numbers via commercial fishers, and there have been reports of fishers cutting off the valuable rostrum of the fish before releasing it back into the water, an act that likely decreases their ability to forage and survive (Morgan et al., 2016; Poulakis & Grubbs, 2019)

Fishing pressures as described above, amongst other threats like habitat loss and pollution, has led to extreme declines in sawfish abundance (Dulvy et al., 2016). A recent study modelled the likelihood of sawfish extinction in certain regions and found that historically, sawfishes were present in the waters surrounding 90 countries, but have now gone locally extinct in about half of those nations (Yan et al., 2021). Furthermore, they found extinction probability is greatest in nations where there are high levels of fishing, poor habitat quality and poor fishery management, as can be seen in Figure 3 (Yan et al., 2021). To truly understand this impact, the researchers set the death's by fishing parameter in their model to 0 in countries with high extinction probabilities to see how these likelihoods would change (Yan et al., 2021). They discovered that without any sawfish deaths by fishing, the likelihood of extinction dropped dramatically in certain regions, and resulted in a 20% decrease in sawfish extinction likelihood worldwide (Yan et al., 2021). This model exhibits clear evidence that fishing pressures largely impacts the ability of sawfishes to survive and persist in their natural environments.

Conservation Strategies:

Despite these harrowing prospects, there is still hope to save sawfish populations from extinction, although this will require a multi-faceted nation-by-nation approach (Yan et al., 2021). In 2014, the IUCN created the Global Sawfish Conservation Strategy which outlined a variety of steps which should be taken to protect sawfish populations (Harrison & Dulvy, 2014). Outlined here are a few proposed steps that could be taken to help sawfish populations recover.

Firstly, it is widely known that sawfish conservation must begin on a more local level, especially because it intersects with social issues within communities and because sawfishes have significant cultural importance in certain regions (Leeney & Poncelet, 2015; Poulakis & Grubbs, 2019). Additionally, traditional ecological knowledge of local fishers is integral to many studies when it comes to understanding sawfish distribution and human impacts upon their populations (Dulvy et al., 2016; Leeney & Poncelet, 2015; Poulakis & Grubbs, 2019; Seitz & Poulakis, 2006). As a result, it is clear that fostering relationships between conservationists, scientists and local communities will be key to prevent people from retaining sawfishes if they are accidentally caught. A conservation strategy which could be successful in doing this would be the implementation of “pay for release” policies, in which local fishers who accidentally catch a sawfish are incentivized to release them via a monetary payment provided by a conservation authority, government or other agency, provided that proof of release is presented (Leduc & Hussey, 2019). Pay for release policies may be useful in the case of the sawfish because when caught in fishing nets, they can be released back into the water alive (Leduc & Hussey, 2019). These policies, combined with local outreach and educational programs, may be able to garner local community interest and active involvement in sawfish conservation programs.

Another solution to relieve fishing pressures upon the sawfish would be to establish legal protections on catching, selling and trading sawfish (Yan et al., 2021). Some countries have already enacted strict legislative measures to protect the sawfish from fishing pressures. More specifically, the United States and Australia are called “lifeboat nations” for their resident sawfish species because they have created strict protective legislation to prevent sawfish fishing (Yan et al., 2021). For example, once the smalltooth sawfish was listed under the Endangered Species Act in the United States, subsequent studies monitoring their recovery in Everglades National Park showed some evidence for increasing abundances within their populations (Carlson et al., 2007).

Secondly, protecting areas of critical habitat such as nurseries by creating marine protected areas (MPA’s) may be useful in protecting mobile species like the sawfish (Knip et al., 2012). As mentioned previously, research has shown that juvenile sawfish can spend up to the first three years of their life in nurseries that are nested within mangrove forests or estuaries (Norton et al., 2012). One study examined how two coastal shark species used MPA’s in Australia via acoustic telemetry techniques (Knip et al., 2012). The results showed that they spent around over 20% of their time on average within an MPA, although this varied by species and on a seasonal and individual basis (Knip et al., 2012). Although there has been no studies specifically looking at the efficacy of MPA’s on recovering sawfish populations, the authors of

the previous study comment that MPA's which protect both adult and juvenile life stages may yield greater protective benefits to that species (Knip et al., 2012).

