

Bloody Waters: Shark, ecosystems and tourism in coastal North America

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Introduction

Sharks are consistently vilified as a dangerous threat around the world, but the global scale of the cruel practice of shark finning makes it seem more appropriate to call sharks the threatened. With the shark fin being by far the most valuable part of the shark body, fishermen prefer to cut off a shark's fins and throw the live shark back into the water to either: bleed to death, drown, or be eaten alive by other fish (Figure 1). With roughly seventy million sharks being caught annually, this problem becomes a global issue, affecting many ocean ecosystems (Myrick & Evans, 2014). Decreasing shark populations have a direct effect on eco-tourism businesses that try to guarantee shark sightings for tourists. Eco-tourism can reduce people's fear of sharks and help the public realize how important they are in ocean ecosystems. Part of what makes the shark fin so valuable is its necessary use in the traditional Chinese dish, shark fin soup. This dish is deeply rooted in Chinese tradition as a way of expressing generosity to guests. Convincing the public to help protect and preserve all shark species continues to be a challenge largely due to the negative reputation of sharks as "violent killers" that the media continuously establishes (Myrick & Evans, 2014).

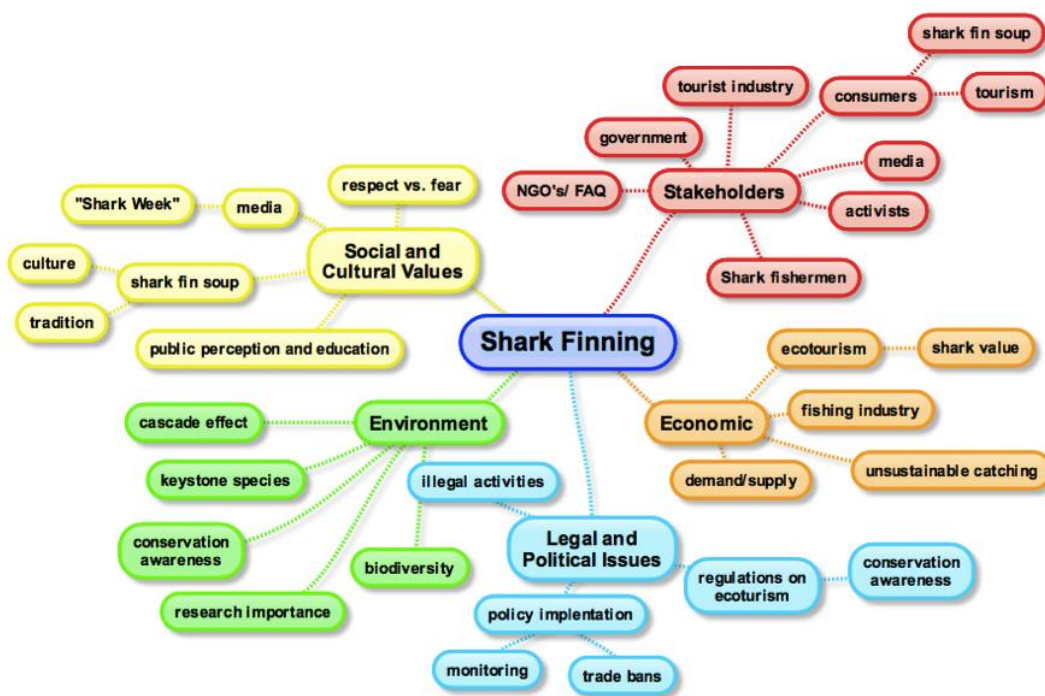


Figure 1. Shark fins have been cut from the main part of body, drying in Macau, China (Wang, 2011).
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Framing the problem

The overfishing of sharks is a wicked problem, meaning that it is a complex issue, which is hard to solve due to its multiple views, unique qualities, persistency, instability and uncertainty.

First of all, there are different stakeholders involved. Consumers create a market for shark products. Shark fin soup is a long-standing tradition in China, therefore there is a high demand. Over the past two decades the value of shark landings has drastically increased (Musick & Musick, 2011). Removing the shark fins from the body while at sea allows the fishermen to store shark fins in an efficient way. On the other hand, people involved in ecotourism, conservation, or research are interested in maintaining and growing shark populations. The problem is made more difficult by the way the public views sharks as dangerous and frightening predators. Because of this widespread fear that people have of most shark species, funding for conservation and research of these species is incredibly difficult to accumulate (Myrick & Evans, 2014).



Mental map of the shark management problem

Laws have to be made on an international level, with emphasis on coastal nations implementing local laws, which protect shark populations. Furthermore, a large proportion of the world's ocean "lies outside of national jurisdiction limits; no one state has the power to impose rules and restrictions or implement integrated conservation efforts, leaving much of

the open ocean virtually unprotected” (Dick & Jefferies, 2013). The geographical vastness of oceans makes monitoring shark populations and catches a strenuous task.

Furthermore, there is a gap in shark finning data. The numbers of sharks killed each year might be higher than United Food and Agriculture Organization suggests (Techera, 2011). This is the case because it is difficult to monitor catches, specifically targeted species, if the fins are not attached to the body. Also, the fact that sharks can be highly migratory species implies that several jurisdictions would need to coordinate to be effective (Techera & Klein, 2011). Illegal fishing that leads to unreported catches further complicates the situation. There is also a gap in knowledge regarding what roles sharks have in the ocean and the importance of a shark may vary depending on the region.



Figure 2. A bowl of shark fin soup (Donovan, 2010). Used under Creative Commons Attribution-NonCommercial-ShareAlike 2.0 Generic license (<http://creativecommons.org/licenses/by-nc-sa/2.0/>)

The issue's persistence may be found in the idea that there will always be ethical issues surrounding shark treatment globally and regionally. Humans want to benefit from sharks in some way or another, but agreeing on what the most morally sound method of drawing this benefit will always be difficult to achieve.

