

An Abstract of the Final Report Of

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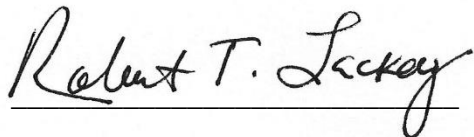
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Abstract:

Pacific salmon are culturally and economically important species to Southeast Alaska, where there is a history of large wild runs and supplemental production from hatchery programs. Salmon management in Alaska is divided amongst various governmental agencies. Non-governmental organizations also play a pivotal role in salmon management. To fulfill the requirements of a Professional Science Masters of Fisheries and Wildlife Administration, my internship was designed to engage professionals from several organizations involved in salmon management in Southeast Alaska. Portions of my internship were spent with professionals at the Alaska Department of Fish and Game, members of the Alaska delegation of the Pacific Salmon Commission, Southern Southeast Regional Aquaculture Association, and the United States Forest Service. My internship deliverables included an internship journal, an outreach presentation at Ketchikan High School centered on salmon management in Southeast Alaska, and a final report. During my examination of salmon management policy in Southeast Alaska I extracted many policy lessons learned. These lessons included: (1) fisheries management is often less about the science and more about the stakeholders; (2) management must be based on consistent objectives and reasoning because decisions will be challenged; (3) science is more frequently debated than relevant personal experience; (4) science is one of the many inputs to management, a fact often overlooked by early career fisheries staff; (5) allocation, the distribution of costs and benefits among stakeholders, is central to fisheries policy debates; and (6) salmon management cannot be fully understood without exploring the history and politics of funding.

Salmon Management in Southeast Alaska: An
Examination of Multi-Dimensional
Management

by
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submitted to
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Introduction

Pacific salmon, an iconic group of species in the Pacific Northwest, are at the center of many contentious policy and political debates. Salmon fisheries management has evolved significantly within the last century. Even with advances in management techniques and scientific knowledge, the current state of salmon stocks varies. Numerous stocks are listed in the contiguous United States under the Endangered Species Act (16 USC. § 1531 et seq), and two stocks in British Columbia under Canada's Species at Risk Act (S.C. 2002, c.29). Salmon management in these areas focus predominantly on reducing fishing pressure and improving freshwater habitat that has been altered by an ever-increasing human population of consumers that require additional space and resources (Roberts and Hawkins 1999; Lackey 2000; Lichatowich 2001). Subjected to various management agencies on the federal, state, and provincial levels, the decision-making process can be convoluted and ineffective. Alaska, with its unique geographic location and abundance of relatively pristine freshwater habitat, hosts salmon runs which still return in large numbers (Heard and Low 2005; Lackey 2005; Munro and Volk 2012). During the 2019 season, 206 million fish were harvested in Alaska, for an ex-vessel value of \$657 million (ADFG 2019). Due to the comparatively late inception of its commercial fisheries, geographic location, comparatively limited human impacts on salmon habitat, and continuous large returns, salmon management in Alaska serves as an interesting case study for fisheries management policy.

The goal of this paper is to extract key lessons learned about salmon management in Southeast Alaska and broadly applicable lessons learned about fisheries management. It will cover the organizations, agencies, and user groups involved, including their responsibilities and authorities, and will also delve into salmon management policy. The overarching theme of this

internship was to determine the extent to which Southeast Alaska's management structure helps achieve successful management of salmon fisheries.

Professional Context

My initial interest in fisheries began during the summers of my undergraduate degree when I served as the salmon hatchery representative on a remote floating salmon processor operated in Neets Bay, Alaska. I was unaware of this at the time, but my experiences at Neets Bay would introduce me to many of the fishery management techniques utilized to prosecute salmon harvesting activities throughout Southeast Alaska. Places like Neets Bay, which host large returns of several salmon species, have management plans established and implemented through regulation, and provide harvest opportunity for all gear groups.

Having gained the confidence to travel to remote places, I signed up to be a fisheries observer in the North Pacific groundfish fisheries. This at-sea biological experience exposed me to a myriad of sampling techniques, fisheries, and fisheries management regimes. These fisheries were off the coast of Alaska, beyond state waters, and were managed federally. Heavily centered on data collection, I learned the importance of funding and biological information that these large-scale fisheries needed to be continually managed successfully. Data were collected and used in real-time by personnel at the National Marine Fisheries Service to track quotas and close fishing when the allocation had been harvested. On-board observers were required by regulation and were paid for by the individual fishing vessels. I learned that this was a sore discussion point because, while fishermen would generally agree that they want a responsibly managed fishery for future harvest opportunities, they do not necessarily enjoy the financial responsibility of funding the program.

Upon returning to Southeast Alaska, I accepted a position with Southern Southeast Regional Aquaculture Association (SSRAA), the local salmon hatchery association. This work experience with salmon was hatchery-centric, as my job duties centered around evaluating salmon hatchery programs and their contribution to regional fisheries. It was not until I started my first course in the Professional Science Masters of Fisheries and Wildlife Administration (PSMFWA) program that I recognized I had a narrow base of experience of salmon management. This sparked a strong fascination about how the larger salmon management enterprise operated. I wanted to know where SSRAA and other hatchery associations fit into the overall picture of salmon management in Southeast Alaska. What made hatchery systems in Alaska “work” in comparison to those in the Lower 48? Which agencies are responsible for what, who are the main players who make key decisions, and how do those decisions affect the other parties involved? I wanted to be able to identify the stakeholders and understand how parties were able to achieve their policy goals.

I was introduced to the PSMFWA program when a recent graduate was fulfilling his own outreach requirements by presenting his experiences at the Alaska Fish Culture Conference in Sitka, Alaska. He spoke to the uniqueness of the program that allowed him to pursue professional internships as the crux of the graduate program. Wanting to network with professionals within and outside of fisheries, remain working and living in Ketchikan, Alaska, and expand my understanding of fisheries management, the PSMFWA program met all the requirements I had of a graduate program. My internship was spent working with an excellent group of people with diverse professional backgrounds in salmon management in Southeast Alaska. During my internship I was able to attend numerous meetings in various settings, work with several agencies, and gain invaluable experiences in Alaskan salmon management.

In lieu of a traditional master's thesis and its emphasis on research, this program required a professional internship, and this allowed me to explore the interface of science and policy in context to Southeast Alaska salmon management. The internship was composed of the following portions:

- Management of a specific salmon fishery
 - Neets Bay Chum Salmon troll fishery
- State salmon management
 - Alaska Department of Fish and Game (ADF&G)
 - Alaska Board of Fisheries
 - Ketchikan Fish and Game Advisory Committee
- Hatchery salmon allocation by gear group
 - Regional Planning Teams (RPT)
- State legislative process
 - Shellfish enhancement bill
- Habitat management on federal lands
 - United States Forest Service (USFS, Tongass National Forest)
- International coordination and treaty requirements
 - Pacific Salmon Commission

History of Salmon Management in Alaska

To understand contemporary salmon management in Southeast Alaska, it is imperative to explore the history of the management programs that exist today. Indeed, salmon fishing on the western coast of North America has a rich history. Indigenous people have long relied on salmon to sustain their livelihood (Henderson and Graham 1998). Salmon have been a culturally important symbol for specific indigenous groups for thousands of years. The United States government entered into many treaties and agreements with Native American tribes during its expansion into the Pacific Northwest. These treaties resulted in the tribes ceding millions of acres of traditional fishing grounds and salmon habitat with the assurance of protection by the US government and retention of certain natural resource harvest rights (Henry 2000). As the

human population of the region increased in the mid-1800s and early 1900s, salmon runs began to be exploited at higher rates. Fishing and canning technology continued to develop, which allowed for increased harvest and improved marketing of products (Fryer 2016). The seasonality of the fishery was challenged when a troll fleet moved offshore and succeeded in harvesting throughout the year (Henry 2000). Thus, the harvest of salmon expanded rapidly and called for responsive changes in management, especially considering that these offshore boats fished on mixed stocks, composed of salmon that originated from multiple streams.

Salmon were treated as an unlimited resource and thus received limited protection. The use of fish wheels and fish traps, along with harvest choices of cannery operations, resulted in severe declines in returns in the 1920s and 1930s (Fryer 2016; PSC 2018). A high harvest level of returns was common (Cooley 1963; Meacham and Clark 1994; Colt 1999; Gresh et al. 2000). Prior to statehood, the federal government managed Alaska's resources, and the White Act, passed by Congress in 1924, represented a more conservation-based management plan that required salmon fisheries to be closed after the midpoint of the run to allow for escapement, the intentional allowance of salmon to return to the spawning grounds to reproduce.

Starting with statehood in 1959, ADFG refined escapement-based management that became the fundamental tenet used by the Division of Commercial Fisheries to ensure an adequate number of spawners returned to sustain each stock. The Alaska Board of Fisheries was charged with creating fisheries policy and allocation of the resources. A few major changes to fishing regulations would occur after statehood. Limited Entry (Alaska Const. art. VIII, § 15) and the Private Nonprofit Hatchery Act would be ratified by voters in 1973. This enabled the state to limit the number of permit holders participating in state fisheries, thus providing a management tool for improved management. The passing of the Private Nonprofit Hatchery Act allowed for

private ownership of hatcheries that would operate enhancement programs that were not financed by taxpayer funding. This act laid the regulatory framework that would allow for regional aquaculture associations, one of the two methods for hatchery ownership defined in state regulation. Paid for by a tax collected on the harvest of salmon within the region, these associations were funded primarily by commercial fishermen who benefit from the additional harvest.

The history of salmon hatcheries in Alaska starts with those that were built and operated by canneries in the 1890s, primarily to produce Sockeye Salmon (*Oncorhynchus nerka*; Roppel 1982). These hatcheries were inefficient due to the lack of understanding of fish culture, and most were closed by the 1930s (Roppel 1982). The Alaska Legislature has played an instrumental role in the re-creation of hatchery programs. There was a rebirth of hatchery practices in the 1970s that began when the legislature developed the Alaska Department of Fish and Game's Division of Fisheries Rehabilitation, Enhancement, and Development. This program was responsible for the research and initiation of hatchery programs across the state, with the intent that the hatcheries would eventually be operated by private non-profit associations. The objective of this program was to build a hatchery system that had few adverse effects on wild stocks while keeping commercial harvest numbers high (Evenson 2018).

