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Title: Today, tomorrow, and every day after that: How commercial salmon fishermen in Bristol Bay, Alaska define and work towards a sustainable salmon fishery.

Abstract Approved:

Flaxen Conway

Rising human global population, appetite for seafood, and the effects of climate change have pushed commercial marine fisheries around the globe onto trajectories that are chillingly unsustainable. Input from fishermen on what it means to have a "sustainable fishery" is often absent or ignored. Some commercial fisheries are lauded for their sustainability. This study looked at the successful case of the Bristol Bay sockeye salmon (*Oncorhynchus nerka*) commercial fishery to determine whether, how, and why Bristol Bay commercial salmon fishermen conceptualize and work towards a more sustainable future for their fishery. Findings suggest that while fishermen care deeply about the sustainability of their fishery, they see their role in achieving that goal to be focused on advocating for their specific fishery to increase social capital, and taking steps to enhance the quality of their product to improve the economic viability of the fishery. In the course of the study, it became apparent that Bristol Bay fishermen were deeply concerned about and motivated to action by the proposed Pebble Mine. It was also revealed that fishermen might not have fully understood the roles and limitations of fishery managers when it came to public advocacy on issues like Pebble Mine. This may indicate that commercial fishermen and managers are on a course towards a toxic relationship, which threatens the sustainability of the fishery. Policy and research recommendations are included in the conclusion.

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Today, tomorrow, and every day after that: How commercial salmon fishermen in Bristol Bay, Alaska define and work towards a sustainable salmon fishery.

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I understand that my essay will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my essay to any reader upon request.

Ivan Kuletz, Author

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First, my thanks to the fishermen I interviewed for this research, and all the fishermen I've come to know as a young man on an old boat. May every set bring you joy, every storm pass you by, and every season see you home safely. Second, my thanks to absolutely everyone in Bristol Bay. Fishermen, biologists, fleet managers, dock workers, processors, boat yard workers, shopkeepers, Coast Guard, state troopers, researchers, pilots, ground crews, subsistence and sport fishermen, and all the smiling, earnest faces. May we all be stewards of the land, sea, and one another.

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1. Introduction:

"If you have an ethos about the way that you manage your resource so you're not managing for a short term gain, then you're more likely to have a sustainable fishery."
-Interview Subject "Xray"

As world population continues to grow, it places ever-increasing pressure on local, regional, and global food sources. This pressure is particularly harsh on fisheries. World per capita fish consumption has increased from almost 10kg per person per year in the 1960s to a little more than 19kg per person per year in 2012[1]. While aquaculture has provided food on relatively small scales for thousands of years[2], and industrial aquaculture production has risen substantially in the last few decades, there is still a gap in marine-based food demand that will come from wild fisheries, and substantial variation in fisheries demand and production ability exists between poor, rich, rural, urban, coastal, and landlocked communities and nations[1]. However, "production" is not the bottom line in fisheries; there are ecological limits on what can be done to the biotic or abiotic components of a system before those components – or indeed, the entire system – collapses and is altered or lost forever[1].

Unfortunately, the historical and present track record for fisheries is not a good one. Perhaps the most well-known fisheries disaster for the Northern Hemisphere is the collapse of and subsequent indefinite moratorium placed on the Atlantic northwest cod fishery in 1992, when Atlantic cod were caught in such huge numbers by increasingly numerous and mechanically capable fishing fleets that human fishing efforts almost wiped out the entire population[3]. Add to that multiple species of tuna, pacific sardine, haddock, orange roughy, and numerous others [3,4], and an idea begins to form that fisheries (and, by extension, humanity) are not being served well by the status quo.

While it would be possible to discredit the assertions that individual or disparate fisheries and marine ecosystems are facing serious trouble, the evidence for a global crisis becomes overwhelming in the aggregate. Only 10% of the world's fisheries are classified as "underfished" – meaning that they are being harvested below the level at which they could optimally be harvested without harming the population – while the other 90% are either depleted, recovering, overexploited, or fully exploited. A particularly worrisome point is that 30% of total fisheries are currently harvested at unsustainable levels, a threefold increase in the last 25 years[1]. The United Nations Food and Agriculture Organization (UN FAO) and other research and monitoring groups paint a stark picture of unsustainable management strategies and fishing practices[1,5,6] made all the more complicated by methodological inconsistencies and disagreements[7].

However, not every fishery is overexploited or on a trajectory to be overexploited; some fisheries are actively and successfully managed for the future of both human and fish populations while retaining economic viability[8,9]. In other words, some fisheries are considered to be "sustainable." In fact, a few of these fish populations are being managed and harvested in ways that strive for a return to or continuation of historic rather than current species populations and ecosystem health. We should look to these sustainable fisheries for guidance on how to move forward.