The diversity of stakeholders, economic incentives, market fluctuations, environmental impacts and conservation perspectives implies that debate and instability will play a role in the evolution of the problem.

Governance Framework

In order to report on the decision-making process and responsible actors in shark fishing regulation, it is useful to analyze different levels of jurisdiction and governance. International agreements, national and provincial legislation, non-governmental organizations (NGOs), and consumer ideologies often related to cultures all play a dominant role in influencing the global impact of overfishing on shark populations.

International agreements are important tools in setting global standards for countries to adopt and report on. The United Nations Convention on the Law of the Sea (UNCLOS) is a widely accepted, legally binding legislation that defines several boundaries and establishes

restrictions on economic activity based on sovereignty (Biery & Pauly, 2012). The Convention on the International Trade in Endangered Species and Wild Fauna and Flora (CITES) focuses on protecting 8 endangered shark species through monitoring of trade in these species and implementation of import and export licences (Sybersma, 2015). The Convention on the Conservation of Migratory Species of Wild Animals (CMS) strives to protect shark species throughout their migratory range in order to maximize conservation efforts between countries (Convention on the Conservation of Migratory Species of Wild Animals, 2015). Regional Fisheries Management Organizations (RFMOs) are international organizations composed of countries with fishing interests in a particular area. They play an important role in controlling shark finning and fishing through quotas and high sea vessel regulation (Dick & Jefferies, 2010).

When considering non-legally binding international agreements, the United Nations' FAO has established an International Plan of Action for Sharks (IPOA-Sharks), which delineates a set of standard objectives aimed at mitigating the impacts of exploitation on shark populations. Signing countries are incentivized to implement national plans in their waters whose values and objectives align with those of the IPOA-Sharks.

National and provincial legislations ensure a mutual reinforcement in levels of governance. National policies also play a critical role through regulating bodies to monitor and take action against illegal fishing activities (Sybersma, 2015). Provincial policies restrict specific fishing activities (recreational or commercial), thus aiding in reducing shark catches. Marine protected areas (MPA) are a legislative tool that promote conservation by restricting human activity.

NGOs such as the World Wildlife Fund, Wildlife Conservation Society, and Wild Aid are directly linked with consumer choices and behavior. NGOs are deeply invested in changing consumer behavior with the ultimate objective of reducing the demand for shark fins. Education on the negative impacts overfishing brings to shark populations and marine ecosystems, and the claims towards animal cruelty and welfare are commonly used mediums through social media. The "I'm Finished With Fins" campaign by Wild Aid's Shark Conservation Program has been successful in using a known celebrity to encourage decreased consumption of shark fins (Dell'Apa, 2014).

Consumer ideology and NGOs have a significant voice in influencing the values encapsulated in international, national, and provincial legislation therefore affecting the net effect of overfishing on shark populations.

Solutions

International Policies

Making IPOA-sharks a legally binding agreement. The IPOA-sharks is a voluntary piece of legislation that encourages states to create NPOA-sharks, with the aim of mitigating global fishery impacts on shark populations. The plan also incentivizes countries to improve data collection methods, including reported catches and trade data, (Sybersma, 2015) and to update NPOA-sharks every four years. While the number of signatories might suggest a successful implementation of NPOA-sharks, the non-legally binding nature of the agreement causes major disparities amongst national levels of success; these include different data collection methods, shark-catch reporting, and resources for the enforcement of objectives

(Dick & Jefferies, 2010). Because the agreement is not legally binding, there are also no sanctions in place to enforce levels of action or inaction. If the IPOA-sharks were to become a binding agreement, sanctions would incentivize countries to implement their national plans and to revise them every four years. Regulatory bodies could be established to ensure that conservation objectives are met by signatory countries. Unfortunately, there is little feasibility associated with such a change in structure of this agreement. The current dissonance in levels of compliance to the IPOA-sharks creates an uncooperative atmosphere that hinders the possibility of success in such a change. There is also the issue of conflicting values amongst nations with regards to shark perception and cultural practices. The resulting differences in worldwide shark fin consumption patterns decrease the feasibility of reaching success in international agreements.

Review of RFMOs to allow increased integration of shark populations into global conservation efforts. RFMOs are international organizations formed by countries with interests in fishing in particular areas. They have the potential authority of enforcing regulation on shark fishing and finning practices through fishing quota and promoting shark bans in the area they cover (Dick & Jefferies, 2010). Shark species are protected under RFMOs such as the International Commission for the Conservation of Atlantic Tuna whose primary objective is the protection of tuna populations. Sharks are thus considered as an incidental by-catch species in tuna fisheries (Tolotti et al., 2015). There is a need for RFMOs whose primary objective is the preservation of shark populations. The complementarity effect of CITES as an international regulative agreement on endangered shark species will contribute to mitigating fishery impacts while increasing the accuracy of data collections regarding shark populations.

Global network of MPAs. The rising concern with individual MPAs, with particular reference to shark populations, is the need to protect migratory species. A network of MPAs enforces cooperation between individual MPAs through strategic placement to accommodate migrating species; this reduces the need for one extremely large MPA and mitigates the impacts to fisheries (Tolotti et al., 2015). The expansion of the network to include the high seas has gained support by the International Union for the Conservation of Nature (IUCN) in light of protecting biodiversity and reducing illegal catching in unprotected areas. When discussing potential challenges to this solution, local livelihoods might be threatened in some regions due to increased regulation on fishing. Furthermore, challenges remain with regards to monitoring and controlling fishing activities in the high seas, but advancements in monitor and control (MCS) systems are promising (Tolotti et al., 2015) .