Introduction to Salmon Hatchery Policy in Southeast Alaska

The creation of modern hatchery programs stemmed from a need to supplement natural harvests in the 1970s, when abundance was low statewide (Evenson 2018). The State played a large role in their formation, though it has since stepped back to allow industry to bear the burden of responsibility. Currently, there are 29 hatcheries operating in Alaska: 25 private non-profits, two operated by ADFG, one federal facility, and one tribal hatchery (Vercessi 2014;

Evenson 2018). Enhancement was established with the intention to supplement fishery harvests rather than replace the harvest of wild stocks. This differed from operations in the Lower 48, which were established as mitigation for habitat alteration, dams, and other needs of society. Hatcheries were championed as the low-cost choice that would allow for human expansion and continued harvest, the ever-sought-after, but ephemeral, win-win policy option (Lichatowich 2001; Lackey 2006). Whereas in Alaska, ADFG is responsible for managing natural production and their priority is to ensure adequate wild salmon escapement. The aim of salmon enhancement in Alaska is to take pressure off natural stocks and to provide additional harvest, especially during years of low abundance.

Alaska's Constitution provides that ADFG should manage the resources in the best interest of the economy and the resource. To achieve these objectives, the bureaucratic permitting process for hatcheries is complex. The main management tools and oversights for hatcheries include Basic Management Plans, the Annual Management Plans, Fish Transport Permits, Annual Reports, ADFG Habitat permits, and DEC Discharge permits. Hatchery permits go through multiple stages where ADFG internally reviews them for management, biological, genetic, and pathological concerns. After departmental review, hatchery permits are examined by the regional planning team (RPT) to receive a recommendation (support or oppose) before finally being presented to the ADFG Commissioner to make the final decision. There is opportunity for public involvement in the process. The RPT meet in a setting where there is allotted time for public input. ADFG highlighted that these programs are stakeholder driven. The most effective place for the public to be involved with hatchery policy is at the RPT meetings. This is where Comprehensive Regional Salmon Plans are drafted, and this step in the process is heavily focused on obtaining public opinion.

Various mandates, regulations, and policies were adopted to allow for the permitting of salmon enhancement programs in Alaska. These documents comprise the *Genetic Policy* (Davis et al. 1985; Davis and Burkett 1989), the *Policies and Guidelines for Alaska Fish and Shellfish Health and Disease Control in Alaska* (Meyers 2014), *Policy for the Management of Sustainable Salmon Fisheries* (5 AAC 39.222), and the *Salmon Escapement Policy* (5 AAC 29.223). The *Genetic Policy* guides ADFG in what species can be reared, with the intent of protecting wild stocks. The document bans the importation of salmon from outside the state for enhancement projects, restricts the movement of salmon stocks between regions, requires the use of locally sourced broodstock, strives to maintain genetic diversity within hatchery stocks by requiring large broodstock sizes (greater than 400 individuals), and limits the number of hatcheries where a single stock can be used. The *Genetic Policy* also calls for the identification of “significant and unique wild stocks” which should be provided protections. Southeast Alaska has not designated any stocks as significant and unique, and this has been discussed in recent meetings. Another aspect of the *Genetic Policy* is the establishment of wild stock sanctuaries. This also has not occurred in Southeast Alaska and has been discussed at meetings. Alaska’s genetic policy has been one of the most restrictive implemented for hatchery programs and has served as a model for others (Evenson 2018).

Fish health for hatchery origin populations is regulated by the *Alaska Fish Health and Disease Control Policy* (5 AAC 41.080) and the *Policies and Guidelines for Alaska Fish and Shellfish Health and Disease Control* (Meyers 2014) which outlines policy for broodstock screening, fish transport, and tracking broodstock disease histories. The important components of this policy include egg disinfection, hatchery inspections, disease reporting, and the involvement

of a pathologist from ADFG. Implementation of these policies has helped reduce the spread of disease between wild stocks and hatchery stocks, and among hatchery stocks (Meyers 2005).

As required by the State in SSFP 5 AAC 39.222(c)(5), in the face of uncertainty, management should implement regulations to manage a resource conservatively. Thus, ADFG relies upon the precautionary approach applied to management, fish health, and genetics. ADFG also manages wild stocks under a conservative strategy. Harvest of these stocks is conducted under the sustainable yield principle, where the expectation is that management does not allow the harvest of more than what is needed to sustain runs. Hatchery placement centers on wild stock interception and wild stock escapement. Hatchery fish health is monitored through ADFG hatchery inspections and disease history tracking to reduce the spread of disease. The genetics portion of management uses local stocks at hatcheries and seeks to limit the interactions between wild and hatchery fish.

Primarily driven by the Alaska Board of Fisheries, fishery management policies related to salmon enhancement are numerous and diverse. The *Mixed Stock Salmon Fishery Policy* (5 AAC 39.220), *Sustainable Salmon Fishery* (5 AAC 39.222), and *Salmon Escapement Goal Policy* (5 AAC 39.223) all pertain to how fisheries will be managed in order to provide for conservation of wild stocks, ADFG's primary concern. Management decisions are geared towards conserving and protecting wild stocks, especially those found in mixed stock fisheries. Escapement goals, management plans, and stock assessment programs facilitate management in the conservation of wild stocks while allowing for the harvest of enhanced hatchery fish in appropriate areas.

Chum Salmon (*Oncorhynchus keta*) predominate the hatchery release number each year in Southeast Alaska, though statewide the species with the highest release is the Pink Salmon (*Oncorhynchus gorbuscha*; Vercessi 2014). In Alaska, Prince William Sound releases the highest

number of salmon (Pink Salmon) followed by the release of Chum Salmon in Southeast Alaska. Hatchery fish are harvested in common property fisheries, and cost recovery fisheries, and are also collected for broodstock (the fish spawned to produce the next generation). On average, hatchery fish constitute 25-30% of the annual harvest of salmon in Alaska (Vercessi 2014; Johnson et al. 2019). Alaska's salmon harvests are still predominantly comprised of wild stocks.

Prince William Sound and Southeast Alaska have established harvest allocations by gear group for enhanced salmon that supplement historical commercial fisheries. Harvest numbers have increased in Alaska substantially since the lows of the 1970s. Hatchery programs across Alaska released a total of 1.7 billion salmon in 2019 (Wilson 2020). The commercial harvest in 2019 was 50 million hatchery salmon valued at \$118 million dollars (Wilson 2020). Hatchery production numbers have remained stable across the last few decades, with most of the increase in harvest coming from rebounding wild runs (Wilson 2020, Figure 1). Three of the largest wild runs recorded have occurred within the last decade, occurring after the establishment of most Alaskan hatchery programs (Sopha 2018).

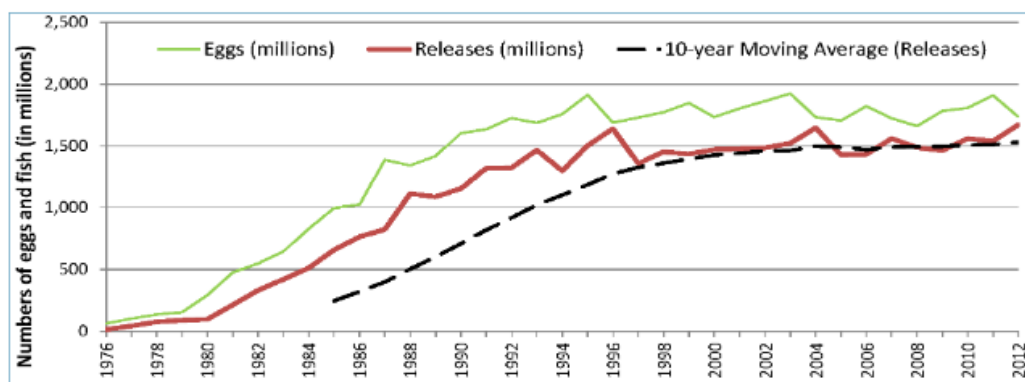


Figure 1. Number of eggs collected, and fish released, in Alaska's salmon enhancement programs, 1976-2012 (Vercessi 2013).

In Southeast Alaska, there are 15 active hatchery facilities, and numerous remote release sites. These hatcheries are operated by private regional aquaculture associations and non-regional

aquaculture associations. These two types of hatchery systems are different in the way they were established, their authoritative powers, and their methods of collecting revenue. Regional aquaculture associations can collect an enhancement tax on fish harvested within their regional jurisdiction to pay for operations. Regional aquaculture associations have a board of directors comprised of various designated seats of the stakeholders of the region. Non-regional private non-profits are unable to collect tax on the commercial harvest of the region and rely upon cost recovery efforts to cover operational costs. The two types of hatchery systems also differ in the level of representation at the RPT meetings, where regional aquaculture associations are given three seats on their respective team, and non-regional associations have a non-voting seat to provide context for their permit alteration requests and opinion on other hatchery program changes.

Salmon management cannot be fully understood without exploring the history and politics of funding. From my experience, salmon enhancement programs are portrayed as being paid for by commercial fishermen. Taxes are collected on commercial harvests in the region and are paid to the regional aquaculture association to finance hatchery operations in conjunction with cost recovery harvest which is to cover the remaining budget. While those two means do constitute the majority of the money for programs there are other sources of funding that are worth noting that demonstrate the State of Alaska's connection to hatchery programs. The Alaska Department of Commerce, Community, and Economic Development - Division of Economic Development has a Fisheries Enhancement loan program that provides regional aquaculture associations the opportunity to borrow up to \$10 million for the construction and operation of hatchery facilities. Also known as the revolving loan fund, the loan is structured so that the borrower does not have to pay principle for the initial six to ten years, which provides

time for the first returns of a new release to be realized. Along with the loan program, there are still 11 state-owned hatcheries currently operating in Alaska, with four located in Southeast Alaska. These state-owned facilities are contracted out to private salmon hatchery associations to be operated. These hatchery facilities are worth a substantial amount of money due to their infrastructure, and are relics of the Fisheries, Rehabilitation, and Enhancement Division, the state agency tasked with building and strengthening Alaska's hatchery programs.

