Southeast Alaska Inside Waters Management Plan
of Walleye Pollock (*Theagrama chalcogramma*)

Tyler Lantiegne – captain and primary contact (thlantiegne94@gmail.com)
Kyla Compton, Diane Murph, Nicole Peterson and Kyle Hagerman
Petersburg High School Cexy Cnidarians

Petersburg High School
PO Box 289, Petersburg, AK 99833
Coaches: Joni Johnson (jjohnson@pcsd.us)
Sunny Rice (sunny.rice@alaska.edu)

Abstract

In Southeast Alaska, we have a population of walleye pollock (*Theagrama chalcogramma*) that is unused by our Petersburg fishing fleet today. We are proposing that the Alaska Department of Fish and Game consider this management plan to create a walleye pollock fishery. Walleye pollock can live to be 17 years old, however, the most fish are concentrated at any given time right before they spawn at the age of three. Walleye pollock play an important role in the food chain, both as predators of plankton, and as a prey species for arrow tooth flounder, stellar sea lions, other pollock, and seabirds. The main goal of our Inside Waters Management Plan (IWMP) is to diversify our town's economy during the winter months, by sustainably using prespawning pollock. In order for this fishery to go through, we will need to examine: alternate methods of fishing with an in depth description of pair seining along with the pros and cons of this method; the correlation between pollock and species such as coral, stellar sea lions, and bycatch species such as Chinook salmon and king crab; the issue of Chinnok salmon king crab bycatch; discuss the importance of observers and the role that they will play in bycatch monitoring; the economics of this plan and the projected economic gain ($4 million) that we wish to achieve with our fishery; the costs of implementation which equal approximately $162,000; and the viability of our fishery. As well as examining the economic and ecological affects of this pollock fishery on our community and our surrounding region.

Introduction

This paper is a proposal to the Commissioner of the Alaska Department of Fish and Game for an exploratory walleye pollock (*T. chalcogramma*) fishery. There is a Total Allowable Catch of 9,245 tons of pollock in Southeast Alaska that has been left untouched. We want to open up a pollock fishery in Petersburg to help out our town and its citizens. Petersburg's total economy is seasonal, with most of the income being made in the summer. In 2010, 468 people in the community held a total of 1,103 fishing permits. These permit holders contribute to the total catch every year. In 2010, 57 million pounds of fish were landed in Petersburg for a total of $51 million ("Commercial" 2011). Petersburg as a community received $605,220 from the taxes placed on the fisheries ("Commercial" 2011). A walleye pollock fishery would help diversify our economy, as most of our fleet is tied up at the dock in the winter.

In this paper will cover the pollock life cycle, habitat, and pollock's role in the food web. Our management plan addresses the issues of bycatch, Steller sea lion populations, and coral habitat. We propose pair seining as a more reasonable method for catching pollock. Finally we discuss the further research that needs to be conducted in order to make the pollock fishery a viable one.

Walleye Pollock Life Cycle

Walleye pollock (*T. chalcogramma)* spawn from late-March to mid-May ("Walleye Pollock") with a peak in May in Southeast Alaska. While there is little information about the biology of Southeast Alaska pollock, we use data from the Bering Sea or the Gulf of Alaska unless otherwise noted. Females start spawning at age two, but ages four and five contribute the most offspring to the population ("Species Profile"). They spawn in dense schools in deep water off the continental shelf ("Species Profile"). Bering Sea spawning usually takes place in 1-3 degrees Celsius ("Species Profile"). Female's spawn many times over a few weeks ("FBE" 2009), producing between 20,000 and 1.75 million eggs and spawn yearly ("Species Profile"). Female pollock spawn yearly, producing fewer eggs with age

("FBE" 2009).

The eggs hatch in one to three weeks in the same depth they were spawned ("FBE" 2009). Pollock usually are found around 30 meters from the surface ("Species Profile"). The newly hatched planktonic pollock larvae are pelagic and metamorphose into juveniles in two to three weeks (Northwest Fisheries). The early-stage larvae eat mostly copepod nauplii ("Walleye Pollock"). Juveniles eat plankton at night, descending during the day ("FBE" 2009). By the end of their first year they will be 12-14 centimeters in length ("FBE" 2009). Juvenile pollock have a diet of euphausiids, copepods, decapods, larvae, and larvaceans, and are eaten by marine mammals, seabirds, and fish ("Walleye Pollock"). When juvenile pollock are a few months old they live above the thermocline in the Bering Sea ("Species Profile"). In the fall, the juveniles descend deeper into semi-demersal waters ("Species Profile").