Chinese National Policies While many nations have the potential to improve their national policies regarding shark management, this section will specifically focus on China. The nation holds notable influence due to its large market for shark fins as well as relatively weak conservation policies.

Require sharks to be landed with the fins naturally attached. This addresses animal cruelty concerns while also facilitating better identification of the shark species being caught (Biery & Pauly, 2012). The prominent drawback, however, is the extra space needed on ships to accommodate the additional shark carcass. This may reduce overall shark kills, but may increase the price of shark fins. Because other nations have implemented similar policies, there is already a policy framework in place and results have been evaluated. The fin attached policy may be a powerful first step on the national level to reduce shark finning.

Re-evaluate current and future Chinese no-take MPA policy. MPAs utilize legislation to enforce various levels of protection to a defined aquatic area (Ma et al., 2013). Of the total 221 Chinese MPAs, 157 are no-take (Ma et al., 2013). Some of the remaining MPAs that prohibit fishing could be converted to no-take zones. Additional no-take MPAs would reduce the population pressure of overfishing and allow shark populations to recover. However, there is little information on how easy it is to convert a no-take MPA back into a fishing-permitted area. Creating barriers to this regression would promote the longevity of no-take MPAs. No-take MPAs may also encourage marine ecotourism to be established, promoting sustainable economic development.

All potential Chinese policies must be considered with respect to their historical fishery reporting. It was found that domestic fishing was over-reported, while fishing in international waters was underreported, likely for political reasons (Pauly et al., 2013). This indicates that the bureaucracy must be addressed if accurate shark finning reporting is to occur. Accurate reporting will be key to evaluating management policies over time for their efficacy.

Environment and Research

Research into shark aquaculture. Shark aquaculture would take the pressure off the wild living sharks. Many animals are farmed for food; doing this with sharks might be a good possible solution. However, certain problems would still remain. The aquacultures that already exist (for example salmon farms) have problems such as a high amount of waste, transmission of disease or escape and interaction with wild stocks (Asche et al., 1999). Those problems would probably be similar for shark farms. Furthermore, feeding sharks is very expensive. To make it economical, sharks must be sold more expensive than the ones caught in the wild. However, money could be earned not only by selling sharks but also by building the farm close to a tourist destination, so people can see sharks and rays. Another possibility would be having a special label; consumers who are interested in protecting the environment would be willing to pay more. With the help of social media or other campaigns it could be spread globally. Another benefit would be working together with an aquarium and a team of researchers. Sharks could be bred in captivity and then repopulated in reef areas. This would benefit marine ecosystems, and the tourism industry.

The living patterns of sharks still remain unclear and it is hard to count how many sharks are actually left in the ocean (Techera, 2011). There are still so many fields to explore, which will possibly take many more years of research. However, we have enough reasons for why sharks have to be protected from overfishing or cruel practices, such as shark-finning. We don't need more knowledge about that, what we need to do is to act now, with every possible solution.



Figure 3: An example of aquaculture (Unsplash, 2015). Used under Creative Commons Attribution-NonCommercial-ShareAlike 2.0 Generic license (<http://creativecommons.org/licenses/by-nc-sa/2.0/>)

Culture and Traditions

This section of the solution analyzes the effects of media and cultural traditions on sharks as well as the general attitude the public has developed towards sharks (see Holland, 2007). Despite television programs (for example, Shark Week) providing more statements about the low number of shark attacks in reality (see N.A., 2015), the footage that is shown in these programs still has caused viewers to become more fearful of them (Myrick & Evans, 2014).

Educate the public about the shark finning problem. To help improve the reputation of sharks one must build onto the solutions being utilized presently. One of these solutions includes educating the public via public service announcements (PSAs) issued by NGOs. PSAs are a relatively effective medium to change the attitudes towards sharks since they utilize similar media that are currently ruining the reputations of sharks (television, internet, etc.). Social media sites such as Twitter also have made attempts to improve the attitudes towards sharks with the creation of accounts that describe the lives of real sharks that are tracked in the ocean. Ecotourism businesses might be the most effective medium in reducing fear of sharks by holding semi-controlled interactions between humans and sharks. The most important ideas that need to be communicated to the public through these media include: The environmental effects of depleting shark populations; the violations committed by shark finning on animal welfare; and the global scale and scope of shark fishing. The ultimate goal of communicating these messages to the public is to reduce the fear of sharks and build respect for them in order to increase funding and public support for shark conservation and research.

Change the cultural values and traditions. Shark fin soup is culturally significant in Chinese culture as a dish that shows a host's wealth and generosity when served to guests (Dell' Apa, Smith and Kaneshiro- Pineiro, 2014). Different cultures have conflicting values towards animal welfare and it is difficult to say which culture's values are more important to maintain when addressing these global issues. If our goal was to reduce shark finning rather than total shark catches one compromise that could be used is the encouragement of shark steaks as a cuisine to replace shark fin soup. This would reduce the need for shark fins specifically and still allow for the consumption of the shark that might hold similar cultural value. This solution, however, may only reduce shark finning practices and not overall shark fishing as it would maintain the demand for shark meat. In terms of changing cultural traditions around shark fin soup, the most effective demographic to target these campaigns would be the youth. Youth seem to be the most open to change around this issue since they are growing up in an age where the tradition is becoming less common due to the realized environmental repercussions of the dish. In this respect, youth are less attached to the tradition than their elders.

