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### **Senegal, A Modest Proposal for Overfishing**

In Western Africa, Senegal is placed at the bottom of the food chain. Senegal, a third world country, relies heavily on its imports rather than its exports. With Senegal's main crops being only cotton, sugarcane, groundnuts, and rice, and with the unpredictable weather, many of Senegal's crop productions are ruined. The narrowing options for agricultural livelihood caused many farmers to turn to fishing. Fishing has always been a major part of Senegal, but with the irregular weather and climate, fishing was consistently placed in the center of attention.

Overfishing is not the first thing in the world that has been overused. Sadly, overfishing has lasting effects that impact countries across the globe. The amount of fish in the oceans is half the amount it was in 1970 (Craig). Common commercial fish like the tuna, mackerel, and bonito have gone down nearly 75% according to World Wide Fund. It is not just the fish that are dying off with marine animals, birds, and reptile populations have fallen by 49% from 1970 to 2012 (Craig). Around the world, marine fish catches fell to 79.7 million tons from 82.6 million tonnes. These past statements support the definition of overfishing: "Overfishing occurs when more fish are caught than the population can replace through natural reproduction" ("Ethnic Groups and Religions"). Overfishing directly affects over 3 billion people around the world that rely on freshly caught marine life as their primary source of protein. In Senegal, a little over 600,000 fishermen are feeling the effects of the lack of fish in the ocean. "In Senegal, fisheries provide 75 percent of the animal protein for the country's diet" (Beatley and Edwards). Over the past five years, the fishermen went from being able to feed up to 650,000 people to only 70,000 people. The crisis is being caused by European and Asian fleets fishing in Senegal's fisheries.

Senegal's population is currently 16,552,277, 44.06% urban population and 55.94% rural population (Sawe). Typically, families have up to eight people in them including grandparents, cousins, and extended family. Senegal is 75,955 square miles, yet only 11% of the total land in Senegal is cultivated for crops ("Senegal"). Houses in the rural areas of Senegal usually consists of walls made from inner earth or straw. In some urban areas, houses are made of cement and have roofs made out of tile or corrugated iron (Hargreaves). Roughly 46.7% of Senegal's population is considered poor, with around 38% of the population living off of a \$1.90 a day (compared to the United States with an average hourly pay of \$7.50) (Lano). Senegal's strengths are its political system and its headway on business climate. Senegal also has oil and natural gas reserves off the Senegalese coast.

Senegal's weakness involves multiple aspects, starting with many exports depending directly on the weather and climate, and building into its weak infrastructure. Overfishing, low capital wealth, and unemployment rates bring up the rear of Senegal's many weaknesses. Senegal separated from the Ghana Empire in the 8th century. During this time period, Portuguese traders made contact with coastal kingdoms and introduced the British, Dutch, and French to the land. By the 19th century, the French had secured Senegal. Senegal made a run for independence from the French. It lasted for two months and then became a republic under the rule of Léopold Sédar Senghor. In the 1980s and 1990s, riots and rebellions broke loose because of tensions with the government ("History").

The main ethnic group in Senegal is the Wolof. The Wolof include Senegal, Gambia, and Mauritania (Sawe). The Wolof language in Senegal is 43% of the total population. The Wolof language originates back to the slave traders in the 18th century. About 95% of the religion in Senegal is Muslim and Islam. Christians in Senegal make up less than 5% of the country's religion. Education in Senegal is free up to the age of 16. Poverty and administrative attitude, as a result, drive many parents and students away from

education. After the age of 16, the majority of students go out in the fields to help work for their families. The main jobs and industries in Senegal include food processing, textiles, tourism, cement and construction, mining, fishing, and refining imported petroleum (“Senegal”).

