SHARK FINNING: A MODERN TRAGEDY OF THE COMMONS

Highly evolved predators with few natural enemies, sharks nonetheless face a threat today they've never seen before: man. The fishing industry kills up to 73 million sharks annually,[1] primarily because their fins are necessary for a traditional Asian delicacy, shark fin soup.

Shark fishing is a gruesome effort. Typically, fishermen slice off pectoral, dorsal and tail fins before tossing the amputated fish overboard. The shark, unable to swim, falls to the seabed dying slowly. Though graphic pictures are available online and scuba divers have routinely told stories of shark graveyards,[2] environmentalists say consumers lack awareness of the issue.[3]

Rampant harvesting has decreased shark populations by as much as 80 percent globally and up to 90 percent for specific species.[4] The International Union for the Conservation of Nature believes that some 30 percent of sharks are threatened or near threatened with extinction. Almost 50 percent are simply not assessed for lack of data.[5] As apex predators, sharks are keystone species for many marine environments and their decimation has cascading effects: removing biological checks on predated species and unbalancing ecosystems. For example, declining shark populations has lead to an overabundance of cownose rays, which devastates scallop populations.[6]

Shark fin soup (broth topped with thinly sliced fin) fetches as much as $100 a bowl. Fin trade is widely considered to be a $1 billion industry and demand is only expected to increase with rising incomes in China, the primary consumer. The major shark fishing countries are India, Taiwan, Spain and Mexico; the largest market for shark fins is in Hong Kong, providing a direct connection to China.[7] India — now believed to be the largest exporter of shark fins — has seen rapid growth of industry in the past several years in response to demand.[8] If shark fishing continues unchecked, serious species collapse is possible.

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[1] Pew Environment Report (2011) Sharks in trouble: Hunters become the hunted. Available at: http://www.pewenvironment.org/news-room/reports/sharks-in-trouble-hunters-become-the-hunted-85899360411

[2] For example, http://www.youtube.com/watch?v=zep7B1esW-M

[3] The Humane Society of the United States (2011) Losing the Taste for Shark Fins. Available at: http://www.humanesociety.org/issues/shark_finning/timelines/shark_fins.html

[4] Pew Environment Report.

[5] Camhi, M.D., et al. (2009) The conservation status of pelagic sharks and rays: report of the IUCN Shark Specialist Group, Pelagic Shark Red List Workshop. IUCN Species Survival Commission Shark Specialist Group, Newbury, England.

[6] Myers, Ransom A., et al. (2007) Cascading effects of the loss of apex predatory sharks from a coastal ocean. *Science*. 315(5820): pp. 1846-1850. Available at: http://www.sciencemag.org/content/315/5820/1846.abstract

[7] Pew Environment Report (2011).

[8] Hausfather, Z. (2004) India's shark trade: An analysis of Indian shark landings based on shark fin exports. *Marine Studies (MAST).* 3(1). Available at: http://www.marecentre.nl/mast/documents/ArtikelZekeHausfather.pdf

ECONOMIC ANALYSIS

The current trend in shark finning is a modern example of the Tragedy of the Commons.[9] Given demand, shark fins represent substantial profits from an open access resource. With no eye to the sustainability, individual fishers have an incentive to maximize their profits today rather than conserve or manage shark populations. This perspective discounts the future enormously: If one fisher doesn't consume the population, another one will; what isn't taken today might not be there tomorrow.

Thus, the global shark population (or a regional shark population) can be thought of as a common pool resource of non-excludable yet rival goods. *FIGURE 1* at the right[10] presents a simplified chart of costs and benefits against effort spent fishing. Costs are assumed to be static, representing the hourly expense of fishing. Individually, fishermen have an incentive to fish until costs equal benefits (TB=AC). This demonstrates the Tragedy of the Commons as separately fishermen each attempt to extract as many sharks (or shark fins) as much as they can. Yet this is hardly the economically efficient level of fishing where net social benefits are optimized (OSB).

FIGURE 1

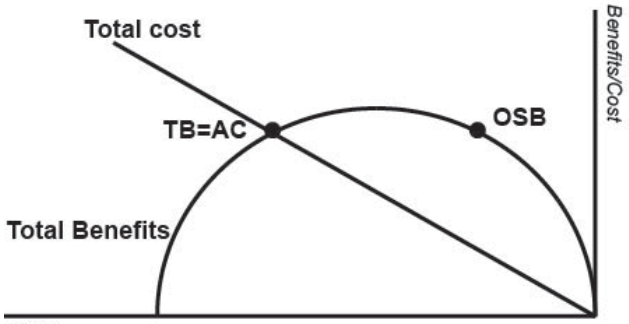

FIGURE 2

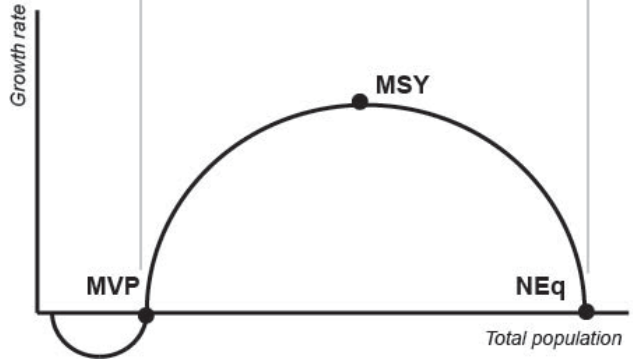

FIGURE 2 represents Milner Baily Schaefer's simplified fisheries model.[11] Population growth is negative until the stock reaches a minimum viable population (MVP). Any point on the curve to the right of MVP represents a potentially sustainable catch that would be replenished by natural growth. The maximum sustainable yield is the point where the growth rate peaks (MSY). For populations larger than MSY, the growth rate declines as the stock approaches biophysical limits — a natural equilibrium beyond which, growth is unsustainable (NEq).