Conclusion

Shark fishery management is a wicked problem that is best addressed with systematic approaches. The solutions recommended are summarized as follows:

- Making the IPOA-sharks a legally binding agreement
- Review of RFMOs to include shark specific treaties
- Establish a global network of MPAs
- Implement a policy in China requiring sharks to be landed with the fins naturally attached.
- Re-evaluate policy surrounding Chinese no-take MPAs.
- Research the feasibility of shark aquaculture
- Educate the public about the shark finning problem.
- Change the cultural values and traditions.

References

Peer Reviewed Articles

Asche, F., Guttormsen, A. G., Tveteras, R. (1999). Environmental problems, productivity and innovations in Norwegian salmon aquaculture. *Aquaculture economics & management*, 3(1), 19-29. doi:10.1046/j.1365-7313.1999.00034.x

Biery, L., & Pauly, D. (2012). A global review of species-specific shark-fin-to-body-mass ratios and relevant legislation. *Journal of Fish Biology*, 80(5), 1643-1677. doi:10.1111/j.1095-8649.2011.03215.x

Dell' Apa, A., Smith, M.C., & Kaneshiro-Pineiro, M.Y. (2014). The Influence of Culture on the International Management of Shark Finning, *Environmental Management*, 54(2), 151-161. doi:10.1007/s00267-014-0291-1.

- The importance and cultural values of shark fins in both China and Hawaii are thoroughly detailed in this article. It also explains why the finning issue should be solved with a social science view by creating educative programs with this cultural mindset. The article goes into great detail with the different ways shark finning has continued despite various attempts to decrease the activity. It then tells of the social issues that must be solved first before attempts are made to solve shark finning; which will prove quite relevant to our group's case study. The article provides impressive evidence to support its argument while providing many references.

Dick, K., & Jefferies, C. (2013). Food for thought: Effecting shark conservation through marine protected areas and enhanced collaboration with international organizations. *Journal of Environmental Law and Practice*, 24(3), 223-255. Retrieved from <http://ezproxy.library.ubc.ca/login?url=http://search.proquest.com/docview/1429233994?accountid=14656>.

Ma, C., Zhang, X., Chen, W., Zhang, G., Duan, H., Ju, M., Yang, Z. (2013). China's special marine protected area policy: Trade-off between economic development and marine conservation. *Ocean & Coastal Management*, 76, 1-11. doi:10.1016/j.ocecoaman.2013.02.007.

Myers R A, Baum JK, Shepherd TD, Powers SP, Peterson CH. 2007. Cascading effects of the loss of apex predatory sharks from a coastal ocean. *Science* 315:1846-50

Myrick, J.G. & Evans, S.D. (2014). Do PSAs Take a Bite Out of Shark Week? The effects of Juxtaposing Environmental Messages With Violent Images of Shark Attacks. *Science Communication*, 36 (5). Retrieved from <http://scx.sagepub.com.ezproxy.library.ubc.ca/content/36/5/544.full.pdf+html>.

This article examines the effects on viewers who watch potentially graphic videos like Shark Week and public service announcements (PSAs) on sharks. It describes how media like Shark Week tend to create irrational fear of shark attacks and how PSAs generally are unable to alleviate these fears. Despite Shark Week recently admitting to the low probability of a shark attacks, the images it presents still have the same affect on viewers. The content of this article will prove to be relevant as it reveals the direct affect of popular media on viewers and how this affects the general attitude towards sharks. The methods used in this study were very reasonable with an elaborate explanation of all of the steps taken in this highly objective research.

Pauly, D., Belhabib, D., Blomeyer, R., Cheung, W. W. L., Cisneros-Montemayor, A. M., Copeland, D.. . Stockholm Resilience Centre. (2014). China's distant-water fisheries in the 21st century. *Fish and Fisheries*, 15(3), 474-488. doi:10.1111/faf.12032

Sybersma, S. (2015). Review of shark legislation in Canada as a conservation tool. *Marine Policy*, 61:121-126.

In the peer-reviewed article "Review of shark legislation in Canada as a conservation tool", Sybersma (2015) summarizes the legislative tools Canada has established with the final objective of shark conservation. The author critically analyzes different legislation that are enacted on different levels of authority in Canada: international, national and provincial. Sybersma succeeds in critically analyzing the success and flaws that Canadian policy has

in regards to shark conservation at all three levels of authority. The author suggests concrete solutions to maximizing Canadian policy efforts in shark conservation. This research is highly insightful in understanding where Canada (and perhaps other countries) can focus their efforts in meeting shark conservation objectives on different planes of legislation. The methods of this study are appropriate because the author covers a numerous array of stakeholders, organizations, and legislature relating to shark conservation policy implementation. The author cites numerous types of literature including NGO produced documents, international acts, national, provincial and municipal legislation and also academic research articles. The fact that the article was published in *Marine Policy* suggests a level of reliability and objectivity that comes associated with journal article peer review mechanisms. The strengths of the articles include being able to provide a general overview of shark conservation legislation in Canada while suggesting critical and often radical modification and alterations of existing legislature in order to maximize efficiency in meeting international targets.

Techera E. J., Klein N. (2011). Fragmented governance: Reconciling legal strategies for shark and management. *Marine Policy*, 30: 73-78.

Techera, E. J. (2011). Good Environmental Governance: Overcoming Fragmentation in International Law for Shark Conservation and Management. *American Society of International Law*, 105: 103–107. Retrieved from <http://doi.org/10.5305/procanmeetasil.105.0103>

Tolotti, M. T., Filmalter, J. D., Bach, P., Travassos, P., Seret, B., & Dagorn, L. (2015). Banning is not enough: The complexities of oceanic shark management by tuna regional fisheries management organizations. *Global Ecology and Conservation*, 4, 1-7. doi:10.1016/j.gecco.2015.05.003

Worm, B., Davis, B., Kettermer, L., Ward-Paige, C. A., Chapman, D., Heithaus, M.R., Kessel, S.T., Gruber, S.H. (2013). Global catches, exploitation rates, and rebuilding options for sharks. *Marine Policy* 40: 194–204.