There are many different causes to overfishing from poor fishery management to illegal fishing. In Senegal, open access fisheries are one of the main contributors to overfishing. With the lack of property rights, fishermen do not feel the need to throw fish back in the water. Poor fishing management is from the government lacking the regulations and traceability of fishing activities. The current rules that the government has for fishing regulations are out of date and full of loopholes, allowing fishermen to take more than their share of fish. Illegal and unreported fishing is another factor affecting Senegal’s fisheries. “Illegal fishing accounts for an estimated 20% of the world’s catch and as much as 50% in some fisheries” (Beatley and Edwards). However, it is just not Senegalese that are overfishing in their fisheries. China too is using Senegal’s waters for fishing grounds. China’s unpracticed ways are causing 90% of the fisheries in Senegal to collapse (Beatley and Edwards).

With the situation in Senegal growing worst by the day, fishermen came together to form a club called the Fishermen’s Committee of Ngaparou. Their goal was to have community-based fisheries management that restore fish stocks and promote a healthy marine environment. The CLP convinced fishermen to not fish in certain zones of their fisheries. They have made more than 20 trips per month to drive away illegal fishermen, yet there continue to be problems with poachers who often use violence to threaten surveillance volunteers (Craig). However, the average weight of lobsters in the restricted zones had gone up 72% and lobster yields have doubled from 1.5 kilograms. Conservation efforts can and do make a difference when implemented properly.

Due to the illegal and unreported fishing that goes on in Senegal waters, bottom net fishing has been banned. Bottom net fishing is dragging the fishing net across the seafloor. Senegal’s government has also limited the number of Chinese boats that are allowed in their fisheries. Regardless of these rules, China still uses this method of fishing in Senegalese waters (Beatley and Edwards). Since other countries in Western Africa do not attempt to stop China’s fishing practices, migrating fish are often overfished, leaving less fish for local fishermen.

One way to introduce native fish back into the Senegalese waters is to promote the use of fish hatcheries solely for replenishing and revitalizing the fish population. Currently, Senegal uses fish hatcheries to raise tilapia for market use only (Berger). Here in the United States, fish hatcheries are used to raise trout because there are not enough trout in the wild due to overfishing. Fish hatcheries work by producing fish until they are mature enough to be let free in their wild habitat. Expanding this infrastructure in Senegal would increase the number of jobs available to fishermen and provide more opportunities to sell market raised fish while also replenishing the native fish species for traditional fishing. In raising fish to be returned to the wild, special attention would need to be paid to the genetic makeup of the fish. “Fish raised in concrete troughs of a hatchery are different than wild fish” because hatchery fish must adapt to a natural habitat upon release (Berger). However, Michael Blouin’s team at Oregon State University have found fish can adapt from hatchery habitation to wild habitation within a single generation, offering hope for areas like Senegal (Berger).

Another way to combat the overfishing issue facing Senegal is to increase the number of Marine Protected Areas (MPA). These governmentally protected areas are created to help control the use of certain marine areas, some totally designated as no-take zones to better allow the natural marine life to recover from human involvement. The United States of America has more than 1700 active MPAs in use and over 41% of its waters are MPAs (Hargreaves). The United States use of MPA’s has significantly aided in improving the biodiversity and populations of its waters. In contrast, Senegal only has only 1.1027% of their water protected by MPAs (“ . Increasing the number of MPAs and expanding the size

of existing MPAs in Senegal will help improve and protect the native fish from being overfished. This method has worked in other places too. In 1995, Egypt established 5 "no-take" fish reserves in the Nabq Natural Resource Protected Area. Over the next five years, scientists found an increase in the targeted fish populations, averaging an increase of two-thirds over the five-year study (Commonwealth of Australia). This method could work for Senegal.

Declaring more MPAs in Senegal will also help curb illegal and unreported fishing from happening. Enforcing these MPAs will prevent Chinese and European ships from being able to fish in Senegalese waters, allowing the fish to make a come back in Senegal. These MPAs will create hundreds of jobs for the Senegalese and help support their families. Jobs like security, mechanics, and fishery managers will make up for the majority of jobs and could be given towards fishermen who are limited by some of the tightening restrictions around fishing.

