

The Environmental and Socioeconomic Effects of Overfishing Due to the Globalization of the Seafood Industry

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Section I: Overfishing as a Consequence of the Globalization of the Fishing Industry

Historically, humans have utilized fishing and the extraction of marine resources as a source of food, for cultural significance, and as a means of livelihood. The first documented cases of overfishing occurred in the 1800s when whale populations were decimated for their blubber, which was used primarily for lamp oil. By the 1950s Atlantic cod and herring as well as California sardines were harvested to the brink of extinction for human consumption (“Overfishing”). Today, overfishing is a global issue that plagues roughly 85 percent of global fisheries (“Overfishing Ocean”). The commercial exploitation of global fisheries has resulted in the unequal distribution of marine resources, especially for poor people in developing nations who rely on seafood as a primary source of protein and livelihood. As affluent nations increasingly demand high-value fish, fisheries have become privatized, making it difficult for people in developing nations to compete with global commercial fishing fleets (Greenberg). As a result, issues of food scarcity and loss of employment will continue to affect the 2.6 billion people that live in coastal communities and developing nations that greatly depend on fish to survive (Hauge, et al. 1). With the globalization of the fishing industry, overfishing has become a prominent food security issue that affects people on every continent, and requires multilateral cooperation and compliance in order to secure the livelihood of millions and prevent the collapse of the fishing industry. If this current trend continues, experts agree that the vicious cycle of overfishing will undoubtedly result in the collapse of ecosystems and economies on a global scale.

As world consumption of marine resources continues to rise, so do dire predictions for the future of the world’s oceans and those who rely on them for survival. As the World Wildlife Fund (WWF) publicized, “Once considered inexhaustible, our oceans are now in a state of global crisis as more and more people compete for fewer and fewer fish” (“The State” 10). Although experts disagree on the extent of decline, it is estimated that 53 percent of the world’s marine fishery resources have been completely depleted or fished to the maximum sustainable level, while 32 percent is currently being overfished,

depleted, or recovering from depletion (“Fisheries and Aquaculture”). Every year more than 170 billion pounds of wild fish and shellfish are caught in the oceans, which is roughly three times the weight of every man, woman, and child in the United States (Greenberg). The Food and Agriculture Organization and the World Bank warn that the current rate of exploitation will result in increased pressure on seafood in the future (“The State” 8).

Currently, fish provides about 1.5 billion people with 20 percent of their animal protein, and provides another 3 billion people with at least 15 percent of such protein (“The State” 3). However, as the demand for seafood increases, so will the price. This will result in billions of people unable to afford seafood due to increasing demand in wealthy nations, and vast commercial fleets that will out-compete local subsistence fishermen. The world catch is already unstable and unequally divided among the nations of the world, and will only be exacerbated as fish stocks are decimated.

Top seafood consuming countries like Japan, China, and the United States are exponentially increasing their annual seafood consumption, creating larger gaps between rich and poor countries (“The State” 10). In 2010, about 76 percent of total fisheries’ imports in value were in developed countries. The United States and Japan together accounted for 27 percent of total world imports, with the European Union representing another 40 percent of the US\$111 billion dollars in imports in 2010 (“Overview” xvii). Exports in 2010 totaled US\$100 billion, with the top exporting countries being China, Norway, Thailand, and Vietnam (“Overview” xvii). Developing countries play a crucial role in supplying the world with seafood products, accounting for nearly 60 percent of all internationally traded global seafood supplies (“Overview” xvii). Despite the pivotal role of developing nations in the seafood industry, many of these fishermen do not see much of the bottom- line profits, and only continue fishing because of a lack of alternative economic opportunities.

In developing nations throughout the world like those of coastal West Africa, fishing is poorly regulated. As a result, local and foreign fishing fleets are decimating fish stocks, and contributing to the growing socio- economic disparity among the fishermen and the people of Senegal, Ghana, Guinea, and Angola (Montaigne). Similarly in Asia, unregulated fishing operations have resulted in the collapse of

nearly all fisheries in the Gulf of Thailand and the Java Sea (Montaigne). Poor people in developing nations are incentivized to continue unsustainably exploiting fish stocks for small wages because they are left with few other options. This example of a “poverty trap” occurs when people become so poor that the short-term need to survive outweighs any long-term advantages to conservation or sustainable management (Cinner, et al. 2016). Similar hardships are felt by fishermen in the Mediterranean as well, who also rely primarily on fishing as a means of survival. An Italian tuna fisherman said, “The price is cheap because more and more tuna are being caught. My only weapon is to catch more fish. It's a vicious circle because the price is very cheap. I want to respect the quota, but I can't because I need to live” (Montaigne). This is an issue that is seen all too often for subsistence fishermen.