Obviously, fish population dynamics and fish biology will be incredibly important in this effort. These are the basis of the sustainable yield principle, which is focused on fisheries outputs[10]. However, the foundational principle of modern management strategies is "sustainability," which looks at healthy ecosystems and healthy human systems[10]. One component of sustainable fisheries and fish harvest is the role that fishermen have to play in them. By learning more about how fishermen within sustainable fisheries understand and contribute to their own fishery, we can learn more about what makes some fisheries sustainable and other fisheries unsustainable.

One fishery that is consistently lauded as eminently sustainable, and is also receiving no small amount of regional, national, and academic press, is the Bristol Bay sockeye salmon fishery in western Alaska; the world's largest remaining wild salmon run[11–14]. These conditions drive the question this research seeks to answer: how do Bristol bay commercial salmon fishermen conceptualize and work towards the ideal of a sustainable Bristol Bay salmon fishery?

2. Background:

"The story is too big for one story."
-Interview Subject "Hotel"

2.1: Sustainability

Before we can address how fishermen define and work towards sustainability, it is necessary to explore what "sustainability" means in an era when it is used on an almost daily basis by an increasingly broad array of individuals, each with their own goals and interpretations. For instance, conservationists might use the word to describe meeting human needs without compromising the health of ecosystems[15], while social scientists could be more focused on community health or resiliency[16]. In essence, the definition of "sustainability" depends on the audience, subject of discussion, and the goals of the one using it. However, this paper uses the widely recognized definition of sustainability: meeting the needs of the present generation without undermining the ability of future generations to meet their own needs[17].

Sustainability is not a new concept. Sustainability has historically been practiced by indigenous societies in many ways[18]. Early fishermen were no exception, and often

had quite complicated systems of fisheries rights and practices, from family-based usufruct rights (right of usage but not ownership) to selective harvest[2]. While these early efforts were laudable, they were far from a perfect system. There are many examples of species harvested to extinction and entire ocean ecologies that have been restructured by indigenous peoples in their efforts to meet their own needs[19].

This concept of continuation and stewardship changed subtly over the centuries as generations began to realize their own ability to shape nature as they saw fit. From this recognition of ability came the assumption of correct action without consequences, the idea that humans and their actions were somehow exempt from the constraints of natural laws[20]. Environmental sociologists would later term this way of interpreting the natural and human worlds as the Human Exemptionalist Paradigm (HEP)[20].

While the HEP was and is a global phenomenon, perhaps the height of this outlook in the United States was realized in the massive hydrological engineering projects that characterized the 19th and 20th centuries: the Erie Canal, Hoover Dam, the rerouting of the Mississippi, and multiple dams placed along the Columbia River watershed. These projects were characterized as being triumphs over nature and boons to humanity[21], and in some ways they were. Cheap electricity and the mitigation of floods and droughts expanded suitable human habitat, arable land, and economic opportunity. However, little thought was given to the consequences felt by wildlife or the communities that were flooded or dried out, relocated, or deprived of livelihoods – particularly Native Americans and riverine/wetland ecologies[22–24].

Partly in reaction to these effects (and others around the globe) and closely tied to economic/ecological interdisciplinary arguments such as the Tragedy of the Commons[25], as well as the counterculture movements of the 1960's, a "new" viewpoint began to emerge that saw humans as being part of nature rather than separate from it, without any special rules that governed their actions differently

from the world they inhabited[20]. This was later termed the New Ecological Paradigm (NEP)[20]. Through this worldview, the concept of providing for current generations without undercutting the viability of future generations was "rediscovered." The World Commission on Environment and Development coined the term "sustainability" to describe this sentiment, movement, and goal in its 1987 report *Our Common Future*[17].

In the U.S., fisheries policy and science was often racing to keep pace with fishing capacity, and the sustainability of U.S. fisheries suffered as a result. This was particularly felt in cases like the collapse of the Atlantic cod fishery. Some of these difficulties stemmed from inherent uncertainties in fish population models, scientist-policy maker disconnect, and lack of coordination between governance systems[26], but some difficulties also came from a lack of explicitly planning for future generations[7]. This cautionary tale, repeated in many of the contiguous U.S. states, was not lost on Alaska[27].

2.2: Alaska

Alaska's economic history is characterized by resource extraction. By achieving statehood in 1959, Alaska benefited from observing the historical choices at the national and state level that led so many U.S. fisheries and other common-pool resource industries into collapse. Drawing on these lessons, Alaska wrote into its state constitution the following, found in Article VII – Natural Resources[28]:

> Section 4. Sustained Yield. 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.