Funding for salmon hatcheries in Alaska is diverse. For example, Crystal Lake Hatchery, is a state-owned hatchery operated by Southern Southeast Regional Aquaculture Association (SSRAA) in Southeast Alaska. Crystal Lake Hatchery receives funding from the ADFG Division of Sportfish and associated funds from the Dingell-Johnson Act (16 U.S.C. §§ 777–777l). The federal Dingell-Johnson Act provides financial assistance to the States for restoration of fish that have value associated with sport fishing. Crystal Lake qualifies because the Chinook Salmon it releases are traditionally caught within sport fisheries. Crystal Lake has also received money from federal programs associated with the provisions of the Pacific Salmon Treaty. The Southeast Alaska Chinook Salmon Fisheries Mitigation Program receives money in the form of a grant from the National Oceanic and Atmospheric Administration to help address the economic impacts of a 15% reduction in Chinook Salmon (*Oncorhynchus tshawytscha*) harvest beginning in 2009 (ADFG 2020). In 2013, SSRAA received \$100,000 in funding for the City Creek King Salmon Project which is associated with Crystal Lake Hatchery (ADFG 2020). Alaska's salmon enhancement programs while portrayed as being paid for by commercial fishermen can have associated funding from other sources as well because of the diversity of users who benefit from them.

Management of a Neets Bay Chum Salmon Troll Fishery

Southern Southeast Regional Aquaculture Association, a private nonprofit hatchery association, was founded in 1976 (McDowell Group 2018). The association is led by a Board of Directors (a 21-member board composed of commercial purse seine, drift gillnet, and troll permit holders, members of industry, and other appointed public positions), management staff, and hatchery personnel. The association has six permitted hatcheries and operates eight remote release sites. SSRAA is permitted by ADFG to collect 253 million summer Chum Salmon eggs, 39 million fall Chum Salmon eggs, 22 million Coho Salmon (*Oncorhynchus kisutch*) eggs, and 5.5 million Chinook Salmon eggs, and 3.7 million Sockeye Salmon eggs annually (SSRAA 2020). These fish will return and be harvested in commercial fisheries through Southeast Alaska, primarily in management Districts 1 through 7. Currently, SSRAA raises summer and fall Chum Salmon, Coho Salmon, and Chinook Salmon. The association does not have any Sockeye Salmon programs nor does it intend to develop any currently (SSRAA 2020).

Neets Bay Hatchery, located approximately 40 air miles north of Ketchikan, has been operated by SSRAA since 1983. Neets Bay is SSRAA's flagship site, hosting the bulk of production and serves as the primary broodstock collection site for the association's summer and fall Chum Salmon programs. In 2020, Neets Bay collected over 100 million summer Chum Salmon eggs to be raised and released at numerous remote sites across southern Southeast Alaska. Currently, Neets Bay Hatchery's production goal is to release 61 million juvenile summer Chum Salmon annually at the hatchery site (SSRAA 2020).

The initial portion of my internship was conducted during the summer of 2018 when I immersed myself in the Chum Salmon troll fishery at Neets Bay. This fishery was unique in that the SSRAA board had allocated 200,000 returning summer Chum Salmon to the troll fleet. The

other gear groups were able to target hatchery chums in the initial openings, but the troll fleet was provided with unique time and area opportunities. SSRAA staff monitored the harvest and provided ADFG with pertinent information such as real-time daily effort level, harvest estimates, and average weight of salmon harvested in the Neets Bay troll fishery. The ADFG troll manager made decisions based on the data collected by SSRAA and the ADFG port sampling staff. In consultation with SSRAA, the area management biologist and troll biologist would open and/or close Neets Bay terminal fisheries to ensure SSRAA met broodstock collection goals.

The following summer in 2019, I was assigned to track the Neets Bay Chum Salmon troll fishery on my own. The forecast for the return was large, and the Board of Directors had allocated 400,000 Chum Salmon to the troll fleet. The trollers harvested 7,790 Chum Salmon during the 2019 season, primarily outside the terminal harvest area in Behm Canal. During 2019/2020 board meeting season, in response to the failure to meet cost recovery revenue goals, the SSRAA Board of Directors voted not to allocate any of the Neets Bay Chum Salmon return to the troll fleet. Trollers would no longer be allowed to fish within the terminal harvest area after the initial rotations, though they could fish in the common property fishery in Behm Canal, which was located outside of Neets Bay (Figure 2, page 19). Trollers have historically been below their allocation for enhanced salmon in Southeast Alaska. The Neets Bay Chum Salmon troll harvest was not a significant portion of the total Neets Bay return. It was an interesting policy decision for the board to take because in conjunction with the other decisions they made it did not amount to many fish and was another reduction to troll opportunity. Amongst the troll representatives there were differing opinions on closing the Neets Bay Chum Salmon troll fishery, and my opinion from sitting in on the meetings is that their votes were influenced by the

fisheries that board members participated in. The consensus at the end of the discussion was that it was what was best for the SSRAA's finances.

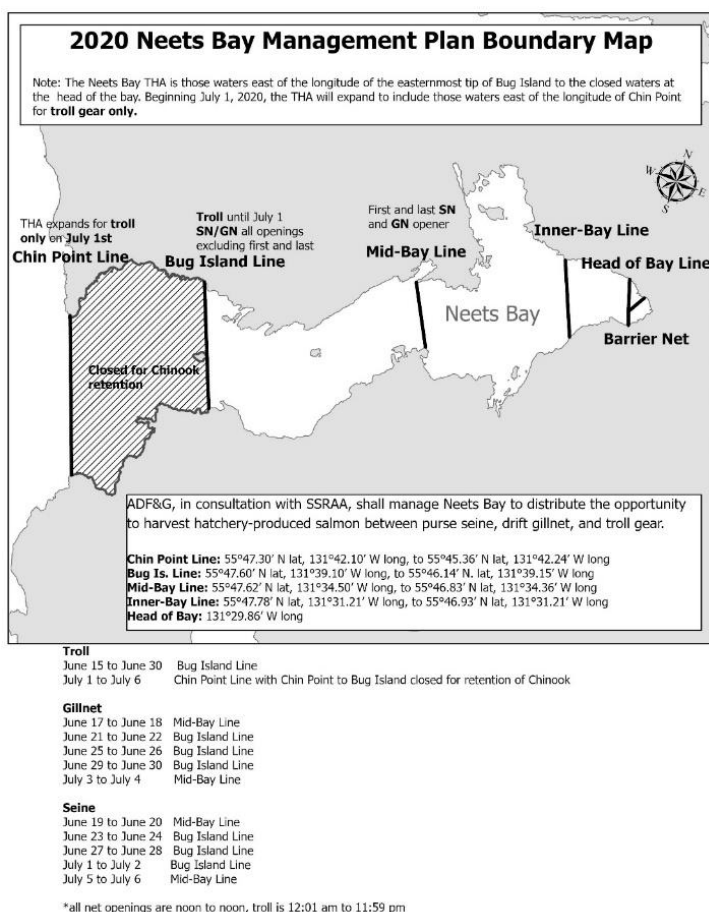


Figure 2. 2020 Neets Bay Management Plan and Fishery Rotations.

My daily tasks for this portion of my internship included collecting fisheries data from local processing plants, tracking the fishery and fisheries parameters within an Excel spreadsheet, and writing weekly updates for the SSRAA's website. This part of the internship was hands-on, and I enjoyed immersing myself in the troll fishery. The troll fishery was a good indicator for what would be returning to both the cost recovery fishery and as broodstock. Through monitoring the troll fishery that occurred in the mouth of the bay, managers were able to get an early assessment of what would be showing up at the barrier net in front of the raceway,

generally within the week. This provided SSRAA management time to work with the ADFG managers and close fisheries if necessary, to ensure adequate broodstock collection.

The establishment of the Chum Salmon troll fishery at Neets Bay was the culmination of the work of fishermen, SSRAA board members, and processing plants. At its inception, fishermen had to learn how to catch terminal Chum Salmon on troll gear, which requires different fishing techniques and tackle from other salmon species (Haughton 1992). Fishermen and processors had to work together to find a market for troll-caught Chum Salmon, which would need to be sold at a higher price than those caught by the net fleets in order to make it economically viable. This fishery works because of the relatively large number of salmon returning to Neets Bay. Chum Salmon troll fisheries would not be economically viable to establish on a small return to a terminal harvest area because they are not as effective. This troll fishery has also served as the model for the formation of other Chum Salmon troll fisheries. Trollers now also target Chum Salmon returning to Crawfish Inlet, Deep Inlet, Lynn Canal, and Kake. These Chum Salmon troll fisheries provide fishing opportunity during times of reduced harvest of Chinook Salmon related to allocations under the Pacific Salmon Treaty, as well as when wild Coho Salmon returns are in low abundance. There are also fishermen who exclusively participate in Chum Salmon troll fisheries. By diversifying the troll fishery, permit holders get additional opportunity to harvest more species across a larger area.

During my internship, I learned about the intricacies surrounding the management of the Neets Bay terminal harvest area and special harvest area, specifically for the Chum Salmon troll fishery. ADFG has established different types of management areas for commercial fisheries. A terminal harvest area is an established area that is opened for common property fisheries for permit holders on hatchery returns to release sites. These terminal harvest areas generally have

established management plans that consider time, area, and allocation. ADFG works with the hatchery association to manage these areas for orderly fisheries. A special harvest area is created at a hatchery release site for the purpose of the hatchery association to harvest fish with the intent to sell product to finance the association's operations, also known as cost recovery. Terminal harvest areas and special harvest areas can be created in the same areas and in many cases are both used within the same salmon season to provide the appropriate stakeholders with fishing opportunity.

There is more to fisheries management than science, which is only one of many inputs in the decision-making process. In many instances, allocation, the distribution of costs and benefits among stakeholders is central management. For example, Neets Bay has one of the more complicated management plans regarding the balancing of opening the terminal harvest area and special harvest area. Generally, there is a rotational fishery that occurs in the terminal harvest area prior to cost recovery measures occurring in the special harvest area. Once cost recovery harvest begins in the special harvest area, the fleets are no longer allowed within the boundary of the special harvest area, though trollers have generally been allowed to fish with the terminal harvest area. What makes the fishery at Neets Bay especially confusing is that the lines change throughout the season for the special harvest area, which could potentially open more of the terminal harvest area to the troll fleet. The boundary changes are written within regulation, but ADFG, in consultation with SSRAA, can change the lines and times based on the return and the needs of SSRAA to collect broodstock or cost recovery. The management of the Neets Bay special harvest area and terminal harvest area is complicated by the need to allocate the harvest amongst the gear groups and hatchery association.