There are several complicated factors associated with the poverty trap that combine with the pressures of socio-economic despair, further augmenting the issue of overfishing. For one, unstable population growth exacerbates poverty in small coastal communities and developing nations by increasing pressure on local resources. In nearly all cases, these people are not aware of sustainable fishing practices because these nations lack stable, reliable infrastructure, as well as regulation and enforcement systems. Ultimately, this negatively affects the local economies because they overexploit already vulnerable and top-predator fish stocks, resulting in issues of food scarcity and loss of livelihood in the future. Another issue is the lack of incentives to protect this valuable industry. Fish are what is known as common pool resources. In countries lacking regulation and incentives to protect fish, conservation efforts are often weak, and overexploitation of the resource becomes close to inevitable (Hauge, et al 2012). As a result, poverty increases, availability of fish and marine resources declines, and people begin exploiting other natural resources to replace losses of income.

Overfishing is a time-sensitive issue, and if not addressed immediately, researchers and ecologists fear that the world could run out of seafood by 2048 (Eilperin). Concerted efforts are underway by dozens of national and regional government agencies, non-governmental organizations (NGOs), international organizations, conservation organizations, businesses and citizens to establish

fishing capacities at a level consistent with both conservation objectives and profitable industry (Montaigne). Consumers can voice their own purchasing power by reducing or eliminating seafood from their diet or by choosing fish that has been certified as sustainable.

Despite these efforts large, apex predator fish like Bluefin tuna are a favorite among consumers in wealthy nations, such as the United States and Japan. The sushi industry is among one of the most demanding of these unsustainably sourced and rapidly declining fish populations. Large tuna and Chilean sea bass are considered luxury food items that have been increasingly featured in high-end restaurants around the world. Japan sits atop the pinnacle of unsustainable seafood demands, and has created an extremely profitable market for these highly desirable fish. In January, 2013, a single Bluefin tuna fish caught off the coast of northeast Japan sold for US \$1.76 million in Tokyo (Foster). Such astronomical profits further incentivize fishermen to continue exploiting this valuable species.

In November of 2012, Japan and 47 other member nations of the International Commission for the Conservation of Atlantic Tunas (ICCAT) voted to continue regulating the species, but agreed to higher the total catch limit (Foster). Increases in catch limits, as well as a lack of enforcement, have resulted in unsuccessful efforts to repopulate the species. As recent as January, 2013, scientists released a stock assessment for the Pacific Bluefin population, which showed a 96.4 percent drop from un-fished levels (“New Scientific”). Despite this shocking statistic, the species continues to be exploited in its most vulnerable stages of life throughout the western Pacific Ocean.

In order to restore fish stocks to sustainable levels scientists and ecologists agree that marine ecosystems must be properly managed to ensure the needs of future generations. In order to do this, the fishing industry must be completely reassessed and managed in a way that no longer prioritizes commercial fishing interests above all else. To start, governments must properly and effectively enforce the set number of fishing vessels, implement gear restrictions, set catch limits and quotas, as well as create marine protected areas to secure the viability of fish populations. It is also crucial that annual government subsidies to the fishing industry be reduced from the current US \$25 billion, which has

historically hidden the true socio-economic and ecological costs of the global fishing industry (Montaigne). These government efforts must be combined with robust contributions and monitoring from environmental and scientific groups, NGOs (especially the UN), and related civil society organizations. As partners and stakeholders, all must be held responsible and accountable.

Unfortunately, however, the most heavily exploited and highly profitable fisheries may never have the opportunity to recover before they vanish forever. Although the developed world is most responsible for the unstable state of global fish stocks due to their insatiable appetite for top-predator fish, it is the globe's poor people that will face the brunt of these socio-economic and ecological disasters. Without seafood, billions of poor people will be plagued with issues of food scarcity and malnutrition, and will lose any sense of economic security that fishing may have provided them. The fishing industry is of great importance to developing economies, and therefore must be protected in order to prevent the collapse of global fisheries and the possible devastating impact on global ecosystems and the global economy.