Adult pollock migrate inshore in the summer and spring to waters off the continental shelf to depths of 90-140 meters ("Species Profile"). They move deeper in the cold months to 160 to 300 meters ("Species Profile"). The maximum age of walleye pollock in Dixon Entrance/Hecate straight is 12 years, and the maximum length is 71 centimeters ("Walleye Pollock"). Both genders have the same rate of growth and maturity. Overall, the maximum life span of a pollock can be 17 years ("FBE" 2009).

Habitat

Walleye pollock are found from California to the Bering and Chukchi Seas, and Japan ("Alaska Pollock" 2011). The most populous sites for walleye pollock are found between the Gulf of Alaska and Bering Sea (Figure 1) ("FBE" 2009). According to the paper "Alaska Pollock and its sustainability", their spawning grounds are found in the Aleutian Basin, the Bering Sea, the Gulf of Alaska, northwest of the Pribilof Islands, and the Strait of Georgia.

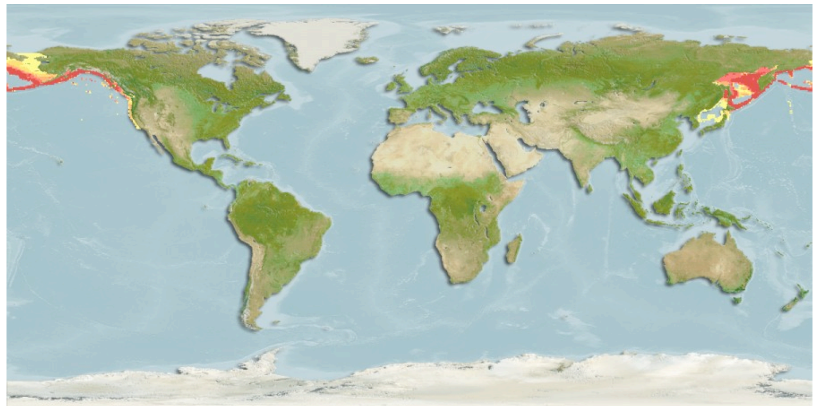

Figure 1: Walleye Pollock range. Red indicates high probability of occurrence, yellow low probability (AquaMaps 2010).

Pollock migrate seasonally from spawning grounds to feeding grounds. Their habitat is in between mid-water and the bottom of the ocean, typically where coral communities are found. Pollock are found between 110 m to 330 m, but can also be found at 1,150 meters (“Alaska Pollock” 2011). They usually live in water temperatures of 2-4 degrees Celsius (“Species Profile”). Older pollock, above the age of five, live more towards the bottom. Pollock younger than five years live and form large schools in the mid-water region (“Alaska Pollock” 2011).

Ocean Circulation

In Southern Alaska ocean currents greatly affect the habitat of sea life. According to the paper, “Southeast Alaska: Oceanographic habitats and linkages”, the North Pacific Current feeds the Alaska Current (Figure 2). This brings semi-warm water into the inside waters of the Gulf of Alaska by way of the Alaska Current (Weingartner et al. 2009). The Gulf has eddies that appear around fall and winter that change the habitat through increased circulation. They bring in substantial amounts of heat and freshwater from the continental slope into the interior. The eddies also bring nutrients and a mix of shelf phytoplankton and zooplankton. An example of

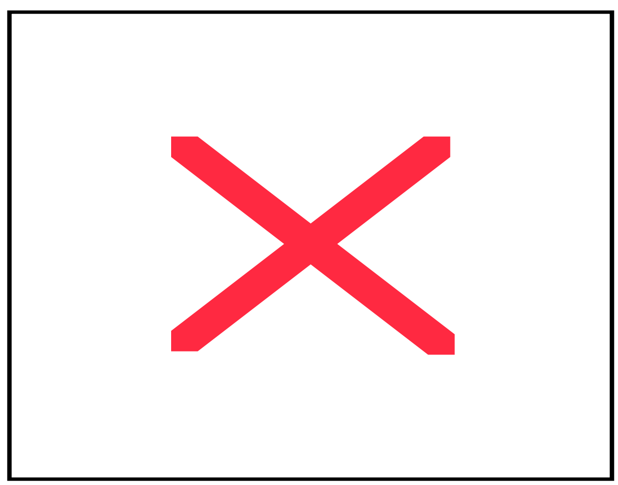

Figure 2: Gulf of Alaska Currents feeding the inside waters (USGS 2011).

an eddy affecting a fishery is the Sitka Eddy, which affects the local salmon migration routes. These eddies never form in the same place twice. This variability affects the physical and biological properties of the adjacent continental shelf and slope (Weingartner et al. 2009).