Regarding the interactions between ADFG and SSRAA for the Neets Bay Chum Salmon troll fishery, I found them to be primarily collaborative and rarely contentious over this issue. I observed SSRAA provide valuable insight to the regional troll management biologist, and it was apparent that he was not only receptive but appreciated what was being shared regarding the fishery. In this instance, collaboration between SSRAA and ADFG appeared to be functioning based on a mutual respect of the individuals involved. However, there were points of contention between SSRAA and ADFG regarding other fisheries, specifically those that target Chinook Salmon. A time reduction was implemented in the beginning of the season in the Neets Bay special harvest area for the purpose of wild stock Unuk River Chinook Salmon conservation. Unuk River Chinook Salmon have struggled to meet their escapement goal in recent years, and these fish are traditionally caught within the Neets Bay special harvest area during the initial fishery rotations. The decrease of harvest opportunity was employed to reduce the interception of these fish as they migrate through the area. Points of contention were centered around loss of opportunity for Chinook Salmon harvest resulting from ADFG management decisions. The troll fleet voiced that their season and their Chinook Salmon harvest allocation continues to decrease. Neets Bay has the largest release of juvenile Chinook Salmon and generally the largest hatchery return in Southeast Alaska. In recent years, the Unuk River Chinook Salmon stock has seen poor returns and is not meeting its escapement goal. Conservation measures were taken, which included delaying the start of the rotational net fishery inside of Neets Bay and reduction of troll opportunity to provide Unuk River Chinook Salmon the chance to pass through that area as they return to spawn. In this instance, fishermen were losing opportunity to harvest terminal hatchery fish in order to provide conservation measures to wild stocks.

Another point of contention was between SSRAA and Tamgas Hatchery and related to the evaluation of programs and unmarked salmon released from the Tamgas Hatchery. Tamgas Hatchery is located on Metlakatla Island in the Annette Island Reserve. By Presidential Proclamation in 1916 (C.F.R. §25.241; 39 Stat. 1777), the Annette Island Reserve is federally recognized and outside the authority of state management, creating an area in the middle of the Ketchikan management area that is outside of ADFG jurisdiction. It is the sole Indian Reserve in Alaska. Annette Island Reserve fisheries are interception fisheries; a high proportion of their catch is composed of Pink Salmon returning through Nichols Passage, Sealed Passage, and Felix Straits to large systems in the Behm Canal stock group. Metlakatla Island does contain numerous streams where Pink Salmon return, though escapement data are not readily available. Annette Island Reserve fisheries also harvest a high number of SSRAA hatchery Chum Salmon. Tamgas Hatchery releases Chum Salmon, originally from SSRAA broodstock, and historically, the Tamgas Hatchery Chum Salmon releases have not been otolith thermal marked. In contrast, all hatchery Chum Salmon released from state authorized hatcheries are thermally marked in Southeast Alaska to evaluate their contribution to regional fisheries. Therefore, SSRAA is unable to evaluate the number of Tamgas Hatchery Chum Salmon harvested in fisheries, so those enhanced fish are counted as “none” marks which are counted as wild fish. This skews the contribution of hatchery fish, reducing salmon enhancement associations’ perceived influence on commercial fisheries. It also increases the number of wild Chum Salmon harvested in commercial fisheries, which can influence managers’ decisions for areas and times open for fisheries.

I observed ADFG make changes in their own management based on recommendations from SSRAA. ADFG management biologists make decisions based on the number of fish

harvested. Fish processing plants operate and report in terms of the weight or pounds of fish. The number of fish harvested is estimated by dividing the total weight by an average weight of the species. Historically, ADFG had used a single average weight of summer Chum Salmon for all Southeast Alaska for consistency throughout the region. SSRAA has tried for years to get ADFG to use a separate weight for SSRAA enhanced Chum Salmon because they have a larger average weight. Through the methods used by ADFG staff, the harvest of SSRAA produced salmon were underestimated in both total weight and value. In 2018, the regional troll management biologist agreed to use the average weight calculated by SSRAA staff from Neets Bay cost recovery harvests to determine the number of Neets Bay troll-caught fish. It would be hard to argue against the use of the “the best available science” and this change represents the collaborative agreement between two organizations to make that change. Collaboration between the two entities and an open sharing of data strengthens both management of the fisheries and the hatchery program by allowing decisions to be made on the basis of the most accurate information available.

State Management – Alaska Department of Fish and Game

The Alaska State Constitution was ratified by voters of the territory in 1956 and became effective upon statehood in 1959. Building on the Public Trust Doctrine that originated in English law, the Alaska State Constitution defines fish as a shared natural resource. In Article VIII, section 3 it states that “Wherever occurring in their natural state, fish, wildlife, and waters are reserved to the people for common use” (Alaska Const. art. VIII, § 3). It is then further provided in Article VIII, section 4 that “Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses” (Alaska Const. art. VIII,

§ 4). Fish are to be managed as a shared natural resource with the intent to be “utilized, developed, and maintained” with those three verbs being key for the State’s management programs. Further, the State Constitution assigns authority to the State agencies responsible for resource management and associated boards with the responsibility to change regulations and allocations.

ADFG is responsible for the management of fish and wildlife in the state of Alaska. Article VIII of the State Constitution provides the management framework and overarching objectives for the State’s shared natural resources. The commissioner of ADFG is appointed by the governor and approved by the legislature. Under AS 16.05.020, the commissioner is directed to “manage, protect, maintain, improve, and extend the fish, game, and aquatic plant resources of the state in the interest of the economy and the well-being of the state.” Integral to the statute is the inclusion of the economic importance of Alaska’s wildlife resources. Economic utilization of natural resources is an essential element of Alaska’s economy, and is central to policy and management decisions (Meacham & Clark 1994). Within ADFG, the Division of Commercial Fisheries and the Division of Sportfish are responsible for salmon management and research.

Escapement goals are the primary tool used by Alaskan management agencies to ensure adequate harvest, sustainability of runs, and provide for conservation of salmon stocks. Escapement goals come in a variety of types which vary in their objective, with the biological escapement goal being based entirely on science and the optimal escapement goal being substantially politically derived to allocate the resource. With an assortment of goals, fishery management is multifaceted and involves the use biological information to obtain the greatest economic return while sustaining the natural resource.

ADFG manages salmon fisheries using three types of escapement goals: biological, sustainable, and optimal escapement goals. These three goals differ in the amount of scientific information used in setting the escapement goal ranges, the objective of the goal, and which regulatory body is responsible for establishing the goal.

First, the biological escapement goal (BEG) is the number of salmon from a particular stock that should be allowed to escape the fishery to achieve maximum sustained yield (Carroll 2005; Clark et al. 2007). In theory, the BEG is entirely biologically based. This goal is presented as a range. The BEG range is set by ADFG biologists.

Second, the sustainable escapement goal (SEG), is the estimated number of fish that need to escape the fishery based on historical data and factors that have been shown to sustain stocks over a 5 to 10-year period (Carroll 2005; Clark et al. 2007). The SEG is used when biological information is lacking and is set by the ADFG biologists. This goal can be a range or a lower bound. Setting goals involves application of judgement by knowledgeable fisheries personnel who are familiar with the stock.

Third, the optimal escapement goal (OEG), is politically derived, and takes into account the biological requirements of a stock to ensure sufficient returns for harvest in commercial, sport, subsistence, and personal use fisheries, and cost recovery programs (Carroll 2005; Clark et al. 2007). This goal is different from the others in that it is set by the Board of Fisheries, the regulatory body responsible for the allocation of resources.

ADFG tracks how effective it is at managing fisheries to meet escapement goals within the escapement goal ranges. Between 2003 and 2011 escapements were within the goal range 35% to 58% of the time (Munro and Volk 2012), and between 2006 and 2014 overescapement occurred 21% of the time (Munro and Volk 2015).

In Alaska, commercial salmon fisheries are managed through the manipulation of area and time (Thynes et al. 2020). Salmon fishery openings are established through emergency orders which change regulations for a predetermined amount of time. This information is relayed to fishermen, industry, and other interested parties through advisory announcements which are released to the public through publication on the ADFG website, email notifications, and available printed copies at area management offices. These management decisions are based on catch data, escapement counts at weirs, and aerial survey counts of fish at spawning habitat collected inseason. ADFG managers release fishery openings in two forms. First, for places with established rotations, they will release an initial advisory announcement with times and areas prior to the fishing season. Other salmon fisheries are announced on a weekly or biweekly basis to enable managers to make decisions inseason and adjust area times and boundaries based on the biological and fishery information collected to ensure adequate escapements are met. Within the State of Alaska's management framework, the Commissioner delegates the authority to write emergency orders to area management biologists. This decentralizes the authority to specific area management offices and enables individuals within ADFG to make specific fisheries decisions for unique fisheries and stocks.

In 1978, the State of Alaska adopted the subsistence law AS 16.05.258(b), which prioritizes the utilization of fish, game, and aquatic plant species for subsistence uses over other user groups. Subsistence is defined as "customary and traditional uses" of natural resources which include the collection of resources for food, raw materials for making clothing, tools or handicrafts, for sharing, for barter, for customary trade, and to provide shelter (AS 16.05.940[32]). The subsistence law does not specifically define who qualifies as a subsistence user. In 1982, the Board of Fisheries adopted regulations for rural subsistence priority. It was

later overturned in a 1989 Alaska Supreme Court ruling *McDowell v. State of Alaska*, which established that the Alaska Constitution precludes any preferences, thus prohibiting the rural residency preference for subsistence. Subsistence fisheries are managed under the ADFG Division of Commercial fisheries along with personal use fisheries. Personal use fisheries were established in 1982 in response to issues with rural priority subsistence (5 AAC 77.005). In Southeast Alaska, traditional subsistence areas are defined, and all Alaska residents can partake in these fisheries. Personal use fisheries are established in areas outside of subsistence areas under a different regulation. They require their own classification of fishery because fish harvest may not be sold (therefore not commercial fishery), they occur in areas that were not traditionally considered subsistence (therefore not subsistence fishery), and the gear differs from sport gear (therefore not a sport fishery). Subsistence and personal use fisheries take precedence over commercial harvest, and management biologists will not close subsistence or personal use fisheries without also acting in a commercial fishery.