Section II: Global Implications for Marine Scientists and Conservationists

Marine conservationists and biologists recognize the dire threats that overfishing pose to the health of the world's oceans and marine biodiversity. As a result, scientists have been emerging in greater numbers to help develop and implement sustainable fisheries management strategies to recover over-exploited fish stocks. Aggregate data confirms that total world fisheries production is higher than ever before, while fish stocks are at an all-time low. Prior to the technological advancements and exponentially growing demand for fish products in the 1970s, fisheries were able to naturally sustain themselves by reproduction (Allison 934). Since then, however, scientists and concerned international organizations have been instrumental forces in determining the scope of the issue, and how to protect marine life, coastal ecosystems, and the billions of people that rely on them for survival. Now more than ever, marine scientists are needed to identify issues of marine degradation to help identify areas of most concern and formulate community inclusive solutions to combat issues of overfishing and unsustainable

marine resource extraction.

Fishing has been a major source of food, as well as a means of livelihood for thousands of years. However, rapid advancements in fishing gear and technologies has resulted in a system that now threatens global fish stocks, the health of coral reefs and marine ecosystems, and the people that rely on fish for a major source of income and survival. In 1982 the United Nations Convention on the Law of the Sea established a framework aimed to better manage marine resources by giving states the right to manage their coastal waters (“Fisheries Management” vii). Since then, coastal states have seized the opportunity to expand their fishing operations and exploit marine fisheries. However, the rapid industrialization of the fishing sector did not come without unforeseen costs.

Since the 1980s fish stocks have been overexploited, ecosystems have been modified, and economies that once thrived from fishing exports have crashed. As a result, international tensions have mounted due to competition over resources, and much debate has been had over how to properly manage fisheries and trading of goods. As of result of such crises, there has been a growing need for fisheries experts, as well as marine conservationists and biologists to identify flaws in global fisheries, and ways to mitigate harmful fishing practices through the development of responsible and sustainable fisheries (“Fisheries Management” 1). With the proper management, fisheries have the potential to reduce malnutrition and provide a stable income to traditional coastal communities and developing nations.

One of the most recognized strategies used by scientists and policy makers attempting to increase fish populations and develop sustainable fisheries is through the use of the ecosystems approach. The main objectives of this model include reducing indirect exploitation of marine mammals (known as bycatch), multi-species management (to increase and maintain biodiversity), protection of vulnerable ecosystems (to ensure the longevity of fisheries), and active community involvement (Morishita 23). This approach was recognized as a viable application strategy by dozens of marine scientists from around the world at the 2002 World Summit of Sustainable Development and at the United Nations Sustainable Fisheries Resolution in 2006 (Morishita 19). This inclusive model has potential to gain the interest and

cooperation of local fishermen and community members, which is vital to the success of any conservation effort.

Although this approach has potential to mitigate overfishing, there is a growing demand for fisheries experts and further research to address local, regional, and global conservation issues. So far a lack of identification and understanding of specific management goals has prevented wide- scale success of eco-systems- based management strategies (Morishita 22). The pressing nature of overfishing has increased the importance of monitoring and evaluation methods used among the conservation community (Stem, et al 296). Likewise, transparency within the fishing industry is instrumental for scientists to gain the knowledge required to monitor and assess threatened areas.

However, scientists and conservationists struggle to implement successful management strategies without the cooperation of local and international stakeholders. Conservationists now understand the importance of incorporating the community throughout the planning, construction, development, implementation and management of crucial marine ecosystems (Agardy 268). First and foremost, context matters. Each region or state requires specialized attention from marine conservationists to target issues specific to the areas economic, social, and ecological situation. There is no one- size- fits- all solution that can be implemented across the board.

The use of marine protected areas (MPAs) is growing in popularity as a key factor in preserving key marine ecosystems. These ecologically or biologically significant zones are used as a science and research based conservation strategy that aims to protect habitats, fish, wildlife, and cultural resources. There are six different categories of marine protected areas established by the International Union for Conservation of Nature (IUCN), which range in level of regulation and protection, all with a common focus on the long-term conservation of coastal and ocean resources (“Applying the Categories”). MPAs are a tool to help reduce stress on marine ecosystems by conserving biological diversity, protecting spawning and nursery areas, and habitats like barrier islands, coral reefs and wetlands that shield communities from coastal storms and flooding.

Marine protected areas are established based on the needs of the local community and health of marine ecosystems. They are defined as adaptive management strategies, meaning they are flexible and responsive to environmental and social change (Agardy 268). They act as legal frameworks to maintain and promote diversity, serve as educational tools for locals and visitors, provide economic opportunities, as well as environmentally sound tourism and recreation, all while sustaining and increasing marine biodiversity and potentially exploitable fisheries. The nature of their flexibility is attractive to states and regions that widely differ in terms of conservation needs and socio-economic structure.