Worm et al. (2013) compile data surrounding global catches of sharks in an attempt to present the most accurate, up-to-date information. Table 4 estimates shark removal, exploitation rate, and biomass and abundance (Worm et al., 2013). Notably, the exploitation rate is estimated between 6.4 and 7.9 percent, outpacing the rebound rate (Worm et al., 2013). From this data it is concluded that shark populations will continue to decline at the current rates (Worm et al., 2013). This research is associated with many North American universities, pointing to its credibility. According to Google Scholar, it has been cited 119 times, suggesting that this paper has been impactful in its area and has been well received. Looking at the methodology, the authors use a variety of sources to generate their data, mostly peer-reviewed literature and data from NGOs. Using a variety of data and acknowledging their limitations strengthens their argument.

Grey Literature

Convention on the Conservation of Migratory Species of Wild Animals. *The Strategic Plan for Migratory Species 2015-2023* (2015). Retrieved from http://www.cms.int/sites/default/files/document/consultation_draft2_10march2014_e.pdf.

Musick, A. J., Musick S. (2011). Fisheries and Aquaculture Review and Studies: Sharks. *Food and Agriculture Organization of the United Nations*. Retrieved from <ftp://ftp.fao.org/fi/DOCUMENT/reviews%26studies/sharks.pdf>

In the sharks “Fisheries and Aquaculture Reviews and Studies”, John and Susanna Musick (2011), on behalf of the Food Agriculture Organization of the United Nations (FAO), summarize knowledge and data on shark products, the profile of shark catches, major fisheries, the status of shark resources and shark fishery management and conservation options. A very important dataset is that of the nominal catches of sharks and rays from 1990-2008 by the Fishstat database provided in this article. The data is explained to be difficult to interpret due to an unequal categorization of catches amongst reporting countries. Amongst these issues is the unreported discarding of caught sharks which is unaccounted for by international and national management bodies. These are evident limitations to the reliability of quantitative data. Nonetheless, the United Nation Food and Agriculture Organization datasets are extremely important in terms of global shark conservation because they are the only source of landings data and global catches in terms of official statistics. A second relevant table summarized from FAO Fisheries Commodities database data is that of the global value of shark landings from 1990-2006. This dataset is highly relevant because it characterizes the increase in demand for shark products throughout a 16-year timespan. In order for policy implementation and trade bans to be effective, monitoring and reporting of shark landings and catches must be targeted as a global objective in the effort to help shark populations grow.

Popular Media

Holland, Jennifer S. (2007, March). An Eden for Sharks. *National Geographic*, 211 (3), pp. 117-136.

This article from *National Geographic* explains how sharks have been vilified throughout history in literature as well as current popular media, and how this makes it difficult to get funding for research on sharks. It also discusses why the Bahamas are a great environment for sharks to thrive in. Again, it argues that sharks are not as dangerous as people think; giving evidence such as the fact that New Yorkers bite more people than sharks do per year. This article will become relevant in its explanation of the social attitudes towards sharks, and how this ultimately affects research and conservation for sharks. As a fairly successful magazine that has been critically-acclaimed for its content, and a continuous existence of 127 years, *National Geographic* proves to be a decently credible and reasonable source to refer to.

Data Sources

N.A. (2015, February 11). ISAF Statistics for the World Locations with the Highest Shark Attack Activity (2005-2014). *International Shark Attack File*. Retrieved from <https://www.flmnh.ufl.edu/fish/sharks/statistics/statsw.htm>.

This website contains several charts of data for worldwide shark attack counts (non-fatal and fatal) as well as the data for attacks in the regions with the highest shark attack counts. The data is totaled for each year from 2005 up to 2014. The data shows that shark attack counts are much lower than expected worldwide within a given year. This reference will help prove that sharks are not as dangerous as the general public assumes. As far as reliability, the website claims that it is put together by the University of Florida; providing contact

information for the staff of the natural history department of the university which gives it a decent level of academic support.

Multimedia:

Amada44 (2011). Spotted ragged-tooth shark (*Carcharias taurus*) in UShaka Sea World. [Online image]. Retrieved November 30, 2015 from https://en.wikipedia.org/wiki/Shark_finning#/media/File:UShaka_Sea_World_1079-a.jpg

Donovan, R. S. (2010). Shark fin soup with shrimp dumpling. [Online image]. Retrieved November 30, 2015 from <https://flic.kr/p/8XA3DY>.

Wang, N. (2011). Fresh shark fins drying on sidewalk. [Online image]. Retrieved November 30, 2015 from <https://flic.kr/p/ar5Xwt>

Unsplash (2015). Aquaculture [Online image]. Retrieved November 30, 2015 from <https://pixabay.com/de/abend-abenddämmerung-dämmerung-690504/>

Additional Sources

Baum, J.K., et al. 2003. Collapse and conservation of shark populations in the Northwest Atlantic. *Science* 299:389–392. Retrieved from <http://www.jstor.org/stable/3833388?pg-origsite=summon>

This source uses a large amount of data of the northwest Atlantic to show the rapid decline of the shark population. Their goal was to obtain unbiased data material. The data has recorded 6 species 1986 onward and 8 species 1992 onward. Since 1986 the estimated decline for hammerhead is 89% and for tiger sharks 65%. The article also discusses marine reserves, which can be effective by rebuilding depleted fish populations. In the open ocean however, it could be different, because the animals move in larger areas. Furthermore the article says that marine reserves cannot be a panacea for overexploitation, even though they bring certain benefits.