According to A'mar, a pollock in its early stages of life can be dramatically affected by ocean circulation. Ocean circulation in turn is affected by precipitation, wind, and transport. Winds during the winter mix the waters, which provide food, thus leading to a higher rate of survival of eggs, larvae, and juvenile fish. More precipitation also helps young pollock survive, whereas more wind mixing during springtime is bad for larvae, juvenile, feeding, transport, and survival (A'mar 2009). Many believe that survival may be decreased in times of low sea surface temperatures and windy weather.

Food Web

Pollock are in the mid-trophic level within the food web. According to Trites, pollock eat mostly copepods, euphausiid, gelatinous zooplankton, and shrimp (Dorn et al. 2010). Southeast Alaska pollock smaller than 250 millimeters eat mostly planktonic crustaceans, and pollock larger than 349 millimeters eat mostly shrimp and fish ("Species Profile"). Pollock eat usually in shallow waters, but

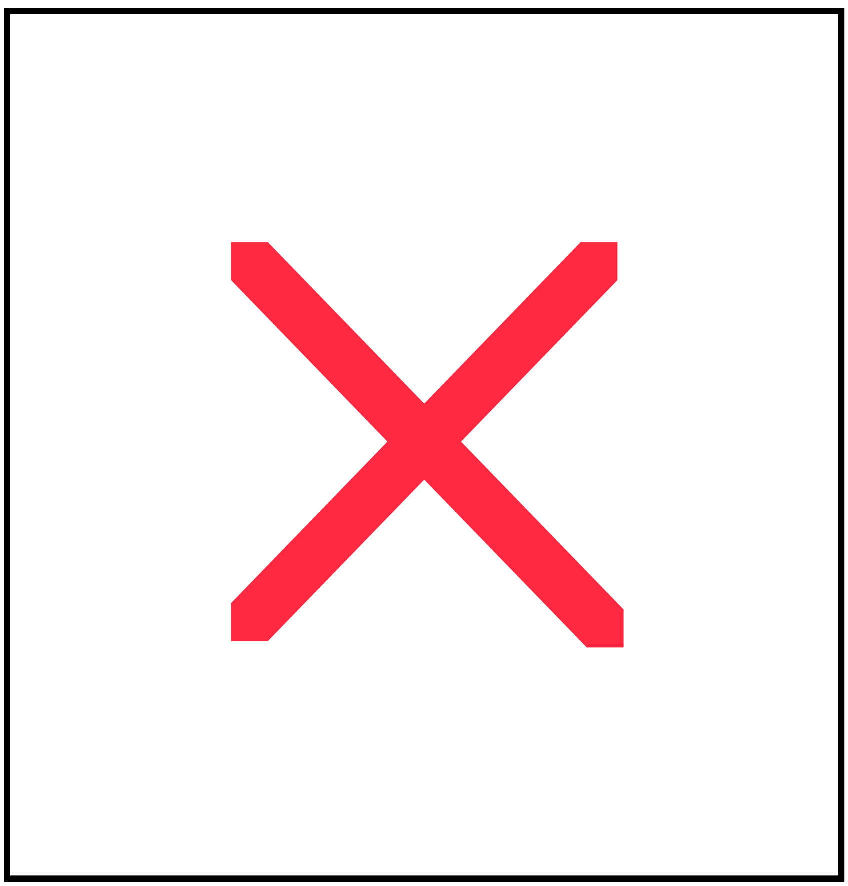

Figure 3: Sea lion stomach contents. Note Southeast Alaska diet. (Trites 2008).

barely eat during spawning ("Species Profile").

Pollock play an important role in the food web as a prey species (Trites 2008). They are an important prey item for; demersal fish (fish living close to the ocean floor), sperm whales, sea lions (Figure 3), birds, rockfish, and groundfish (Trites 2008). The predator-prey relationship between pollock and sea lions has been a cause for concern in Gulf of Alaska pollock fisheries.