Despite their success, opposition to marine protected areas exists due to apprehension of fishermen and locals in coastal communities, especially in developing nations (Agardy 880). This is most commonly due to the length of time it takes to see results. It is difficult for those that rely on fish for their primary source of food and livelihood to sit patiently and wait for fisheries to recover, even if it is in their best interest in the long- term. Although all situations are different (based on location, societal structure and economic opportunities), the importance of community inclusion is vital to ensure the success of any form of fisheries management, especially when initiated by a foreign, third party. Community based management practices have become increasingly popular among conservationists over the past twenty years. This approach allows for a cooperative effort between the local people and the scientific community.

In some developing nations, such as Kenya, there is an ongoing shift in fisheries management from top- down command-and-control to a more community inclusive ecosystem approach. This transition is much needed to revitalize Kenya's struggling economy and to ensure that fisheries become long- term economic assets ("FAO Fisheries and Aquaculture"). Fishing is not only the primary occupation of local coastal residents in Kenya, but is also an integral part of tradition and custom, making it even more important to involve community members throughout the planning and management processes (Mangi, et al. 467). Since the implementation of marine parks (one classification of a marine protected area), Kenyan fisheries have experienced a moderately fast recovery of some fish species

(McClanahan, et al. 1061). Kenya's success provides hope for fishermen and a realistic model for coastal communities around the world.

Similarly in the Turks and Caicos Islands (TCI), fisheries resources provide locals with the second highest generator of income, following tourism, which is largely dominated by foreign investors. Unsustainable tourism and development, along with a lack of economic opportunities has prompted the increased extraction of marine resources. Further exploitation of key resources will place a heavy burden on local fishermen and strain the socio- cultural structure of the islands already affected by emigration due to lack of economic opportunity. Efforts are underway to develop conservation and management strategies to provide stable, sustainable economic growth for the people of the TCI (Medley and Nines 1). However, TCI's 33 marine protected areas require stricter regulation and more funding to ensure the repopulation of over-exploited fisheries (Rudd, et al. 199). Without access to such resources it is likely that unsustainable growth and development of the tourism industry, as well as increases in fishing efforts will cripple marine ecosystems in the Turks and Caicos Islands.

On a much larger scale, Chile has also devastated local fisheries since the 1970s due to deregulation of fishing, new economic policies that incentivized exports, and an exclusive economic zone that disproportionately favor sea- based products (Ibarra, et al. 514). By 1990 Chile became the third largest fishing state in the world. Since then, the Chilean government has recognized that they face the effects of unchecked economic growth based on finite resources, and have attempted to reregulate the fishing industry and sustainably manage large- scale fishing operations (Ibarra, et al. 526). However, a recent law aimed at ensuring the sustainable growth of Chilean fisheries will likely devastate small- scale fishermen. The law gives four large- scale private fisheries control of 92 percent of Chile's marine resources (Gubin). The Chilean President claims that this law and future management goals aim to ensure the sustainability of the fishery resources and to strengthen the role of science in the decision-making process in the field of fishing administration. He has plans to form 11 scientific committees to oversee the state of the Chilean Sea, however local citizens are outraged at the social implications of his decision,

which will strip four indigenous groups of their fishing domain, and devastate their sense of livelihood (Gubin). This strategy will most likely enrage local peoples, and result in the noncompliance of all those negatively affected.

It is essential that scientists and all affected peoples should be consulted in decisions regarding fisheries management. Without taking a participatory approach in fisheries management the results will most likely be unsuccessful. Although limiting catch size and implementing fishing restrictions may be initially opposed, it ultimately benefits the local economy and ensures the recovery of currently depleted fish stocks.

Section III: Impacts of Alternative Fishing Methods in Thailand and the Effects on Conservation Efforts

As world consumption of seafood continues to rise and marine fish stocks continue to be depleted, the farming of marine species has become a rapidly growing domestic and international industry. There are, however, a number of challenges that this industry presents. For example, since the 1980s the shrimp aquaculture industry in Thailand has rapidly increased from 31,000 tons in 1976 to 2.6 million tons in 2006 (Giap, et al. 123). Of all farmed shrimp, about 90 percent of it is produced in Asia and South Asian countries, most notably in Thailand, China, Vietnam, Indonesia, and India. Today, nearly half of all shrimp that consumers purchase is quite literally grown in tropical, developing countries in coastal ponds, only to be sold to developed, wealthy nations (Giap, et al. 123). Although the expansion of the shrimp aquaculture industry has been profitable for developing nations like Thailand, and has potential to decrease the extraction of wild marine resources, there are still many risks involved that need to be addressed before these aquaculture methods can be considered sustainable. Likewise, if commercial fishing efforts, small- scale subsistence fishermen, and farming operations continue to experience unmonitored and unregulated growth in all sectors, Thailand will experience rapid loss of profitable fisheries, exacerbate environmental degradation, and threaten the health and livelihood of millions.