Cisneros-Montemayor, A., Barnes-Mauthe, M., Al-Abdulrazzak, D., Navarro-Holm, E., & Sumaila, U. (2013). Global economic value of shark ecotourism: Implications for conservation. *Oryx*, 47(3), 381-388. doi:10.1017/S0030605312001718

Cisneros-Montemayor et al. compile worldwide data to estimate both historic and projected income generated by shark ecotourism (Cisneros-Montemayor, Barnes-Mauthe, Al-Abdulrazzak, Navarro-Holm, Sumaila, 2013). They then compare this with similar data surrounding shark fisheries (Cisneros-Montemayor et al, 2013). It is concluded that by 2023, global income from shark ecotourism will outpace that of shark fishing (Cisneros-Montemayor et al, 2013). The authors assert that this is the first research regarding global shark ecotourism income, making this a potentially impactful paper (Cisneros-Montemayor et al, 2013). However, validating this statement is difficult and requires expert knowledge of this issue. Another strength of this paper is its recent publication, offering up-to-date information surrounding the issue. Regarding the methodology, it is notable that the authors both review other research and then compile it with their own data. Interestingly, the authors define sharks as “sharks, rays, and chimaeras” (Cisneros-Montemayor et al, 2013). Taxonomically, rays and chimaeras are closely related to sharks, but are not sharks. The authors do not justify this definition or offer a precedent. The research is backed by a

university and the first author is a post-doctoral fellow focusing on fisheries economics research. The paper appears to be credible.

Davis, B., Worm, B. (2012). The International Plan of Action for Sharks: How does national implementation measure up? *Marine Policy*, 38: 312-320.

Davis & Worm (2012) review Canada's National Plan of Action for Sharks (NPOA-sharks) in terms of its efficacy at meeting its goals, comparing it to Australia's NPOA-sharks and finally determining the efficacy at integrating guidelines established by the Food and Agriculture Organization. Davis & Worm critically compare and summarize Canada and Australia's success in adhering to NPOA-sharks guidelines through the use of tables representing action categories, number of objectives met, and overall progress. The authors highlight an impactful problem in shark conservation policy: the lack of appropriate monitoring in order to analyze the NPOA and modify them accordingly. Research into countries NPOA is critical in understanding the level of success in policy implementation of specific countries in efforts to succeed in shark conservation. The strengths of this article are derived by the insightful revision the authors suggest of Canada's NPOA. The revision incorporates specific recommended actions based on significant amounts of empirical evidence from cited research articles, NGO produced documents, government reports and international legislature. The revision provided by Davis & Worm can also provide significant guidance to the revision of other countries NPOA plans. A limitation of the article might be the section on conservation management which can be interpreted as not being relevant to the final objective of the paper and undermines the significance of other findings in the study. The article was reviewed by agencies such as the Department of Fisheries and Oceans and funded by the National Science and Engineering Research Council of Canada and WWF-Canada. The influence of these agencies coupled with the numerous amount of peer-reviewed material cited in the article suggest a high level of reliability in research.

Driscoll, J.W. (1995). Attitudes Towards Animals: Species Ratings. *Society and Animals*, 3(2). Retrieved from https://animalsandsociety.org/assets/library/302_s324.pdf.

"Attitudes Towards Animals: Species Ratings" gives an interesting account of a survey that asked how people thought about the general usefulness, intelligence, importance, and dangerousness of thirty-three different species. The results concluded that the public generally evaluates animals by their usefulness to the human population, the emotional connection, and the historical reputation of the animal. The article concluded that knowing how people form their attitudes towards animals will better help how to create proper educational programs to change some of these attitudes towards particularly important species. The article provides specific information on sharks in its study, for instance, the shark found itself as the second most dangerous species on the list after the rattlesnake. The study very accurately detailed the steps taken in the survey and also displayed the information very objectively, making the source a rather reliable one.

Ferretti, F., Worm, B., Britten, G. L., Heithaus M. R., Lotze, H. K. (2010). Patterns and ecosystem consequences of shark declines in the ocean. *Ecology letters* 13: 1055 – 1071.

Due to the overfishing during the past decade, it is an urgent topic to find out what the features of a shark in an ecological system are. This study highlights the differences from sharks to other marine predators. Furthermore it discusses the history and analyses a current state. In the conclusion it discusses when the sharks plays an unique role and how the ecosystem depends on this role.

Godin, A.C., Worm, B. (2010). Keeping the lead: How to strengthen shark conservation and management policies in Canada. *Marine Policy*, 34: 995-1001.

In the peer-reviewed article “Keeping the lead: How to strengthen shark conservation and management policies in Canada”, Godin & Worm (2010) provide an evaluation of the role of legislation surrounding shark conservation in Canada while describing key limitations and priorities surrounding shark management nationally and globally. Their methods include determining the conservation status of sharks in Canada by analyzing the amount of attention endangered species have under the Species at Risk Act in Canada, analyzing by-catch management strategies and shark finning regulation, the management of recreational fishing for sharks and finally the overall status quo surrounding the success or failure of Canadian shark management. This method allows the authors to analyze the issue of shark legislation under a substantial diversity of perspectives in relation to highly relevant topics and issues. The research done by Godin & Worm is pertinent to understanding how in order to achieve international cooperation and initiative in shark conservation, national leadership and commitment must be considered a priority. Other strengths of this article are the five recommendations for new policies in Canada which could potentially be broadly applied to other nations. A limitation that could be pointed out is the absence of promoting international cooperation in the recommendations for new policies in Canada; this might decrease the likelihood of a global commitment atmosphere. One other factor that could have been incorporated into the list of new policies is the regulation of illegal shark fishing practices in particular; this could lead to a substantial decrease in shark population decline over the long run. The sources cited by Godin & Worm include a high abundance of scientific peer-reviewed journals, international legislative bodies such as the International Union for Conservation of Nature (IUCN), the Canadian Species At Risk Act (SARA), reports from the Department Of Fisheries and Oceans (DFO) and several case studies from different countries relating to management of sharks. The nature of how serious the declining shark population issue is can suggest that the pressure of third party influence, bias, or subjectivity on the quality of research can be relaxed when it comes to journal articles regarding shark conservation legislation.