The "sustained yield principle" is an ecological principle whereby the proportion that can be extracted cannot reduce the base of the capital itself; that is, only the

"surplus" of a fish population required to maintain ecosystem services at the same or increasing level over time can be harvested[10]. By using the sustained yield principle as the basis of management, managers are required by state law to put the needs of a target species ahead of the socioeconomic needs of humans when managing state lands and waters. Because less than 1% of Alaska is privately owned[29], Article VII, Section 4 of the State Constitution has incredibly far-reaching implications for Alaska and its fisheries. This statutory obligation was further extended in later years to focus even more effort on the preservation and use of vital resources, particularly fisheries[28].

Some Alaskan fisheries are targeted commercially, and some are allocated for subsistence use. Subsistence fisheries are vitally important to Alaskans, but only commercial fisheries are the focus of this paper. Alaska's commercial fisheries accounted for 5.35 billion pounds of fish and shellfish in 2011, which was worth $3.0 billion[30]. A large part of this ecological and economic productivity is due to the drafting and enforcement of the Magnuson-Stevens Act, originally adopted in 1972. The Magnuson-Stevens Act established a 200-mile Economic Exclusion Zone (EEZ) around the entire U.S., a zone where it was illegal to fish without the express permission of the U.S. government, and where the U.S. government had the authority to regulate all economic activity – particularly fisheries.

While "fisheries" are often described in the world of economics as a single economic unit, in reality each "fishery" is sharply delineated and their management is dictated by the individual constraints, requirements, and biology of their attendant species and human dimensions. Because of this, it becomes important in this paper to focus on one particular species and, if possible, one particular fishery in geographic area and management authority. Among Alaska's various fisheries, salmon stand out as being especially important due to their cultural gravitas, relatively predictable biology, and commercial value[27]. While many Alaskan salmon fisheries deserve recognition, the undisputed centerpiece of Alaska's salmon catch is Bristol Bay.

Figure 1: Bering Sea and Bristol Bay
Image Credit: visitbristolbay.org

The Bering Sea is a region of incredible biological productivity off Alaska's western coast[31]. At the eastern boundary of the Bering Sea is Bristol Bay, shown in Figure 1. The Bristol Bay area is a broad region characterized by riverine and coastal ecosystems, bordered and punctuated by dramatic mountain ranges and volcanoes. The eastern and central coastlines are sandy and shallow, with extensive tidal flats, shifting sandbars, and few rocks. The western and southern coastlines are rocky, dramatic, and mountainous. Bristol Bay is sparsely populated, with only about 7,500 year-round residents spread over an area the size of Ohio.

The communities of Bristol Bay, the largest of which are Dillingham, Naknek, and King Salmon, are only physically connected to the outside world via boat or plane, and are separated from the state highway system by several hundred miles of wilderness. Telecommunications technology has greatly increased the residents' access to the outside world, but the standard method of communication between far-flung residents is still the local public broadcasting radio station, KDLG, which relays messages as part of its regular programming. In the summer, the region's population spikes with an influx of thousands of in-state, out-of-state, and international commercial and recreational salmon fishermen and associated processing workers, supporting services, and tourism services. All of them are there for the thing that makes Bristol Bay truly remarkable: the largest Pacific salmon fishery in the world[27,32].

2.3: Bristol Bay Commercial Salmon Fishery

While there are multiple salmon species that come in their own time during the summer and fall, the economic focus is on sockeye salmon, *Oncorhynchus nerka*. During the frenetic months of June and July, sockeye arrive in the tens of millions over a matter of days and vanish just as quickly. The commercial harvest from this annual surge of salmon, or "run," is worth a ten-year average ex-vessel amount of $109.9 million per year[32].

The Bristol Bay sockeye run has averaged 25.1 million sockeye caught annually since 1992[32]. However, this is far less than *could* be caught, as there is no quota limit for salmon in the fishery. Instead, it is a limited-entry fishery, where only a certain number of fishing permits are available for private ownership and sale. These permits are durable entitlements and grant the bearer the right to practice commercial fishing in Bristol Bay according to the restrictions set in place by the

Alaska Department of Fish and Game (ADF&G) and the Alaska Board of Fisheries (BOF).

The Bristol Bay area extends from Cape Newenham to Cape Menshikof and has nine major river systems. For fishery management purposes and the reference purposes of this paper, Bristol Bay is arranged into different districts based on the dominant river systems in different regions. Clockwise from the western-most district, the five districts are Togiak, Nushagak, Naknek-Kvichak, Egegik, and Ugashik, shown in Figure 2.