Prior to 1984, Thailand harvested nearly 90 percent of their shrimp from naturally flowing bodies of water, most abundantly from the Gulf of Thailand (“TED Case Study”). These techniques existed

without developing new, intrusive infrastructure and without disrupting the health of local ecosystems. However, in the 1980s aquaculture shrimp farming experienced rapid growth in Thailand as it presented poor people with a previously undiscovered source of income. By 1987, extensive monoculture ponds began replacing the extraction of shrimp from coastal regions. Today, Thailand now contributes to 25 percent of the global market's pond-raised shrimp ("TED Case Study"). However, such rapid expansion of the shrimp sector has not come without its setbacks.

The use of traditional fishing methods from marine waters and undisturbed mangrove ecosystems is still prevalent among subsistence fishermen today throughout Thailand's coasts. However, a significant reduction of stocks due to commercial fishing fleets threatens the security of thousands of small-scale fishermen. In 2010, catch rates throughout fishing villages experienced a 50 percent decline in fish stocks (Giap, et al. 123). These fishermen also experience losses of fishing gear due to commercial trawlers, and face reduced profit margins due to fluctuations in gas prices. As sizable fish became more difficult to find close to shore, fishermen have to travel further from coastal areas, which results in higher expenses and lower profits. Other unexpected setbacks, such as natural disasters, like the tsunami that affected Thailand in 2004, threaten the success of fishing efforts, and drive down profits (Wong 405). The risk of similar catastrophic events in the future poses risks of even greater economic hardship and degradation of coastal environments.

Such risks and financial insecurities have promoted the growth of the aquaculture industry in developing countries like Thailand because of the high potential financial gains. Together, the top producers of aquaculture shrimp products account for an estimated 70 billion dollars ("Topic"). Such financial incentives have caused the Thai government, as well as international development agencies to provide funding to expand the shrimp sector and further develop coastal areas in order to meet the demands of the growing shrimp market.

Although the monetary gains are enticing, aquaculture fish operations are not the end-all- solution to replacing large-scale marine fishing efforts. This is especially true in Thailand today, where the

expansion of the aquaculture sector is not favorable to the Thai people. Shrimp farming operations in Thailand today are owned by multi- industry companies that use cheap, imported labor, taking jobs away from native villagers and farmers.

As the number and scale of these aquaculture operations increases so do the risks of rapid environmental degradation. The continuous improvement in aquatic production technologies, and economic incentives created by international trade have created a global production system based on high chemical inputs to satiate the global demand for seafood (Giap, et al. 123). The conversion of mangrove swamps to profitable fishing ponds has led to the cultivation of shrimp and other fish species at a level that has disregarded the viable carrying capacity of the mangroves. This threatens the health of entire vital mangrove ecosystems, coastal habitats, and contributes to the growing socioeconomic disparity of Thai coastal village people.

These large scale shrimp cultivating operations were once vastly bio-diverse mangrove ecosystems, which provided valuable resources and services to the local people. For centuries the mangroves have provided the people of Thailand with a source of food, fuel, medicine, textiles, shelter, and grazing areas for livestock (Primavera 457). The total economic value of intact mangrove ecosystems is valued anywhere from \$1,000 to \$36,000 per hectare; while mangroves used for shrimp aquaculture ponds are valued at only \$200 per hectare (“Shrimp Campaign”). The true ecological value of the mangroves is far higher than the short- terms profits yielded from mangrove shrimp farming operations, making it critical that they are protected to benefit the greatest number of people.

If global mangrove habitats continue to be unsustainably exploited, and global fish stocks continue to decrease, these people will be faced with larger financial and ecological burdens. The mangroves, which provide coastal protection from the devastating effects of storms, prevent erosion of shorelines and riverbanks, and act as a buffer from pollutants and toxic runoff, are in steady decline. Nearly 75 percent of all tropical and subtropical coastlines were once covered with mangroves, however, only about half of that remains today (Upadhyay, et al. 1329). As a result, recent storms have resulted in

higher death tolls and property damages in coastal areas where mangroves have been largely deforested. Regions that are covered with healthy mangroves have proven to provide up to twenty times the protection from tsunami waves as those areas with inadequate mangrove cover (Kathiresan and Rajendran 604). The protection that these natural buffer zones provide to coastal communities is invaluable.