McCook, L. J., Ayling, T., Cappo, M., Choat, J. H., Evans, R. D., De Freitas, D. M., . . . Williamson, D. H. (2010). Adaptive management of the great barrier reef: A globally significant demonstration of the benefits of networks of marine reserves. *Proceedings of the National Academy of Sciences of the United States of America*, 107(43), 18278-18285. doi:10.1073/pnas.0909335107

This journal article, published in Proceedings of the National Academy of Sciences of the United States of America, summarizes and synthesizes data regarding the Great Barrier Reef and its management. The authors assert that no-take areas show ecological and economic benefits (McCook et al., 2010). An analysis of available data suggests that reef recreation and tourism generate more income than that of commercial fishing (McCook et al., 2010). This paper is notable due to its methodology of synthesizing of a variety of data, including scholarly and gray literature. Specifically, the section relating to the economic results of no-take zone focuses mostly on government –published literature, with some scientific research. This may be a short coming of the paper, but it also may indicate that little research outside of the Australian government has been done on this topic. The paper is highly cited, 236 times according to Google Scholar and 136 times according to Web of Science. This suggests that the article has been well received by peers and appears to be credible. However, this article does not note how data was selected.

Muter, B.A., Gore, M.L., Gledhill, K.S., Lamont, C., & Huveneers, C. (2012). Australian and U.S. News Media Portrayal of Sharks and Their Conversation. *Conservation Biology*, 27 (1). Retrieved from <http://authorservices.wiley.com/bauthor/onlineLibraryTPS.asp?DOI=10.1111/j.1523-1739.2012.01952.x&ArticleID=1061112>.

This article makes a comparison of the media coverage about sharks between Australia and the U.S., the two countries with the most human-shark interactions in the world. It contains a study of all of the articles published about sharks in 20 different newspapers produced in Australia and the U.S. While noticing that over half of the articles contained negative messages about sharks and spoke about attacks rather than conservation or eco-tourism, Muter et. al see how these attitudes again affect sharks in fishing and conservation problems. This article will help enhance our case study as it provides more insight into the structure and stance that media takes with sharks. The methods used in this article were very reasonable and appropriate; choosing to focus on these particular countries' media was a very rational decision considering the topic. The particular computing processes that were used for this study proved to create very accurate results as well.

Neff, C. L., Yang, Y. H. (2012). Shark bites and public attitudes: Policy implications from the first before and after shark bite survey. *Marine Policy*, 38: 545-547.

In the academic journal article "Shark bites and public attitudes: Policy implications from the first before and after shark bite survey" Neff & Yang (2012) discuss the previously undocumented response in public attitudes towards sharks following shark accidents. The methods adopted in this study are surveys before and after shark accidents in two Cape Town communities located in beaches rich in biodiversity. The criteria the survey was based on included general public level of pride in local marine life and confidence in beach safety protection efforts. The results indicate an unchanged sense of pride and safety both before and after the incident. The significance of this study is highlighted by the consequences the neutral correlation between shark incidents and human attitudes towards sharks might have on public policy making. The results shockingly suggest a shift in public perception of shark incidents and shark attitudes in general. This finding might imply that a different approach on public policy making related to shark populations should be considered. There are some limitations to this study: the limited sample size of the survey and the restriction of the survey to one specific location. The criteria the survey was based on could have integrated more specific feelings regarding public perception of existing policies surrounding shark populations. It is obvious that the findings of this study cannot be directly generalized to other countries while it does encourage further research on the topic. Because of its limitations, the same magnitude of importance of the other three journal articles cannot be attributed to this article in terms of shark legislation and policy making.

Quintanilla, Gomez, Ramirez, Sorzano, Bessudo, Soler, Bernal, Cabalero. Conservation Genetics of the Scalloped Hammerhead Shark in the Pacific Coast of Colombia *J Hered* 1 January 2015: 448-458.

The study investigated the genetic diversity, phylogeography and connectivity of the scalloped hammerhead shark, which were found in three areas of Colombia's Pacific coast. The reason why they were looking for those locations was to protect young sharks from fishing. The reason why I chose this source is because it is a good example of conservation awareness. By finding out more of sharks life patterns, it is more likely possible to protect them from extinction.

Rowat, D., & Engelhardt, U. (2007). Seychelles: A case study of community involvement in the development of whale shark ecotourism and its socio-economic impact. *Fisheries Research*, 84(1), 109-113. doi:10.1016/j.fishres.2006.11.018

This case study describes the economic effects of workshops and increased awareness of whale sharks in Seychelles (Rowat and Engelhardt, 2007). By forming a monitoring network, there is increased community awareness and ecotourism operations develop (Rowat and Engelhardt, 2007). It is found through surveying that on average, visitors are willing to pay US\$55 for a shark encounter (Rowat and Engelhardt, 2007). There eventually may be a closer link between research institutions and ecotourism operations, as operations can report sightings (Rowat and Engelhardt, 2007). This research appears to be more on the qualitative side as it tries to generate soft data. This adds a new perspective to current understanding on shark ecotourism. This paper is associated with NGOs. It would strengthen this paper to also be backed by university research groups.