History of the Pollock Fishery in Southeast

Southeast Alaska used to have a pollock fishery, albeit with problems. With subsidies from the State of Alaska, Southeast's pollock fishery started in 1976 (Barry Bracken pers. comm. 2011). Due to the lack of flat continental shelf that pollock aggregate on, the large groups of pollock that were targeted by trawlers were almost unheard of, making it hard to turn a profit (Barry Bracken pers. comm. 2011). This pollock fishery continued until the F/V *Kimber* and F/V *Lancer* went on a pollock survey, leveling vast grounds of coral habitat and catching enough salmon in that run to surpass the cumulative value of the pollock fishery to that point (Linda Blehken pers. comm. 2011). For these reasons, the pollock fishery in Southeast Alaska never took off (Barry Bracken pers. comm. 2011).

How Alaska Pollock Fisheries are Managed

Federal fisheries for walleye pollock take place in the Gulf of Alaska, the Bering Sea and the Aleutians. In the Gulf of Alaska, winter fishing targets pre-spawning groups in Shelikof Strait, and the Shumagin Islands. Summer fishing mainly occurs on the east side of Kodiak Island and along the Alaska Peninsula. Winter fishing in the Bering Sea Aleutian Islands concentrates on spawning populations on the continental shelf of the eastern Bering Sea, mainly north and west of Unimak Island ("Walleye Pollock Management" 2011).

Total allowable catch (TAC) is an annually determined catch that is species-specific. TACs are determined for the upcoming fishing season by using biological conditions of stocks in an annual Stock

Assessment and Fishery Evaluation (SAFE). SAFE contains historical catch trends, biomass and allowable bycatch (ABC) estimates, evaluations of harvest impacts, and alternative harvesting strategies. Socioeconomic considerations include promotion of efficiency, optimum marketable size of fish, impacts on prohibited species, seasonal access, commercial importance to local communities, subsistence needs, and the need to promote utilization of certain species (DiCosimo 2011).

A pollock fishery in Southeast has a proposed rank of tier 5. This is from a ranking process of 1-6. It relates to how much information you have in biomass. A rank of 1 has the most detailed biological information you can have and 6 is the least. We would need to survey the biomass to get a better reading on what the actual biomass is (Grabacki 2008).

According to the current Southeast Alaska pollock quotas from 2011 and 2012, the Over Fishing Level (OFL) is 12,326 tons, the allowable bycatch (ABC) is 9,245 tons, and the Total Allowable Catch (TAC) is 9,245 tons. These numbers are based on an estimated biomass in southeast Alaska from the 2009 NMFS bottom trawl survey (Dorn at al. 2011).

Along with the Federal fisheries the state of Alaska also manages a pollock fishery. The Prince William Sound pollock fishery is managed using a harvest rate strategy, where the Guideline Harvest Level is the product of the biomass estimate. In 1999 the Board of Fisheries directed ADF&G to set up a Prince William Sound pollock trawl fishery management plan to reduce potential impacts on the population of Steller sea lions. ADF&G's surveys of pollock in Prince William Sound are what is used to help set the Guideline Harvest Level rather then setting it as a fraction of the federal Total Allowable Catch for the Gulf of Alaska ("Walleye Pollock Management" 2011).

INSIDE WATERS *T. Chalcogramma* MANAGEMENT PLAN

The main goal of our Inside Waters Management Plan (IWMP) is to diversify our town's economy during the winter months, by sustainably using prespawning pollock. We also will follow the guidelines of the Gulf of Alaska Management Plan which are: establishing fishing guidelines and population thresholds; stimulating development of domestic fisheries; and watching out for the ecosystem. As a whole, this sums up what we wish to accomplish with our management plan. However, because our fishery is in inside waters, our quotas and fishery areas will be determined by ADF&G.

Alternate Methods

The trawl ban in the state waters in Southeast Alaska was a fishing restriction implemented in 1998 (Linda Behnken. pers.comm 2011). This ban was brought about by local citizens of Southeast, but mostly by long line fishermen from Sitka (Witherell et al. 2000). The trawl ban was instigated because trawling caused lasting damage to deep sea coral and sponges, and caused problems for the Pacific rockfish population, which caused closures of other fisheries (Linda Behnken pers comm. 2011, Witherell et al. 2000). Since trawling is banned, we must discuss other gear types that could be viable.