In order for these MPA's to be effective however, the rules set for each MPA need to be enforced. The Senegalese government will need to dedicate further time and money for this project. MPAs are no good by themselves; in order for them to be used to their full potential, they must be protected and enforced. By putting the national guard out on the coast of Senegal, the government will protect these MPAs from illegal and unreported fishing. In addition, using the knowledge of local fishermen and the science from other successful MPA infrastructures across the world would help communicate their importance to the general public.

Additionally, implementing fishing restrictions will force fishermen to have a daily limit that they can take from the fisheries. For instance, today fisherman in Senegal are told to catch as much as possible in as little time as possible (Craig). In order to correct this, the Senegal government can make certain windows or seasons for fishing (Berger). To go along with this, strict fishing limit requirements will be put into action. Limiting the number of fish one can take per day or per season will keep fishermen in check, allow more fish in the fisheries, and more time for the population to rebound. Keeping this in mind, the fishermen will get a share of the percentage of the fishery. The more fish in the fishery, the more money the fisherman will get from stocks shared with the fishery (Craig). The fishermen will, in turn, take better care of the fisheries and will also protect the fisheries from illegal and unreported fishing. This sort of fishermen education is essential; without understanding the restrictions and guidelines, fewer fishermen will follow them, even with increased government enforcement.

In the United States of America, a combination of Marine Protected Areas and fish hatcheries have helped America push through its own overfishing problems. Thanks to the Magnuson-Stevens Fishery Conservation and Management Act, NOAA Fisheries was created. NOAA Fisheries is based upon sustainable fisheries management, which involves, "sound science, innovative management approaches, effective enforcement, meaningful partnerships, and robust public participation"(Noaa). These Fisheries provide commercial, recreational, and numerous other types of safe fishing practices. NOAA Fisheries, using commercial and recreational saltwater fishing, "generated more than \$208 billion in sales and supported 1.6 million jobs in 2015"(Noaa). As of result, America has strengthened its economy, communities and local marine ecosystems.

However, this is not all NOAA Fisheries has done. NOAA Fisheries target numerous fishing techniques such as MSY (maximum sustainable yield), overfishing and overfished. Overfishing includes harvesting a fish species at a higher rate than it is produced. Overfished means that the fish population size is too low for legal fishing to take place. By putting down quotas such as different stocks for commonly overfished

fish in the United States, America is able to control different populations of fish species. In America, 8.9 million saltwater fishermen help support 439,000 jobs and create 63 billion dollars in revenue (Noaa).

To support Senegal's fishing economy, Senegal could assimilate America's NOAA Fisheries. As a form of foreign aid, NOAA Fisheries representatives could educate Senegal's government. This education would encompass the benefits of regulated, sustainable fisheries. America's representatives would have to sell the government on the ideals of sustainability, job creations, and profitability. Ideally, Senegal's educated government would mentor and train its citizens to practice and embrace these new concepts of sustainability.

Solving the problem of overfishing is not limited to just fishermen and those in the trade. Approximately 1 million people in Senegal rely on fish as the main course in their meal (Senegal). Because of this high demand for fish, it is important to educate them about why the fish populations are decreasing. Educating the population will allow them to understand the long term impacts of overfishing and will encourage alternative solutions to overfishing. It is not only Senegal but the whole world that needs to be educated about overfishing, including the 3 billion that relies on fish as a daily source of protein ("Sustainable Food Overview"). People must also be educated about the China and European fleets of ships that are invading Senegal's waters and in boarding countries near Senegal. The people of Senegal, including the government, must understand that educating their people about the protection of MPAs and fishing restrictions will not only help the fish and the fishermen but aquatic environments and economic stability.

Although Senegal has made efforts in the past to address these issues, further inaction will only harm their people. The solutions proposed above, if implemented with clear guidance, accessible education, and sound follow through, will help to ensure the safety of the environment and the people of Senegal. With these solutions, Senegal will receive both economic and environmental prosperity.

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