Figures:



Figure 1: A sawfish swims through an aquarium in this image. Note the rostrum, which resembles a long extended “saw” that gives this fish its name (Source: Ripley’s Aquarium, 2019).

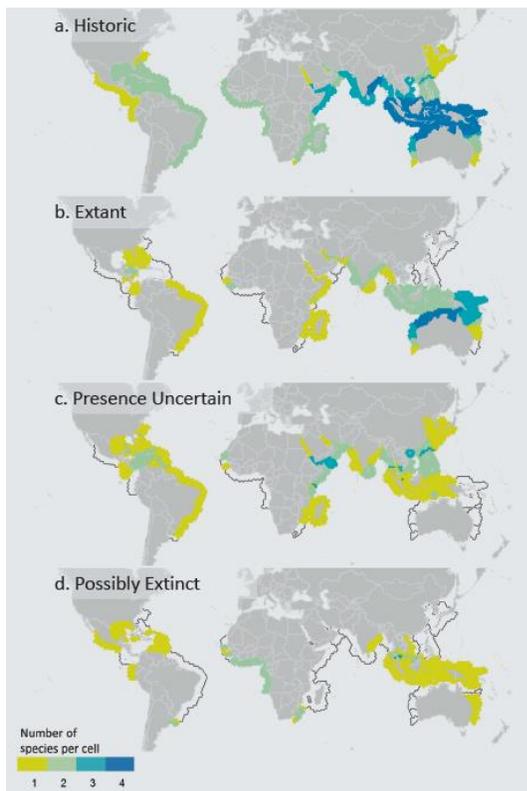


Figure 2: This map displays the potential distributions of each sawfish species and displays their historical ranges (A), current predicted ranges (B), areas where their distribution is unknown (C), and areas where they are estimated to be extinct (D) (Harrison & Dulvy, 2014).

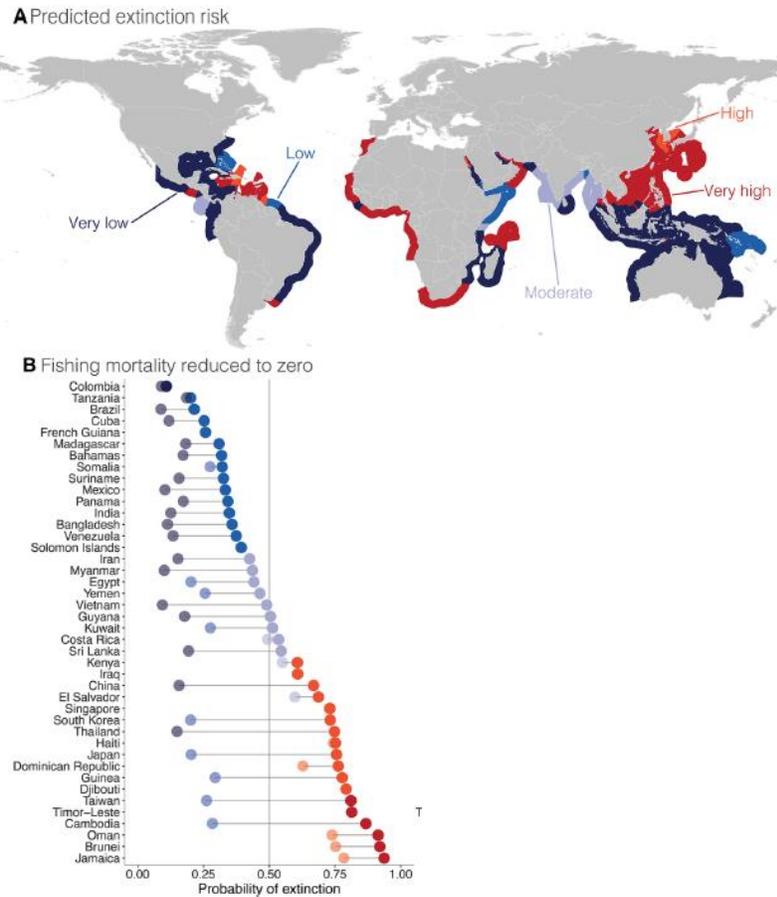


Figure 3: This figure shows calculated global extinction risks for sawfish populations across the globe (A) and demonstrates how the likelihood of extinction for sawfishes can potentially decrease by nation if their deaths by fishing was marked as 0 in the researcher’s model (B) (Yan et al., 2021).

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