Alternate methods include, longlines, pots, and pair seining. Longlines could be a viable method of fishing as it is ecologically sound because the bottom is not disturbed and we only have to worry about halibut and other groundfish for bycatch. This method is discounted because we would not be able to catch enough per set to make it economically viable. Pots would also be a viable method to catch pollock, but it would cost more to keep the pots baited and to pull each set. Pair seining is the method that we will detail the use of for our management plan (Figure 4), because it will not catch rockfish or coral, and can catch large volumes of pollock.

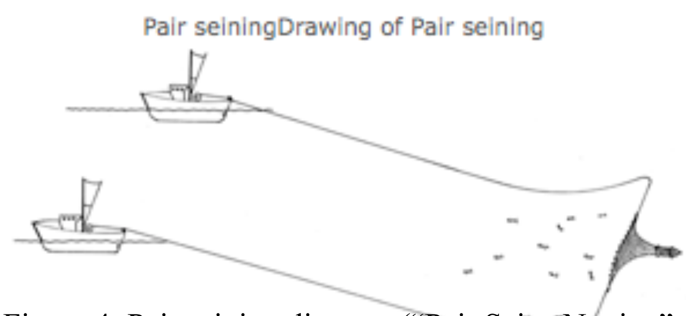

Figure 4: Pair seining diagram ("Pair Seine Netting" 2011)

Pair seining can be an environmentally sound method that involves two boats. Fishermen's boats go 0.5 nautical miles apart with a net dragging between them (Thomson, 1978). The pair seine gear is lighter and does not have trawl doors so any bottom impacts will be lessened. Additionally, if done properly, this method minimizes contact with the bottom, leaving most benthic habitat undisturbed. This method is also good at increasing catch numbers for spread out groups of pollock which is beneficial for the waters surrounding Petersburg. The only problems with this fishing gear are it must be regulated to keep the nets off the bottom to save coral habitats, and to minimize the bycatch of king salmon. Although pair seining is a viable method, there are still some issues.

With help from Gerry Merrigan (2011), we have found three major problems with the pair seining method. First is the problem with pair seining and the dramatic tides and strong currents that are in our inside waters. These currents and tides can flip unsuspecting boats. With prior knowledge of these currents and tides, however, this risk of flipping will be minimized. The second problem with pair seining is keeping the two boats together. In an interview with Gerry Merrigan, it was made clear that synchronizing the movements of the two boats involved is imperative to the success of a pair seine run. If the boats were to be off even slightly, a pair seining run could be jeopardized. This along with the point above shows that we must be sure to have fisherman who know what they are doing to make this fishery successful. The final problem that we have discovered with the pair seining method is bycatch; we will address this issue below.

Ecology

In order to have a successful fishery, we must develop a multi-species management plan. We are targeting adult pollock, and will regulate net size to keep the catch of smaller fish and juvenile pollock down to a minimal level. We will also have to monitor the bycatch and the ocean floor where we are fishing to make sure that our impact is minimal. We need to consider the relationship of pollock with sea lions, sea birds, bycatch species, and coral.

Sea Lions

The relationship between sea lions and walleye pollock is a unique one. A typical sea lion's diet usually consists of herring and pollock (Ferrero et al. 1994). Pollock is a very low energy food, and when other food sources are less abundant, sea lions may have to tweak their diet to suit their environment (Ferrero et al. 1994). The western Gulf of Alaska population of sea lions is endangered, and the eastern population is threatened (Ferrero et al. 1994). The pie chart above shows that almost half of a sea lion's diet in Southeast Alaska is pollock. We will have to carefully watch to ensure that there is not an impact from pollock fishing to sea lion populations. In the case of over fishing, we will need to immediately respond by lowering the guideline harvest level (GHL) in order to not negatively impact the population of sea lions.