Unsustainable management of the mangrove aquaculture ponds has also exacerbated issues of unemployment, urban migration, and food security for the local people. Currently, 65 million Thai people suffer from undernourishment; with most of these people relying on small-scale fishing efforts as a means of food and livelihood (Gray, et al. 1). Aquaculture shrimp farms have replaced rice fields which once provided a staple source of food in the diet of rural Thai people. All the while, nearly all shrimp harvested in these mangrove ponds are exported to the global market, providing very little food for the local people. The use of heavy chemical inputs in ponds also threatens ground water aquifers, causing a lack of potable drinking water (De Silva 23). In addition, employment opportunities in this sector prove to be of low wage, while more profitable jobs are given to an outside workforce (De Graaf and Juan). This not only expropriates funds from the local community, but also displaces former farmers and landowners, who are forced to seek jobs in urban settings.

The Ranong mangrove ecosystem on the Andaman Sea coastline in Thailand is one example of an area now devastated by abandoned shrimp ponds. In order for conservationists to identify proper restoration measures they must understand the effects of mangrove deforestation on the local ecosystem and improve other deforested sites throughout Southeast Asia. The Thai government and the United Nations Educational, Scientific and Cultural Organization (UNESCO) have recognized the ecological, economic and social importance of these ecosystems and have begun establishing biosphere reserves throughout the country's vulnerable coastal mangrove forests (Ashton, et al. 332). Awareness campaigns aimed to educate the Thai people of the true value of these mangrove ecosystems has led to renewed efforts to protect and restore them. Although mangrove restoration projects have a history of success; it is essential that proper site assessment and evaluation of replanting efforts is completed before hand.

So far, economic restraints have limited the biodiversity of mangrove replanting efforts. This has altered the natural biodiversity of mangrove ecosystems and has reduced the ecological function vital to maintaining genetic richness and resilience in the ecosystem (Ashton, et al. 332). In order to properly address the socio- economic and environmental impacts of the shrimp farming sector in Thailand, policy makers must better regulate the entire aquaculture industry.

Unfortunately, the lack of financial incentives and personal interest in farmers to self- regulate shrimp farm operations has sparked little progress. Thai policy makers have proposed using market- based incentives, and potentially taxing aquaculture farmers to fund waste water treatment projects (Anantanasuwong). The Thai government has also worked with the World Bank and the United Nations' Food and Agriculture Organization to promote more sustainable management practices through training and education programs.

Despite these efforts, Thai shrimp farmers continue to use unsustainable aquaculture practices. If this trend continues it is likely that the entire industry will eventually collapse, and leave Thailand's coastal areas barren. It is essential that this issue and others like it will surface to a larger, global audience, and will result in consumers using their purchasing power to make responsible, informed decisions to help fight issues of environmental degradation and socio- economic disparity that result from unsustainable fishing industries, and recognize that fish farming is not the solution to the issue of global overfishing.

Works Cited

- Agardy, M. Tundi. "Advances in Marine Conservation: The Role of Marine Protected Areas." *Trends in Ecology and Evolution* 9.7 (1994): 267-70. Web. 24 Mar. 2013.
<[http://www.coastman.net.co/publicaciones/amp/\(0012\).pdf](http://www.coastman.net.co/publicaciones/amp/(0012).pdf)>.
- Agardy, Tundi. "Information Needs for Marine Protected Areas: Scientific and Societal." *Bulletin of Marine Science* 66.3 (2000): 875-88. Print.
- Allison, Edward H. "Big Laws, Small Catches: Global Ocean Governance and the Fisheries Crisis." *Journal of International Development* 13.7 (2001): 933-50. Print.
- Anantanasuwong, Dararatt. "Shrimp Farming in Coastal Areas in Thailand and the Proposed Economic Instruments for Sustainable Shrimp Farming." Rep. Mar. 2001. Web. 26 Feb. 2012.
<<http://www.ritsumei.ac.jp/acd/cg/ir/college/bulletin/vol13-3/13-3-08Anantanasuwong.pdf>>.
- "Applying the Categories." Guidelines for Applying Protected Area Management Categories. IUCN, n.d. Web. 13 Apr. 2013. <http://data.iucn.org/dbtw-wpd/html/PAPS-016/4_Applying_the_categories.html>.
- Ashton, E., Macintosh, D., and S. Havanon. "Mangrove Rehabilitation and Intertidal Biodiversity: A Study in the Ranong Mangrove Ecosystem, Thailand." *Estuarine, Coastal and Shelf Science* 55.3 (2002): 331-45. Web. 4 Apr. 2013.
- Cinner, Joshua E., Timothy R. McClanahan, Tim M. Daw, Nicholas A.J. Graham, Joseph Maina, Shaun K. Wilson, and Terence P. Hughes. "Linking Social and Ecological Systems to Sustain Coral Reef Fisheries." *Current Biology* 19.3 (2009): 206-12. Web.
- De Graaf, G.J. and T.T. Juan. "Extensive Shrimp Farming, Mangrove Clearance and Marine Fisheries in the Southern Provinces of Vietnam." *Mangroves and Salt Marshes* 2.3 (2000): 159-66. Print.
- De Silva Sena S. "Tropical Mariculture and Coastal Environmental Activity." *Tropical Mariculture*. [S.l.]: Elsevier, 2007. Print.