I began this internship with a preconceived notion that ADFG management was based solely on biological facts. That notion was challenged through my examination of area management authority designation to specific individuals and observing how their understanding of the fishery influences the decisions that are made. Therefore, decisions are subjective, based on an individual's perception of what is occurring. Management is complicated, with inputs from more than just scientific facts. Managers must know the facts (i.e. the science), but that is only a start. Management biologists must also rely on experience to make judgements on how the fishery will react to changes in regulation. Management must be based on consistent objectives and reasoning because decisions will be challenged, which I observed numerous times throughout my internship. Managers must be able to defend their choices, and this is what helps

steer managers in the direction of the “right” choice, one that is supported to the greatest extent possible. Managers rely upon directives from within ADFG and the Board of Fisheries and are guided by objectives established in the State Constitution and their own experiences to make decisions. There is no win-win situation in policy and management decisions (Lackey 2006), and I continue to return to this mantra during my review of management decisions and presentations.

State Management – Alaska Board of Fisheries and Advisory Committee

The Alaska Board of Fisheries (Board) consists of seven members nominated by the governor and confirmed by the legislature, and they develop policies surrounding the conservation and management of fisheries resources (AS 16.05.221). Board members sit for three-year terms which are staggered. Members are appointed based on their knowledge of fisheries and backgrounds and are supposed to be chosen without regard to political affiliation or geographic location. There has historically been a precedent of members representing specific groups. Alaska Statute 16.05.255 establishes the Board’s authority to adopt regulations in accordance with the Administrative Procedure Act (AS 44.63; 1959). By legal precedent, the State courts rely upon the decisions made by the Board of Fisheries when ruling on cases related to fishing regulations (Fitzgerald 2009). The ADFG and Board of Fisheries work in conjunction with each other to establish fisheries management regulations and operate management programs to meet regulatory and program objectives.

The Board’s regulatory power covers “setting quotas, bag limits, harvest levels, establishing marking and identification, and classifying the state’s subsistence, commercial, sport, guided sport, and personal use fisheries” (Alaska Statute 16.05.221). The Board makes policy decisions for the previously listed categories. It is important to note the division of power, the Board of Fisheries is responsible for determining harvest allocations for fisheries, and the

Alaska Department of Fish and Game is responsible for the management of the fisheries. The Board is required to use the best biological information available in conjunction with socioeconomic information as a basis for decisions (ADFG 2018). In addition to being a public process, the Board also receives information from ADFG, Alaska Department of Public Safety, Alaska Department of Law, and other advisory council members (i.e. Federal Subsistence Board).

Board of Fisheries meetings are regularly scheduled. I attended a Board of Fisheries work session in fall of 2018 that focused on hatchery production. It provided an opportunity to observe the Board and ADFG interact. There were two agenda change requests (ACRs) that specifically pertained to hatchery production. ADFG gave two presentations; one regarding salmon hatchery programs, and the Alaska Hatchery Research Program study results that were completed at this point. Discussion of hatchery programs within the Board of Fisheries has been limited over the past 15 years because they generally do not deal with hatchery program regulations. Hatchery program decisions have been reserved primarily for ADFG with permitting authority and RPT meetings, which were established for the specific purpose of determining hatchery program policies and providing recommendations to the commissioner.

Inspired by the complaints of individuals, an emergency petition was filed by Kenai River Sportsmen Association which calls for no enhanced fish in their area. Building on the emergency petition, ACR 1 reads, “Prohibit Valdez Fisheries Development Association from incubating, rearing, and releasing Pink Salmon resulting from additional egg take capacity permitted in 2018 and cap egg take capacity at the level permitted in 2017 (5 AAC 24.366)”. This policy conflict is between charter, sport, and commercial fishermen. It is complicated by the fact that, in that region, fish are released by ADFG for sport harvest and by hatchery for

commercial harvest. In Alaska, salmon are a common property resource, meaning they do not belong to anyone until they are legally harvested by that individual. An associated issue with this is that production changes usually pertain to future brood years and not extant production. This ACR called for the destruction of living organisms. Speaking with members of industry I was informed that specific policy preferences, especially ones that pertained to production reductions, would be more likely to shut down new production instead of stopping current production.

ACR 2 related to hatchery production, and specifically asked to, “Cap statewide private non-profit salmon hatchery egg take capacity at 75% of the level permitted in 2000.” If this ACR had been adopted and passed during the next Board of Fisheries session, it would have been difficult for them to enact this policy. Fishery allocations would have to be revisited due to production cuts at specific release sites associated with specific fisheries. Compounding this issue is the split of management authority between ADFG and the Board of Fisheries. Hatcheries are permitted through ADFG, not the Board. At the end of the meeting, the Board voted not to adopt the two ACRs. There will be an opportunity for these proposals to be submitted again when the Board is meeting within that region on its next cycle.

Hatchery production plays a role in salmon production and commercial harvest, and there are those who support and oppose hatchery programs. This has been most apparent at recent Board of Fisheries meetings, and most of the opposition has been pointed at salmon hatcheries in Prince William Sound that raise and release Pink Salmon. To address concerns about hatchery programs, the Alaska Hatchery Research Program was established to conduct a genetics study focusing on whether hatchery strays were affecting the genetics of wild runs, and thus reducing the fitness of wild stocks. This multi-year study will look at both Prince William Sound Pink Salmon and Southeast Alaska Chum Salmon. A science panel was chosen and given oversight of

this project. The panel is comprised of leading salmon researchers from across the state. Some members associated with hatcheries stepped down, to ensure that the panel did not appear to have a hatchery bias. The ADFG personnel spoke to the importance of the proper use of scientific literature and the peer review process at the fall 2018 Board of Fisheries workshop. This is a clear intersect between science and policy. The ADFG lead scientist was requesting that those on all sides of the debate use the best available science and not pick and choose facts based on how it supports their policy preferences.

I served a portion of my internship as the secretary of the Ketchikan Fish and Game Advisory Committee. Advisory committees are local groups established with the purpose of discussing relevant fish and game regulations and policy to provide the boards with local recommendations. These local groups provide the community with a forum for natural resource management discussions, and recommendations are passed on to the Board of Fisheries. Alaska Statute 16.05.260 and regulations found in 5 AAC Chapters 96 and 97 provide the legal framework for their establishment and purpose. The Ketchikan Advisory Committee was reformed in 2018 after a period of inactivity beginning in June 2012. The Ketchikan Advisory Committee's areas of concern include Southeast Alaska finfish and shellfish and Game Management Units 1A and 2.

During the time I spent serving as the secretary of the Ketchikan Advisory Committee, I saw what succeeded and failed when it came to presenting proposals. Proposals that were simple and concise were more likely to gain support. Proposals that tackled more than one issue inherently had more aspects to debate and were less likely to be supported as initially written. I learned to question the intent of the author, and to analyze what the author was trying to

accomplish and if the written proposal would accomplish that. This can be challenging when the topics are as complex as those covered in this venue.

The advisory committee followed Robert's Rules of Order to the best of their ability. This was done to try to make the meetings move in a timely fashion, but also to provide a fair opportunity for members and the public to speak to issues. I found that the chairman of this committee set the tone for the meetings and had significant influence in how discussions of topics were held. The importance of a strong leader who was fair and impartial for groups such as these was apparent to me throughout our discussions, which could become contentious at times due to the weight the boards give to advisory committee recommendations on proposals.

The advisory committee and ADFG have a strong relationship. While the advisory committee has the authority to oppose proposals submitted by ADFG, the Ketchikan Advisory Committee generally supported the ADFG proposals. Department personnel are available to the committee, and appropriate staff show up to the meetings based on the topics to be discussed. During my time on the advisory committee, ADFG staff provided presentations on contentious issues to provide background information to committee members. Overall, I found these presentations to be helpful, but it was important to realize that ADFG personnel have clear mandates and management objectives. These were policy decisions, and there was not necessarily a right or wrong choice. Options should not be categorized as good or bad. The distribution of costs and benefits among stakeholders is central to any policy debate (Lackey 2006). The options presented were competing policy preferences and decisions were based on what the committee felt would be best for the resource and the community of Ketchikan.

Serving on the advisory committee was an excellent opportunity to represent constituents. There were many proposals that I did not have a strong initial opinion on due to being unfamiliar

with the issue. It was my role as a member to represent the people of Ketchikan. That included learning what the proposal sought to do, what it would change, and how that would affect residents of our community. I learned to think through the proposal and the process to determine the actual outcome. The committee took up proposals that pertained specifically to the Ketchikan management area for fisheries and wildlife topics, but also proposals of other management areas that would affect Ketchikan residents who commonly harvested in those areas.

Advisory committees have regulatory language (5 AAC 96.021) that enables them to establish designated seats for certain groups of people. The Ketchikan Advisory Committee had previously established two seats reserved for representatives from Saxman, Alaska, which is located within the Ketchikan Gateway Borough. Saxman was formed in the late 19th century by Alaska Natives. The designation of seats, as directed by law, provide representation for specific groups. To be a voting member of an advisory committee one must be 18 years old (5 AAC 97.005). The Ketchikan Advisory Committee voted to establish a non-voting seat for high school students. This provides students with the opportunity to have a seat at the table and experience the process of how fisheries and wildlife policy is determined.

Hatchery Salmon Allocation by Gear Group

In Alaska, the politics surrounding gear group allocations are complex and generally contentious. For effective management of any ecological issue, determining who the stakeholders are is a vital part of the process (Lackey 2005). At an abstract level, all Alaskan residents are stakeholders due to fish and wildlife being defined as a shared natural resource in the Alaska Constitution (Alaska Const. art. VIII, § 3). Commercial fishermen, processors, buyers, restaurants, food retailers, fisheries suppliers, recreational fishermen, the charter fleet, and coastal communities are more engaged stakeholders of salmon fisheries. Due to the different

policy priorities of the stakeholders and potential competing values, salmon management has historically been contentious (Lackey 2000).