Bycatch

According to the Magnuson-Stevens Fishery Conservatory and Management Act, bycatch is defined as fish that are harvested in a fishery but are not sold or kept for personal use (NPFMC 2008). There are four categories that species and species groups can fall under; the prohibited species, the target species, other species, and nonspecified species (DiCosimo 2001). In some cases the FMP will establish catch limits for that species and once the limit is reached the fishery closes. In our IWMP for pollock, the bycatch may consist of king crab, pacific salmon, coral, and other ground fish. Pollock would fall under the target species, while king crab, coral, and Pacific salmon would fall under the prohibited section. Bycatch rates for the Alaska Pollock fishery is usually low, but in recent years the fishery has brought in a large amount of Chinook salmon. These stocks are experiencing dramatic declines in population, but it is unclear how much of an impact the Alaska Pollock Fishery is contributing to the declines ("Associated Press" 2010). Our IWMP would follow the North Pacific Fishery Management

Council's example by using time and area closures, prohibited species limits, and gear requirements (NPFMC 2008).

The ideas we have to minimize bycatch include time of year, depth regulation and observers on each boat. If we fish during the winter, bycatch will really only be limited to winter kings and the pollock price will be greater due to the better quality roe in the fish. Proper depth regulation would also help to minimize bycatch and keep bottom damage to a minimum. The final and best method would be to have observers on the boat 100% of the time to make sure that our pollock boats are following all the set rules and regulations. The role of observers is instrumental in our pollock fishery.

Coral

According to Witherell and Coon, coral is found in Alaskan waters on the continental shelf, in the Aleutian Islands and the Gulf of Alaska. Alaskan coral is mostly of the order Gorgonacea. Gorgonians in Alaska are slow growing, living up to five centuries. Coral is extremely important to Alaska's underwater ecosystems because it provides homes and food for fish. Coral also contains essential medical antibiotics, and acts as an underwater history lesson, providing records of the ocean's temperature from thousands of years ago. Coral is protected under the Magnuson-Stevens Act. This act states that it is required that all fishing councils protect coral, and attempt to minimize the destruction and damage of it (Witherell et al 2002).

Observers

The Gulf of Alaska Groundfish management has many pieces that we will implement and refine in our management plan. We believe in using as much of the pollock as possible and will prohibit the exclusive harvesting of the roe. Both of these plans involve observers, however, our plan will require full 100 percent observer coverage. Observers, just like in the Gulf of Alaska fishery, will be checking to make sure that all of our vessels and fisherman follow fishing regulations. This method will help make sure that pollock fishing will be as conservative to the bottom as possible. The observers also insure that bycatch is properly counted (Dorn et al. 2011). To implement this plan, more research and monitoring is needed.

Monitoring/Research

As of now, there are large gaps in our understanding of the state of pollock in Southeast Alaska waters. Much more research will be needed in order for us to accurately set our GHL, such as total biomass, spawning age, age of the population, population density, and much more. Right now, there is a possible multi-million dollar fishery sitting in our waters, we just need more research to use it.

In order for this management plan and fishery to be successful, we must pursue additional research such as the possibility of excluding gear on pair seine nets (Gerry Merrigan, pers. comm. 2011). Many biological factors need to be addressed about pollock. The first survey we need to conduct is one for the health of the sea lion and sea bird population. This survey would help us determine if there is a profound impact on sea lion and sea bird populations. We need to survey spawning age and the age to length ratio that will allow us to put a size limit on the fish brought in. Also, we need to find a total biomass number that gives us a Guideline Harvest Level (GHL) (Figure 5).

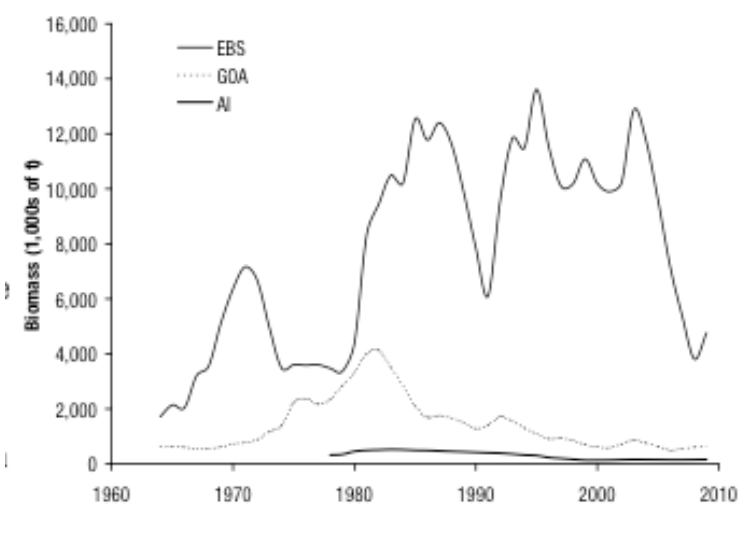

Figure 5: Estimated biomass of walleye Pollock. EBS = Eastern Bering Sea, GOA = Gulf of Alaska, and AI = Aleutian Islands (Dorn et al. 2008)