- Eilperin, Juliet. "World's Fish Supply Running Out, Researchers Warn." *The Washington Post*. N.p., 3 Nov. 2006. Web. 2 Mar. 2013. <<http://www.washingtonpost.com/wp-dyn/content/article/2006/11/02/AR2006110200913.html>>.
- "FAO Fisheries & Aquaculture - FI Fact Sheet Search." FAO Fisheries & Aquaculture - FI Fact Sheet Search. N.p., n.d. Web. 27 Mar. 2013. <<http://www.fao.org/fishery/countryprofiles/search/en>>.
- "Fisheries and Aquaculture." FAO: FAO Home. Web. 24 Nov. 2011. <<http://www.fao.org/docrep/014/am859e/am859e07.pdf>>.
- "Fisheries Management- 2. The Ecosystem Approach to Fisheries." *FAO Corporate Document Repository*. Food and Agriculture Organization of the United Nations, 2003. Web. 23 Feb. 2013. <<http://www.fao.org/docrep/005/Y4470E/Y4470E00.HTM>>.
- Foster, Malcolm. "Bluefin Tuna Sells for Incredible Record \$1.76 Million at Tokyo Fish Auction." *Huffington Post*. N.p., 4 Jan. 2013. Web. 13 Apr. 2013. <http://www.huffingtonpost.com/2013/01/05/bluefin-tuna-sells-for-incredible-record-tokyo-fish-auction_n_2415722.html>.
- Giap, Dao Huy, Po Garden, and Louis Lebel. "Enabling sustainable shrimp aquaculture: Narrowing the gaps between science and policy in Thailand." *Sustainable Production Consumption Systems*. Springer Netherlands, 2010. 123-144.
- Gray, Timothy, Estelle Jones, and Chanin Umponstira. "Small-Scale Fishing: Perceptions and Threats to Conserving a Livelihood in the Province of Phang-nga, Thailand." *The International Journal Published by the Thai Society of Higher Education Institutes on Environment* (2008): 1-7. Print.
- Greenberg, Paul. "Seafood Crisis." *National Geographic* Oct. 2010: n. pag. Web. 5 Mar. 2013. <<http://ngm.nationalgeographic.com/2010/10/seafood-crisis/greenberg-text/1>>.
- Gubin, Anastasia. "Fishing Law Privatizes Sea off Chilean Coast." *Epoch Times*. N.p., 2 Jan. 2013. Web. 28 Mar. 2013. <<http://www.theepochtimes.com/n2/world/fishing-law-privatizes-sea-off-chilean-coast-331610.html>>.