The commonly used approach in Alaska to engage these various competing stakeholders is the use of RPTs to address hatchery salmon allocation issues. Fisheries management is often less about the science and more about the stakeholders, and this holds especially true for the RPT process. A RPT is composed of six members: three representatives from the regional aquaculture association, three ADFG personnel, and two non-voting members. In Southeast Alaska, there are two RPTs: a northern RPT and a southern RPT. The two RPT's will often meet under a joint RPT to address topics that affect Southeast Alaska in general. The main purpose of the RPT is to coordinate salmon enhancement projects in their region, to develop comprehensive salmon plans, and to provide the commissioner with recommendations for the approval or rejection of production alteration requests. The most recent comprehensive salmon plan for Southeast Alaska was published in 2004. Drafted by the joint RPT and approved by the commissioner, who holds management authority for the State, this established guidelines for specific enhancement programs. In Southeast Alaska, the RPT generally meets twice a year. The initial meeting in April serves as a place for hatchery operators to bring production alteration requests to the meeting for discussion. The second meeting is held in November/December, which provides RPT members with adequate time to determine the effects of the production alteration requests. After the RPT has voted on the issue, the RPT chair writes a recommendation to the commissioner regarding the proposed change. The commissioner has the final authority to approve or deny, though generally aligns their choice with the recommendation of the RPT. The RPT does not make allocative decisions for wild stocks or traditional fisheries. It is appropriate

for the RPT to suggest changes to fisheries conducted in terminal harvest areas and special harvest areas that target returning hatchery produced salmon.

The two non-voting RPT members represent the Tongass National Forest for United States Forest Service (USFS), and a non-regional aquaculture association. The USFS, as a federal entity, is responsible for projects with wild runs in national forests. The rivers of the Tongass National Forest produce 75% of salmon caught in the commercial fisheries in Southeast Alaska annually (Johnson et al. 2019). While the USFS has its own set of jurisdictions within Alaska, they still need to have a fish transport permit, granted by the ADFG, to move fish for projects. The non-regional aquaculture associations are not afforded a voting seat on the RPT but are provided representation through a non-voting seat. This enables them to speak to production alteration requests and other enhancement production changes at the meetings.

The ADFG is mandated to include stakeholder and public involvement in salmon management (5 AAC 40.210; 5 AAC 40.370). This is apparent in the numerous avenues for public involvement in the salmon management process. Regional planning team (RPT) meetings provide a space for the public to speak their opinions regarding hatchery production. A public hearing must also be held prior to the completion of a hatchery permit (5 AAC 40.210). Meetings are advertised via the ADFG's advisory announcement system, and commonly included in local newspapers and broadcasted on radio stations.

The RPT process served as a case study for policy decision making, as RPT members may have conflicting policy goals. On some issues, there is a divide between regional aquaculture association representatives and ADFG personnel. Current divides between the two organizations center on a push for regional aquaculture associations to have more production and additional release sites. ADFG has been hesitant to grant production increases due to contention

in other regions of the state and concern regarding over production. ADFG has implied that additional Chum Salmon production in Southeast Alaska is unlikely. Production increases associated with Pacific Salmon Treaty mitigation funding, or for species targeted by trollers such as Coho Salmon and Chinook Salmon would be considered, which demonstrates the power of decisions made at the international treaty level because these species are managed under treaty obligations. Another level of conflicting goals can be found within the regional aquaculture association representatives. While increased production is normally good for all the gear groups, this arena rightly serves as a place for debate over allocation, the distribution amongst the fleets. These disputes represent the strictly “human” aspect of fisheries management and how quickly it can become about who receives what benefits. Essentially, fisheries management is a zero-sum game (Lackey 2006).

Contention between gear groups, was present and obvious. Troll harvests have continually been below their allocated quota of enhanced salmon because of the ever-increasing restriction of the troll fleet for harvest opportunities of Chinook Salmon tied to provisions of the Pacific Salmon Treaty. The issue of the troll fleet being below their allocation is also compounded by the higher financial cost of raising Chinook Salmon and Coho Salmon compared to other salmon species. The gillnet fleet has historically been over their allocated quota, and the seine and troll fleets have been below their allocations (Pryor 2017, Figure 3). Each group has its own style regarding how it attempts to push its policy preferences. “The plight of the troller” is commonly heard within meetings. This gear group is not afraid to voice its concerns regarding the loss of harvest opportunity. The gillnet and seine fleets compete for more opportunity to harvest hatchery-produced Chum Salmon. It is common to hear that the gillnet fleet: “has been above their harvest allocation” when other fleets are trying to reduce additional gillnet

opportunities. Additionally, gear groups will attempt to push their policy preferences by cloaking their argument in science and conservation (Lackey 2006). All gear groups push to expand fishing opportunities in both area and time. Strategically shared stories of experiences on the water are used to support policy preferences or sway voting members one way or another. This experience taught me that science is more frequently debated than relevant personal experience.

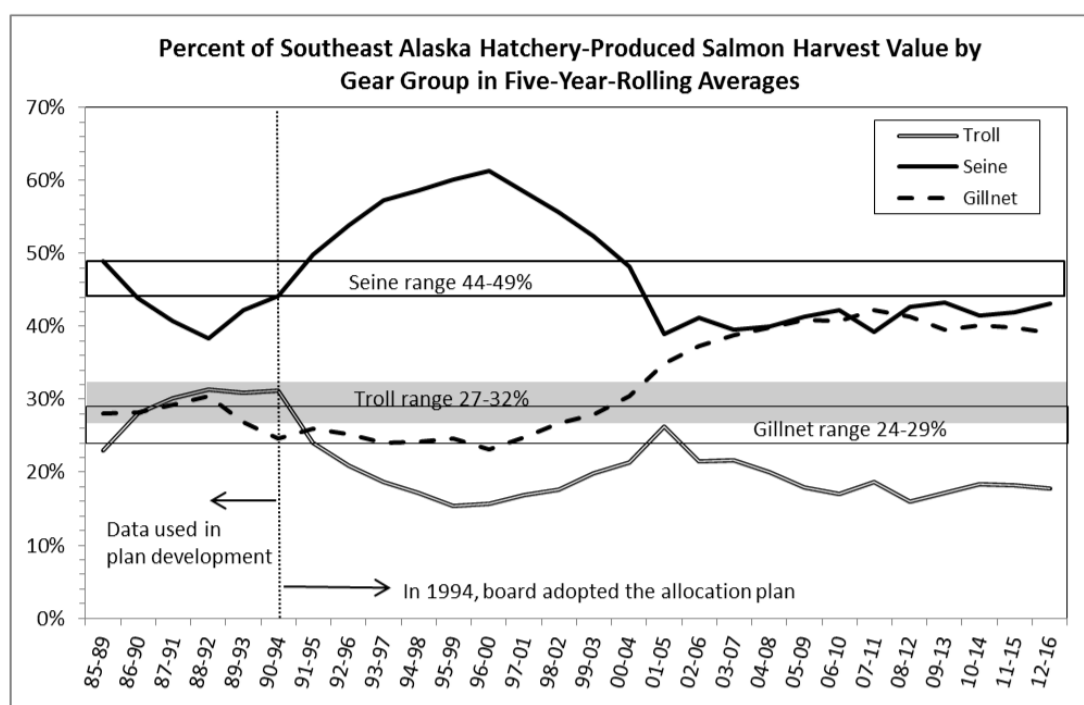


Figure 3. Percentage of hatchery-produce salmon harvested by gear group (Pryor 2017).

State Legislative Process – Shellfish Enhancement Bill

The legal means to establish private non-profit salmon hatchery programs was passed by the legislature in 1974 through a salmon enhancement bill (Versecci 2014). For a portion of my internship I shadowed the director of ADFG – Commercial Fisheries Division in relation to the shellfish enhancement bill which served as a proxy for the state legislative process that the salmon enhancement bill went through. The Shellfish Enhancement Bill was modeled after the salmon enhancement program; how the program would be established and the policy behind how

it operated. The shellfish enhancement bill proposes providing the shellfish industry with the opportunity to enhance wild stock production. Central to the spirit of the shellfish and the salmon bills is that they were established to supplement, not replace, wild stocks.

House Bill 41, Shellfish Enhancement Bill, was modeled after House Bill 28 which did not make it through the legislative process. House Bill 28 was proposed by ADFG, where House Bill 41 was proposed by the mariculture industry and supported by ADFG. House Bill 41 served as an important case study in my internship for how the current administration has influence on ADFG involvement and stance in policy issues. During the previous administration, ADFG had been the champion of the bill and pushed to establish shellfish enhancement within state waters. With the change in administration, many policy priorities changed, and the new bill was presented by Representative Dan Ortiz.

The enhancement bill defines mariculture and states that it does not apply to aquatic farming, which is covered under a different state statute. In terms of enhancement, the objective would be to provide additional production of species relative to what would be available from natural production. With restorations, actions would be taken to address areas of decline, which could be from natural processes such as predation. Overall, this bill would establish a legal framework for the shellfish enhancement industry, which could provide economic opportunities across the state. Section 1 gives the Board of Fisheries the authority of allocation and other associated management powers. Section 2 is about the increase in the permit fee to \$1000, to be consistent with the private non-profit salmon enhancement permit fee. Section 3 is modeled after the salmon enhancement bill and defines how broodstock and cost recovery efforts could be conducted, establishes a process for hearings and public inputs, defines guidelines for the selection of brood stock, the construction of infrastructure, the sale of shellfish, cost recovery

purposes, annual reports, and proper definitions, and gives ADFG permission to inspect sites. Section 4 is about permit entry. Section 5 defines the legal fishing gear for a shellfish special harvest area. Section 6 is about exemptions from farmed fish definition. Section 7 and 8 relate to income tax exemptions. Section 9 is an exemption from the seafood tax. Section 10 provides a date for permits. Section 11 requires ADFG to implement regulations, and Section 12 sets an effective date for Section 8.

Salmon enhancement programs release fish that can be harvested by anyone with a commercial permit, and within subsistence, personal use, or sport fisheries. Enhancement programs are modeled to rear fish or shellfish in a controlled environment during the early life history phases where mortality is high. The intent of shellfish enhancement would be to raise shellfish in a hatchery and outplant them so that those participating the common property fishery could harvest them. The shellfish produced would be a common property resource, belonging to no one until legally harvested.