Bycatch is another aspect we need to address with our management plan. If we were to catch too much of another fishery's target species that fishery would be affected negatively. Some otter trawlers have salmon and halibut excluders on their nets; this equipment has not been fully tested and researched on pair seine nets. If pair seining does not work well, researching other methods of fishing will be crucial. It is important to research the grounds around Petersburg so as to identify possible areas for closure. This research would be instrumental in generating a viable and successful fishery.

Economics

Currently, there are 1,030 seafood-processing jobs in Petersburg, with total wages of $8,507,095 (Hiatt 2010). Other jobs are affected by the industry, such as: accountants, consultants, hardware stores, shipyards, supply businesses, advocacy and marketing organizations, air cargo crew, freight agents, fish processors, fisherman, and scientists. In 2010, 57 million pounds of seafood were landed in Petersburg (Hiatt 2010). A pollock fishery would improve the economy. Randy Lantiegne, the Fleet Manager of Petersburg Icicle Seafood, projects that we could add $4 million to our economy during the winter lull in fishing. This comes from a Total Allowable Catch of 9,200 tons caught over five weeks for the fishery bringing in over 18 million pounds (Figure 6). The outside waters price for walleye pollock is 22 cents/pound (24 cents/pound with roe) (Randy Lantiegne pers. comm. 2011). This would increase our annual seafood income by approximately 7.2%. It will also allow otherwise dormant boats to fish in the winter months.

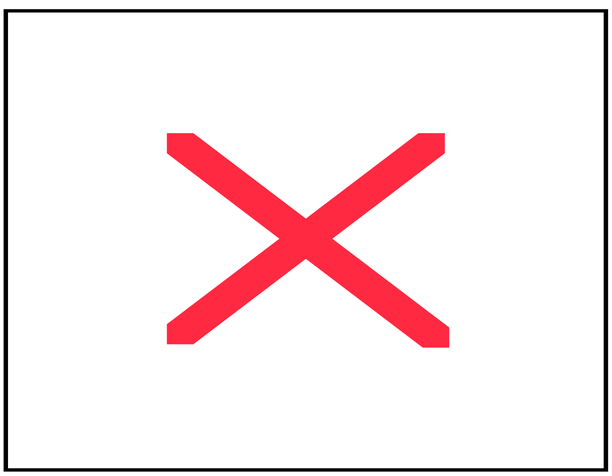

Figure 6: Alaskan walleye Pollock catch. EBS = Eastern Bering Sea, GOA = Gulf of Alaska, and AI = Aleutian Islands (Dorn et al. 2011)

Cost of Implementation

In order to implement this fishing plan we must first analyze the costs. According to the Canadian Fishing experiment, it costs, on average and adjusted for inflation approximately, $24,000 to install the pair seining gear on each of the vessels (Rycroft 1969). So, for six boats like we propose, the cost would be $144,000. The observers would be paid, on average, $3,000.00 a month. We also need to pay for research and monitoring, which would have to be funded by the State of Alaska.

Conclusion

Our IWMP bring to account many of the controversial and important topics that would be imperative in our pollock fishery. We discuss the biology of pollock, with emphasis on the fishable age of pollock and their role in the food chain as a forage fish. The main goal of our management plan is to increase our local economy by sustainably fishing pollock. We examined the pros and cons of pair seining, the bycatch of king salmon, the relationship of pollock to sea lions, coral, and the aforementioned bycatch species, the role of observers, the research into pair seining and the biology of our local pollock and monitoring of pollock and apex predator populations, the economic gains of this plan, and the cost of implementing this plan.

In conclusion our pollock fishery and management plan has potential to be a great moneymaker for our fishing community during the off-season. With all of the necessary restrictions and the sheer fact that there may not be enough pollock to make a profit calls into question if this fishery would even work. We still must pursue research into the little known biology of walleye pollock in Southeast Alaska in order to fully use, this as of today, untouched by fisherman resource.

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