- Hauge, Kjellrun H., Belinda Cleeland, and Douglas C. Wilson. *Fisheries Depletion and Collapse*. Rep. International Relief Governance Council, 2009. Web. 4 Mar. 2013. <http://irgc.org/wp-content/uploads/2012/04/Fisheries_Depletion_full_case_study_web.pdf>.
- Ibarra, Alonso, Chris Reid, and Andy Thorpe. "The Political Economy of Marine Fisheries Development in Peru, Chile and Mexico." *Journal of Latin American Studies* 32.2 (2000): 503-27. Print.
- Kathiresan, K., and N. Rajendran. "Coastal Mangrove Forests Mitigated Tsunami." *Estuarine, Coastal and Shelf Science* 65.3 (2005): 601-06. Print.
- Mangi, S., C. Roberts, and L. Rodwell. "Reef Fisheries Management in Kenya: Preliminary Approach Using the Driver–pressure–state–impacts–response (DPSIR) Scheme of Indicators." *Ocean & Coastal Management* 50.5-6 (2007): 463-80. Print.
- McClanahan, Tim R., Nicholas A. J. Graham, Jacquelyn M. Calnan, and M. Aaron MacNeil. "Toward Pristine Biomass: Reef Fish Recovery In Coral Reef Marine Protected Areas In Kenya." *Ecological Applications* 17.4 (2007): 1055-067. Print.
- Medley, P., and C. Nines. "Fisheries Management in the Turks and Caicos Islands." Department of Environmental and Coastal Resources, 7 July 1995. Web. 26 Mar. 2013. <http://www.spc.int/DigitalLibrary/Doc/FAME/Meetings/SPC_FFA_Workshop_1995/BP33.pdf>.
- Montaigne, Fen. "Global Fisheries Crisis." *National Geographic* n.d.: n. pag. Web. 1 Mar. 2013. <<http://ngm.nationalgeographic.com/2007/04/global-fisheries-crisis/montaigne-text> >.
- Morishita, J. "What Is the Ecosystem Approach for Fisheries Management." *Marine Policy* 32.1 (2008): 19-26. Print.
- "New Scientific Report Shows Pacific Bluefin Population Down 96.4% - The Pew Charitable Trusts." Pew Charitable Trusts. N.p., 9 Jan. 2013. Web. 13 Apr. 2013. <http://www.pewtrusts.org/our_work_report_detail.aspx?id=85899441615>.
- "Overfishing Ocean Issues from the Seafood Watch Program of the Monterey Bay Aquarium." Overfishing Ocean Issues from the Seafood Watch Program of the Monterey Bay Aquarium.

- Monterey Bay Aquarium, n.d. Web. 14 Apr. 2013.
<http://www.montereybayaquarium.org/cr/cr_seafoodwatch/issues/wildseafood_overfishing.aspx>.
- "Overfishing." National Geographic. N.p., n.d. Web. 7 Mar. 2013.
<<http://ocean.nationalgeographic.com/ocean/critical-issues-overfishing>>.
- Overview: Major Trends and Issues. Rep. Food and Agriculture Organization of the United Nations, n.d. Web. 7 Mar. 2013. <ftp://ftp.fao.org/FI/STAT/summary/YB_Overview.pdf>.
- Primavera, J. "Mangroves as Nurseries: Shrimp Populations in Mangrove and Non-mangrove Habitats." *Estuarine, Coastal and Shelf Science* 46.3 (1998): 457-64. Print
- Rudd, Murray A., et al. "Are marine protected areas in the Turks and Caicos Islands ecologically or economically valuable?." *Fish. Cent. Res. Rep.* 9.8 (2001): 198-211.
- "Shrimp Campaign." *Environmental Justice Foundation EJF*:. Web. 27 Feb. 2012.
<<http://www.ejfoundation.org/page211.html?clid=CIzhmb2mvq4CFQPe4AodFlsHNw>>.
- The State of World Fisheries and Aquaculture, 2010*. Rome: Food and Agriculture Organization of the United Nations, 2010. Web. <<http://www.fao.org/docrep/013/i1820e/i1820e.pdf>>.
- Stem, Caroline, Richard Margoluis, Nick Salafsky, and Marcia Brown. "Monitoring and Evaluation in Conservation: A Review of Trends and Approaches." *Conservation Biology* 19.2 (2005): 295-309. Print.
- "TED Case Studies." *Thailand Shrimp Farming*. 11 Jan. 1997. Web. 27 Feb. 2012.
<<http://www1.american.edu/ted/THAISHMP.HTM>>.
- Topic, Policy. *U.S. Commission on Ocean Policy*. Web. 24 Nov. 2011.
<http://www.oceancommission.gov/documents/full_color_rpt/welcome.html>.
- Wong, Poh Poh. "Rethinking Post-tsunami Integrated Coastal Management for Asia-Pacific." *Ocean & Coastal Management* 52.7 (2009): 405-10. Print.

Upadhyay, V.P, Ranjan, R., Singh, J.S “Human-mangrove conflicts: The way out.” 2002. *Current Science*, Vol 83, No II pp1328-1336

WWF Annual Review 2006. Rep. World Wildlife Fund, n.d. Web. 01 Mar. 2013.

<http://awsassets.panda.org/downloads/wwf_ar06_final_28feb.pdf>.