Popular media

Bland, A. (2015, March 3). Why Shark Finning Bans Aren't Keeping Sharks Off The Plate (Yet). *National Public Radio*. Retrieved from <http://www.npr.org/sections/thesalt/2015/03/03/390449252/why-shark-finning-bans-arent-keeping-sharks-off-the-plate-yet>

In the online article "Why Shark Finning Bans Aren't Keeping Sharks Off The Plate (Yet)", Alistair Bland makes the argument that policies targeted towards banning the practice of shark finning are not effective in reducing the overall amount of exploitation of the vulnerable species. Bland describes that while the trading of shark fins has been reduced, the demand and trade in shark meat has been significant in the past decade. This article successfully dismantles the notion that trade bans on shark finning are successful legislative tools in reducing overfishing of shark populations. The author quotes several actors such as sustainability activists, members of international projects (The Ocean Foundation's Shark Advocates International project), and environmental organizations (Wild Aid) which add to the cumulative credibility of the arguments being made. It seems like all of the cited research and information contained in this article are in favour of the author's argument; this could be considered a limitation because no counter arguments are provided. The fact that the article was published by the National Public Radio media organization implies that the information should be critically analyzed to find possible bias, hidden motives, or third party influence.

Boyle, A. (2014, July 17). How Shark Fin Soup Is Turning Sour, and Why That's Sweet for Us Humans. *NBC News*. Retrieved from <http://www.nbcnews.com/storyline/sharkwatch/how-shark-fin-soup-turning-sour-why-thats-sweet-us-n158476>

In the article "How Shark Fin Soup Is Turning Sour, and Why That's Sweet for Us Humans", Alan Boyle successfully summarizes the issue around shark finning as a threat to shark populations. He discusses the need to dampen the demand for shark fin products and restrict the global high supply (including quantity of exports). The article mentions the update in international regulations set by the Convention [on International Trade in Endangered Species](#) of Wild Fauna and Flora (CITES). The update includes five new shark species that have been added to the control list. Other organizations are mentioned such as the Pew Charitable Fund and their efforts to increase global awareness through the use of

training sessions for those five shark species. The importance of this article also lies in the summary Boyle makes of efforts in the United States to protect some shark species under the Endangered Species Act or to restrict trade around food containing shark fins and shark fins in general. One evident limitation this article presents is the unidimensional perspectives in the re-occurring quotes from the director of the Pew Charitable Fund. These direct citations almost suggest a bias in the author's towards presenting arguments in favor of his point. If the author had incorporated a diversity in perspectives and corresponding actors in his article (perhaps contrasting opinions and arguments) the overall level of completeness and coherence might benefit.

Bradsher, K. (2005, June 17). Disneyland in China Offers a Soup and Lands in a Stew. *The New York Times*. Retrieved from http://www.nytimes.com/2005/06/17/business/worldbusiness/disneyland-in-china-offers-a-soup-and-lands-in-a-stew.html?_r=0.

This New York Times' article describes the situation that arose once Walt Disney Company announced that it would be offering shark fin soup at its new Hong Kong park. Many environmentalists lashed out at the company for supporting cruel fishing of a rather sensitive species. Despite the criticism, Disney did not take the item off of their menu for wedding ceremonies at the park as it was considered a traditional and culturally-significant dish in the country (although a few days after this article, the final decision was made and the soup was removed from Disney's menu). Clearly, the Walt Disney Company had to face the issue of which is more important: cultural practices, or animal conservation? This New York Times' article proved to be fairly accurate, giving specific quotes from representatives that were involved in this issue back in 2005.

Datasets

N.A. (2015, March 23). ISAF Statistics on Attacking Species of Shark. International Shark Attack File. Retrieved from <https://www.flmnh.ufl.edu/fish/sharks/statistics/species3.htm>.

This source includes a table of the different species of sharks and how many reported attacks there are for each species. More interesting than the actual data in the table is the disclaimer at the top of the site page that describes the potential social implications that skew the data in the table. The table shows that the Great White Shark has by far the most attacks (three times as many as any other species) but in reality it is very difficult to discern which type of shark is attacking a victim in such an emergency situation. Often it is very hard to distinguish between shark types from simply analyzing the teeth marks on the victim. This information could be of interest to our case study as the one of the potential reasons to why the most recorded attacks are from Great Whites could be due to the social stigma that that particular species holds. The Great White is the species that is engrained in everyone's minds from movies like *Jaws* and other shark-related media. This website has been referenced in many other shark-related sources on the internet as a go-to source for shark attack data; giving it a decent level of reliability.

Grey Literature

United Nations Environment Programme. (2013). *Green economy and trade- trends, challenges, opportunities*. Retrieved from <http://www.unep.org/greeneconomy/GEandTrade/GreenEconomyandTradeReport/tabid/106194/Default.aspx>

This report, produced by the United Nations Environment Programme, outlines the current state of tourism globally and what trends have arisen in sustainable tourism. This report briefly mentions shark ecotourism as a growing trend, alongside other marine and coastal tourism activities. An explanation is offered regarding values on how sharks contribute to national GDPs, both as a food and as a tourist attraction, around the world. While there is no explicit conclusion or position, one can infer that the values offered suggest that shark ecotourism has a valuable role in several economies around the world. While produced by the United Nations, a reputable source, this section only references one source. The values would be strengthened if there was synthesis with other data. The source that is cited is the Pew Environment Group, a NGO that focuses on conservation and understanding natural environments. While also a reputable NGO, it has clear motives and introduces some bias in the data.

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