There are two models that shellfish aquaculture associations could use to collect money for operations: a fishery assessment tax and directed cost recovery fisheries. The salmon enhancement industry relies on both models. Shellfish have various life histories and mobility, and therefore both models will have to be evaluated for specific fisheries. When enhancement is done for commercial intentions, it is easy to figure out who is responsible for the funding. When enhancement is used for subsistence or personal use determining who is responsible for funding the project would prove challenging. ADFG is only responsible for permitting, not determining funding for these projects.

Time was spent observing the bill move through the different legislative committees. Each committee had their own set of concerns based on their representation and authority. A

common concern through each committee was ADFG resource allocation, and if the mariculture bill was going to require additional funds in the ADFG budget to administer the program. This concern stems from the ever-shrinking state budget and lack of additional funding to establish new programs. It was stated that ADFG would not require any additional funds to permit for mariculture enhancement. These programs were portrayed as important for expanding the mariculture industry in Alaska, which was a goal set by the previous administration.

A lesson that was apparent through this process was the importance of having stakeholder and public support at legislative meetings. Demonstrating the public's desire to establish these types of programs is a powerful tool for those voting in the legislature. During the meetings, there were very few supporters of the mariculture enhancement bill that spoke to the benefits of having regulatory language that would enable enhancement programs. It was shared with me that the previous time this bill was proposed, there had been a larger turnout of supporters at meetings. This highlighted a disconnect between the private sector and the government process and is a pace where establishing stronger ties between the two could be strengthened.

Habitat Management on Federal Land – United States Forest Service

The United States Forest Service (USFS) is a federal agency and has authority over salmon habitat management on federal lands in Southeast Alaska. The USFS management authority for salmon revolves around freshwater habitat. Projects and monitoring by this federal agency focus on managing salmon habitat within national forests and improving habitat in areas that have been altered by natural resource extraction.

The final portion of my internship which was to be completed in the spring of 2020. Unfortunately, this portion ran into obstacles resulting from the COVID-19 pandemic. I had planned on conducting stream surveys with USFS fisheries biologists to examine habitat and

discuss the different objectives between state and federal management agencies. This required riding in a USFS vessel, for which I had already undergone training to safely participate. Upon the COVID-19 outbreak, that was no longer an option, due to increased safety precautions. This portion was also to include discussion on the new Roadless Rule which pertains to natural resource usage on federal lands. The USFS ruling on the Roadless Rule would potentially open wilderness areas for natural resource extraction. These areas could include the allowance of roads to be built near highly productive salmon streams. The public comment period lasted for a predetermined amount of time, and hundreds of thousands of comments were submitted. The USFS reviewed these comments and announced that the ruling would be released towards the end of the summer in 2020.

When comparing how the federal government and state government manage salmon in Southeast Alaska, one of the more interesting differences I noticed was the difference in reactions to the COVID-19 pandemic. ADFG's stance was to do everything it could to make operations as safe as possible and manage as normally as possible. Many projects operated with fewer personnel, and the research vessel implemented a strict COVID-19 protocol. ADFG personnel were no longer allowed to fly on commercial airlines, and if personnel did for personal reasons, a two-week quarantine period was required. Individuals could still fly in small aircraft, which is essential for the management of herring and salmon fisheries. ADFG offices remained open, though with limited access to the public. The USFS implemented strikingly different protocol. USFS projects were put on hold or did not occur. Personnel were permitted to fly commercial airlines but could not fly in small aircraft. Individuals were almost exclusively working from home. These major differences boil down to where the authority to implement policy lies. The State deals exclusively with Alaskan fisheries, while the USFS senior

management resides in Washington D.C. and implements policy for the USFS throughout the entire United States. Alaska management agencies specifically tailor policy to match the challenges unique to Alaska, while the USFS management needed to draft safety protocols that would be effective for agency personnel throughout the United States. Pandemic response represented the differing levels of government authority and the effectiveness of drafting a one-size-fits-all policy.

Federal management in Alaska is also influenced by the Alaska National Interest Land Conservation Act (ANILCA; 16 USC § 3101-3233) passed by Congress in 1980 with the intent to conserve nationally significant federal lands in Alaska while still allowing for recreational opportunities. National preserves were established to have similar functions as national parks, with the exception that national preserves allowed for the taking of wildlife by sport and subsistence users. Although, the Alaska Supreme Court has found that rural preference is unconstitutional, whereas Title VIII of ANILCA defines subsistence users as rural Alaskan residents and provides them with specific harvest opportunities. Therefore, in this instance residency determines if one is entitled to federal subsistence privileges. Authoritative power was divided between the Department of Interior, which is responsible for the management of subsistence users on federal lands, and the ADFG which sets sport management regulations for state lands. ANILCA influences fisheries primarily on a subsistence scale. It is used to establish freshwater subsistence fisheries, and there are relatively few of these for salmonid species. There is a steelhead subsistence fishery in Southeast Alaska under the USFS management authority established from ANILCA (Harding and Coyle 2011).

The eulachon (*Thaleichthys pacificus*) fishery represents a species under the authority of state and USFS collaborative management in Southeast Alaska. ADFG has management

authority for saltwater fisheries within state waters. The eulachon fishery is an established commercial fishery (5 AAC 33.520) and subsistence fishery (05 5AAC 01.730). The issue with the management strategy for this fishery is that if ADFG opens a state managed fishery, then the federal government is required to open a subsistence fishery with designated preference for rural users. Eulachon runs are highly variable in run sizes and are vulnerable to overharvest. Therefore, ADFG has chosen not to open fisheries due to conservation concerns. Conversely, the USFS currently manages a personal use eulachon fishery in Southeast Alaska.

International Cooperative Management – Pacific Salmon Commission

The Pacific Salmon Treaty (PST; treaty) between the United States and Canada was signed in 1985. A summary of the history of Pacific Salmon Commission history is as follows: the beginning of the present-day treaty starts with the Sockeye Salmon Convention on May 26, 1930, which served as the first formal agreement between the US and Canada (Miller et al. 2001; PSC 2018). Next, the International Pacific Salmon Fisheries Commission (IPSFC) was established and comprised of three representatives from both the US and Canada (PSC 2018). Under the direction of W.F. Thompson during the 1930s, the IPSFC conducted research aimed to assist fisheries management. Tagging studies, spawning ground enumerations, and stock identification were some of the most significant work by the IPSFC during its 49 years of existence (PSC 2018). The IPSFC was a successful first attempt at cooperation and resulted in a plethora of knowledge about salmon ecology researched by the scientific community (PSC 2018). Through this period, it became apparent that a stronger agreement between the two nations was needed.

The PST provides the US with four seats on the Pacific Salmon Commission, the regulatory body established by the PST. The four American seats are selected by the US

President; representatives are nominated by the governor of Alaska (one), the governors of Washington and Oregon (one), and the tribes of Washington, Oregon, and Idaho (one). The fourth seat is held by a representative of the federal government who generally does not participate in the voting process. The appointment of Commission seats represents a shift towards the decentralization of federal power to increased representation of state and local interests (Yanagida 1987). Each seat on the Commission represents groups of people with vastly different policy goals, and these groups have allowed disagreements to hinder cooperative decision making (Colson 2001). Differences in policy objectives commonly occur amongst the US representatives (Schmidt 1995).

Alaskan fisheries benefit greatly from Alaska's geographic isolation (Knight 2001). Chinook Salmon migratory routes take fish through rich Alaskan waters to feed (Miller 2000). Upon return, Chinook Salmon regularly take a north to south migration pattern which leads many stocks to travel through Alaskan coastal areas (Miller et al. 2001; Noakes et al. 2005). Of all the Parties involved in the treaty, Alaska's fish are intercepted the least by non-Alaskan fleets (Miller et al. 2001). Further, up to 78% of Chinook Salmon harvest in Alaskan fisheries are of British Columbia, Washington, Oregon, Idaho, and California origin (Swanton 2018; Figure 4, page 46). Canada has used United Nations Convention on the Law of the Sea Article 66 to support reductions to Alaska's fisheries; Alaskans have counter-argued that these fish feed in Alaska's waters and compete with fish of Alaskan origin (Miller 2000). This divisive management issue centers on ownership of the natural resource.

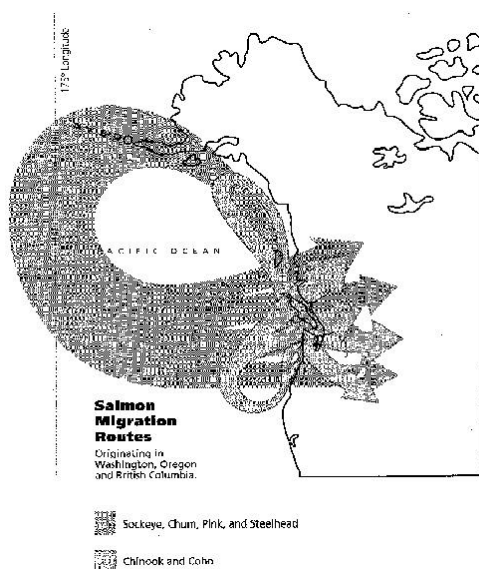


Figure 4. Salmon migratory patterns (Cederholm et al. 2001).

My time spent shadowing fisheries professionals related to the Pacific Salmon Commission, the Pacific Salmon Treaty, and Alaska salmon management was by far the most eye-opening portion of my internship. The success of Alaskan fisheries can be directly tied to the federal funding they receive from the Pacific Salmon Commission, which enables management programs to continue. This funding is essential for ADFG to conduct the programs and projects required under the treaty. Funding is allocated to the general annual budget of ADFG's Southeast Alaska region specifically to keep existing management programs, but also for additional research projects related to the treaty. Recently, funding was procured for Southeast Alaska Chinook Salmon Mitigation Programs and marking trailers, which are used to mark hatchery fish with adipose fin clips and coded wire tags. Marking trailers have the potential to provide fishermen with additional opportunities to harvest Chinook Salmon, if specific types of fisheries are implemented such as mark select fisheries, or through the reduction in the risk factor applied to the current abundance index that provides Alaska with a Chinook Salmon allowable catch. Mitigation programs have been established to provide fishermen (primarily trollers) with

additional enhanced Coho Salmon through hatchery programs to offset the decline in Chinook Salmon harvest opportunity in recent years. The usage of marking trailers could have far reaching implications on Alaskan fishery management techniques, for mark-select fisheries in Southeast Alaska have not been established yet on a large scale.