[9] Hardin, G. (1968) The tragedy of the commons. *Science* 162: 1243-1248.
[10] Created by the author for explanation purposes.
[11] Schaefer M. B. (1957) Some considerations of population dynamics and economics in relation to the management of marine fishes. *Journal of the Fisheries Research Board of Canada* 14: 669–81.

Vertical co-consideration of the graphs demonstrates that TB=AC is considerably closer to MVP, a lower yield than MSY and an inefficient collective shark catch. This results in the same catch level as OSB, yet TB=AC requires substantially more effort. Additionally, there exists a danger that fishermen could inadvertently fish beyond MVP, if biological population estimates are flawed. Also, any externality that results in a shock to shark populations might decrease the numbers below MVP. In essence, the closer harvesting is to MVP, the less room for error or unseen circumstance.

A few other considerations are also worth noting. Sharks are slowly maturing and an individual shark might only yield one or two pups per birth; recovery from overharvesting will take substantially longer. Data on shark lifecycles, geographic distributions and numbers are woefully incomplete[12] so assembling a biological model is difficult at best. What is known: Sharks are open-ocean going fish, and their lack of respect of political boundaries complicates efforts to preserve them. Lastly, shark populations are caught in a feedback loop of harvesting. Rising incomes drive up demand. This bows the benefit curve in *FIGURE 1* outward, pushing TB=AC farther to the left, or closer to MVP on *FIGURE 2*. This increase (and resulting revenues) boosts the incentive to increase and improve technology, lowering the cost curve. TB=AC again moves farther left.

POLICY OPTIONS

What then is an appropriate, economic policy response to prevent the Tragedy of the Commons in shark fishing for fins?

FISHING BAN?

Strict regulation of the industry is an obvious if problematic option. Several countries, including Palau, the Maldives, the Bahamas and Mexico have planned or implemented territorial shark fishing bans.[13] Ecuador prohibits shark fishing in specific areas.[14] The United States bars landing a shark without its fins intact, to prevent the dumping of finned sharks into the ocean to make more room in holds. California has banned the sale of shark fins.[15] Yet all bans have practical limits. Sharks remain fair game beyond any nation's exclusive economic zone, and nations with large shark finning industries or markets are politically averse to bans; India's brief experiment with a shark fishing ban in 2001 lasted less only six months in the face of lobbying and fisherfolk

[12] Camhi, M.D., et al.
[13] Greenwire via the New York Times (2011) Mexico will ban shark fishing as global sanctuary movement grows. Sept. 23, 2011. Available at: http://www.nytimes.com/gwire/2011/09/23/23greenwire-mexico-will-ban-shark-fishing-as-global-sanctu-29510.html
[14] Personal interviews, 2010, Galapagos Islands and coastal Ecuador.
[15] Greenwire.

protest.[16] In this way, national bans don't necessarily decrease fishing overall; they can simply concentrate depletion in unrestricted waters.

TECHNOLOGY BAN?

Limiting technology — prohibiting gill nets or long lines, for example —shifts fishermen to lower technology, which moves the cost curve upward. This makes fishing less profitable, moving TB=AC closer to OSB. But this regulation does not address the underlying problem of individual incentives to overharvest. It simply creates additional costs without additional benefits for society.

TAXES?

Taxes also shift the cost curve up, lowering the value of time spent fishing while still capturing benefits. But they are difficult to design and implement, particularly in developing nations with low monitoring and collection capacity. Taxing fishing output is problematic because counting catch is difficult; cheating by hiding fish or fins is easy. Taxing imports or sales in primary markets like Hong Kong might increase costs, moving harvest closer to socially optimum OSB, but could also push imports to secondary markets. Boat taxes — a harbor exit tax or a bow-to-stern length tax — might only increase the incentive to fish more intensively to recover costs, leading to an increased harvest. A sales tax on bowls of shark fin soup seems politically unlikely, as consumer nations want to consume more, not less. Again, implementation would also be difficult, as any off-the-books back alley street vendor could sell the soup.

QUOTAS!

A system of transferable quotas for shark fishers — though complicated — comes closest to extending the time horizon of individual fishermen and creating an incentive for conservation. (Note: This does not end shark fin harvesting. On the contrary, it recognizes that the consumer willingness to pay for the delicacy is sufficiently high, such that an end to shark fishing entirely is likely impossible.) Implementing quotas, however, does seem feasible at the regional or national level; quota systems have worked for other fisheries, as fishermen begin to act collectively to conserve.

Governments first must establish shark quotas as determined by a biological model at (or at least closer to) the socially optimum catch level OSB. Catch shares — certainly transferable but ideally also rentable — must be assigned to players in the fishing industry, perhaps through an auction or by percentages according to historic rights. This allows fishermen to sort out efficient

[16] Hausfather.

allocation of fishing boats and effort privately, also accounting for gains from trade. Efficient technology is also incentivized as fisherman want to make the most out of their shares.

The quota system is not perfect and does require monitoring. Fishermen must monitor each other, as shark fins are relatively small and easy to hide, and biologists must monitor overall stock levels. The system would likely benefit by additional measures: some critical no-take protected ecosystems, requirements to land entire sharks to reduce fishing waste, and perhaps an initial buyout of boats to make the quota economically viable for the remaining fishermen.

However, despite its complexity, the quota system accounts for economic and politically reality and creates an appropriate targeted incentive for collective action. Fishermen conserve sharks as a renewable resource for the future by harvesting closer to social optimum, via the assignment of rights of a sort. This staves off the Tragedy of the Commons and the current trend of take-it-while-you-can shark fishing.