A common theme throughout my internship experiences was the importance of depth of representation amongst group members and this held true for the Alaskan panel members on the Pacific Salmon Commission committees. Committee and panel members were comprised of individuals from a wide variety of backgrounds and interests in Southeast Alaska salmon harvest. I observed members work towards the larger objectives of “Alaskan” goals with each bringing pertinent knowledge to the discussions. The Pacific Salmon Commission is not the appropriate venue for gear allocation squabbles, and panel and committee members respected that. Their purpose is to represent Alaska, acting primarily as its own entity, separate from the other delegates from the Lower 48.

Discussions at the Alaska delegation level of the Pacific Salmon Commission were not limited to strictly international decisions. A recurring issue throughout my experiences at meetings was discussion of the listing of southern resident killer whales (*Orcinus orca*) under the Endangered Species Act. Alaska does not currently have any species of salmon listed under the Endangered Species Act. The Mitchell Act and the Magnuson-Stevens Act open the door for federal involvement in fisheries management in Southeast Alaska. The consensus within the room was that federal involvement would not be ideal, because Alaska benefits greatly from the ADFG being the single management agency, that does not have to deal with the complexities that go along with multiple management agencies managing cooperatively. What was most illuminating for me during this portion was that Alaska fisheries do not occur in a vacuum. State

management is reliant upon federal money set aside for management of Alaska's fisheries under the Pacific Salmon Treaty. Federal decisions that are made regarding ESA listing of species and have the potential to affect how state management programs operate.

The Alaskan delegation, is one of the simpler, more cohesive groups, based on how the state management system is set up. There is one singular management agency (ADFG) and there are no tribal representatives. Other PST parties in the Lower 48 have multiple agencies which complicates management. Specifically, when species are listed under the Endangered Species Act, then the federal government must become involved. Alaska benefits primarily in instances such as data tracking and sharing due to the single management agency, ADFG, which bears the responsibility.

From my observations of the Chinook Working Group and the Chinook Technical Committee, I concluded that science can be a proxy for policy agendas. The new model used for determining the allocation of Chinook Salmon would not have been accepted by the southern US parties had it not benefited them. Even if it were to be considered better science, those who needed to get on board would not have done so if it had reduced their allocation or opportunities to harvest. This has to do with how the fisheries work and how they have been operated in the past. Alaskan fisheries have always caught fish that originated in British Columbia, Washington, Oregon, and Idaho. This is due to migration patterns where Chinook Salmon return to coastal waters of Southeast Alaska and fish run the gauntlet of hooks and nets back to their natal streams to spawn. Treaty provisions provide that historical fisheries must be taken into consideration and that disruption of those fisheries should be avoided (PST 2020). The Chinook Technical Committee has established a "catch neutral translation" to connect the outputs from the old

model and the new model, and ensured there would not be a reduction of fish for specific Parties using this new method.

The Northern Boundary Panel for the Pacific Salmon Commission is comprised of members from southern Southeast Alaska and British Colombia, and their focus is on fisheries near the Canada/US border. Central to the panel purpose, Canadian sockeye which are intercepted in southern Southeast Alaskan fisheries are a primary management topic. The Nass River and the Skeena River are the two largest Canadian runs that are monitored for abundance and are harvested primarily in the District 4 purse seine fishery and the District 1 drift gillnet fishery. In years of high abundance, all fishing sectors are provided harvest opportunities. The situation becomes contentious quickly when run sizes decrease and Canadian fisheries do not occur. In recent years, there have been low returns to the Nass and the Skeena, and Alaskan fisheries have decreased their fishing times in response to the projected returns. The model used by the Canadians is debated heavily to make sure it accurately represents what is occurring and that the Alaskans agree with how the run is being portrayed. This situation highlights that science is often used as the surrogate debate for policy which is who gets to harvest these fish and how much (Lackey 2006). One of the more contentious issues I observed through my internship was how to deal with Skeena sockeye harvests outside of the treaty period. A shift in run timing is thought to be occurring, and this changes how the agreed upon management terms in the treaty is affecting harvest and the allocation between user groups. There are concerns from the US and Canada representatives about how this should be addressed. Alaskan fishermen feel that they are losing out on harvest opportunities, and Canadian representatives do not want to provide Alaskan fishermen with any additional opportunity to harvest Canadian sockeye (which have been traditionally harvested in the Section 1-B gillnet and District 4 purse seine established fisheries).

The 2019 annex of the Pacific Salmon Treaty will be in force until 2028, and I highly suspect that at the time of renegotiation this topic will be a very contentious agenda item.

The definition of words and agreed upon terms are vital for productive policy conversations (Lackey 2006). This was apparent in the discussions I witnessed between the United States and Canada for the Northern Boundary Panel. The Canadians use the term “harvest rate” in a different context than the US representatives who use “exploitation rate” to describe the same concept, and this continued to cause questions and misunderstandings from representatives on both sides. The science gets played out in the Northern Boundary Technical Committee, and the policy is determined at the panel level. The Northern Boundary Technical Committee is a collaborative effort involving representatives of both Parties. Funding for projects on both sides is voted upon by members, and while there can be contention regarding how the science is portrayed and determined, at the end of the day both Parties want each other to have funding to provide the group with the best available science for decision making.

During my time spent at the PSC meetings, I was able to observe interactions within the panels. One observation occurred during a meeting where the panel members were frustrated because they could not understand what was being presented to them. I learned that it is important to know your audience and to be able to clearly explain the data that are being provided or interpreted. Many of these concepts were quite complex and it is important to be able to distill these complex ideas down to share with people who have expertise outside of science. Another observation I made was that industry is given more leeway in what they can say. Members of ADFG were bound by their job duties and the objectives of the organization for the types of comments they should and should not be making. Members of industry are representatives from various backgrounds. They were given more freedom in what they could

discuss and say. Representatives and panel members from all backgrounds would debate the science, but no one disputed what fishermen representatives shared in their experiences. Again, science is only one aspect of fisheries management and often is not the most important part of the decision-making process.

Lessons Learned

At the completion of my multi-faceted professional internship I felt that I had accomplished what I had set out to learn about salmon management in Southeast Alaska. At a basic legal level, salmon management in Southeast Alaska is divided by jurisdiction and is subjected to provisions under the Pacific Salmon Treaty. Federal jurisdiction is delegated primarily to the USFS whose focus is on stream habitat protections and small freshwater subsistence fisheries. The State of Alaska is responsible for fisheries within three nautical miles of shore, and all waterways. The State has distributed authority between the Alaska Department of Fish and Game and the Board of Fisheries. The Board is tasked with allocative and regulatory authority and ADFG was assigned with direct management of the resource. The Board receives input from local Advisory Committees, a group of elected individuals who represent their communities at large. ADFG has established RPTs to address hatchery production within the region. Members are ADFG personnel and regional aquaculture association representatives. Hatchery associations must be permitted through the ADFG to rear, transport, and release salmon. State statute has established means by which hatchery returns can be managed to provide income for associations to finance operations, and this is managed by ADFG. The state courts are where interpretation of disputed and/or unresolved regulations are played out. The legislature is responsible for establishing laws and statutes which provide the framework for regulations.

The overarching lessons learned during this internship were:

- 1) **Fisheries management is often less about the science and more about the stakeholders.** I came to this conclusion because of the amount of time spent during meeting's discussions that pertained to who would benefit from specific policy options. Management is complicated by competition amongst stakeholders. For example, the science behind escapement goals, the central tenant to ADFG management, is relatively simple and straight forward. The allocation of the resource amongst the stakeholders though is very divisive and complicated.
- 2) **Management must be based on consistent objectives and reasoning because decisions will be challenged.** There are always winners and losers in policy decisions, and generally those with the most to lose speak the loudest. I encountered this lesson several times when I was shadowing management professionals at ADFG. Stakeholders challenged the decision that was made because they were losing access to the resource, and management personnel were expected to provide support for the policy option chosen. Therefore, having a strong base of understanding of the management objectives and rationale is crucial to defending the policy option chosen.
- 3) **Science is more frequently debated than relevant personal experience.** I observed this on several occasions at salmon management meetings. The interpretation of models and the presentation of data was commonly debated, though when an individual would speak to what they had experienced rarely was the content questioned.
- 4) **Science is one of the many inputs to management, a fact often overlooked by early career fisheries staff.** Which was well illustrated by my own preconceived expectations of how fisheries management was conducted. I initially thought that management relied

solely upon science when determining appropriate management actions. My understanding has evolved to include an encompassing view of the many factors that go into the decision-making process. For example, fishery management professionals use science through the data collected and analyzed to make decisions. Science is not the only input into the decision-making process which includes factoring in parameters related to economics, allocation, and stakeholders. The interpretation of the outcome of the decision on the many different parameters is the true art of fisheries management.

- 5) **Allocation, the distribution of costs and benefits among stakeholders, is central to fisheries policy debates.** This lesson was gained by my experience participating in the Ketchikan Advisory Committee and watching RPT meetings. Generally, individuals involved in the decision-making process agree that there should be some level of harvest and the sustainability of the resource is of the highest priority. Beyond that agreement, the distribution of access to the resource is commonly debated.
- 6) **Salmon management cannot be fully understood without exploring the history and politics of funding.** This lesson was stressed by several of the professionals I shadowed. Individuals were eager to share experiences that highlighted the importance of funding for the success of fisheries programs. The source and stability of funding play into the longevity and success of research and management programs. Alaska has variety in the types of funding for enhancement programs, and the history of the politics behind funding provide insight into their role and function in Alaska salmon management.

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I began my graduate school journey with Dr. Lackey's course: FW 620 Ecological Policy. I had never been as intrigued and intellectually stimulated in an academic setting. It changed my world perspective and set the tone for my graduate studies. While my writing has improved in this program, I still struggle to find the words to express my gratitude.

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