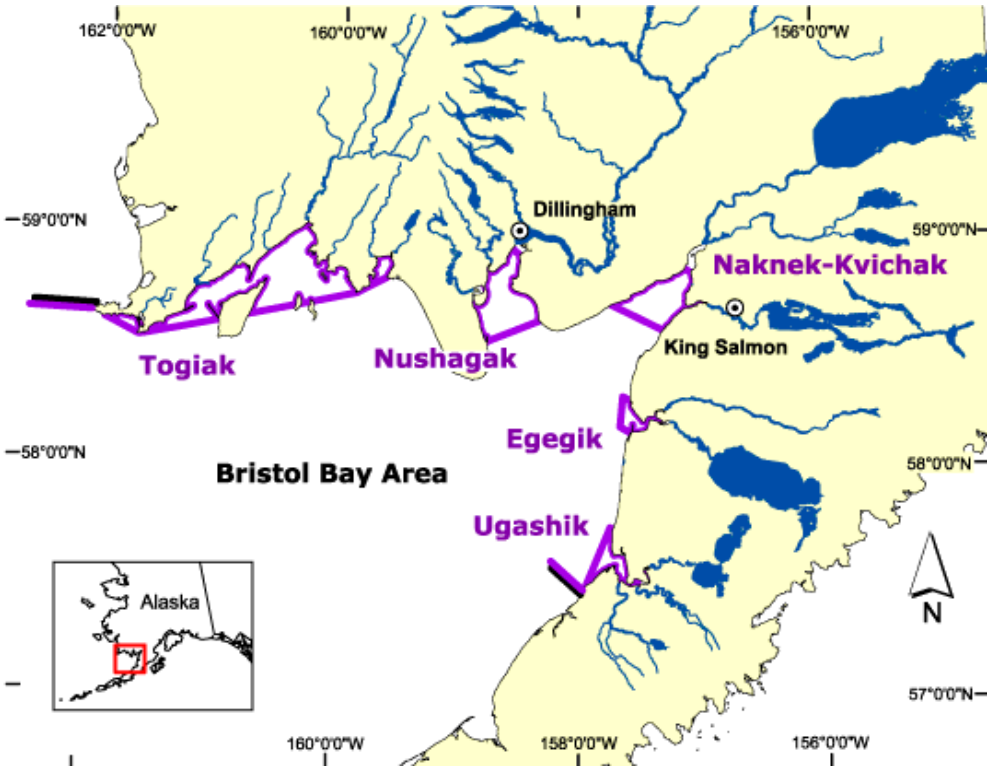

Figure 2: Bristol Bay Salmon Fishing Districts
Image Credit: Alaska Department of Fish and Game

Generally speaking, permit holders are only allowed to fish in one GPS-defined district at a time. Their movement between districts is restricted by a rule which states that when fishermen want to transfer from one district to another, they are not allowed to fish in any district from the time that they declare to ADF&G of their

desire to transfer until precisely 48 hours later. Because fishermen deliver their catch to at-sea "tender" vessels (large service vessels) within hours of catching them, this rule assists fishery managers in collecting valid data on the status of the sockeye run. Between catch numbers provided by processors, genetic information from a test fishery located several day's time from the main Bristol Bay districts (referred to as the "Port Moller test fishery"), and round-the-clock data from upriver counting towers tracking the number of fish passing through to spawning beds ("escapement"), ADF&G district managers have a relatively accurate idea of where the sockeye run is in relation to an idealized sustained yield curve[33]. This helps them make hour-to-hour, and sometimes minute-to-minute, decisions on whether to continue or halt fishing.

In terms of statutory obligation, district managers are beholden to Article VII Section 4, bolstered by the adoption of the Policy for the Management of Sustainable Salmon Fisheries in 2000. In summary, the primary concern of each district manager is to do everything in his or her power to see that the salmon are harvested as close to the idealized sustained-yield model as possible in order to ensure the future strength of the salmon run. They do this by having scientifically solid escapement goals and alternately opening and closing the fishery's districts for anywhere from 4 to 24 hours to meet those goals, with as little as two hours' reprieve between openings, out to indefinite closure or perpetual fishing. This means that individual district managers have complete control over the fishing time allotted to the fishing fleet in their district. All ADF&G regulations, including the times and areas allowed for fishing, are strictly enforced by the Alaska State Troopers, who use land-based spotters, high-speed skiffs, "undercover" boats, low-flying planes, and helicopters. The intense, brief nature of the fishery allows for the intense, focused allocation of law enforcement resources. This means that the level of enforcement in Bristol Bay is quite high despite its remoteness.

While managers have a great deal of control over the opening and closure of the fishery, fishermen have none. What fishermen do have is the ability to propose, debate, and give testimony on regulations such as boat size, number of permits allowed on one boat, and funding of fishery research (such as the previously mentioned Port Moller test fishery) through self-taxation via BOF meetings. BOF meetings are held four to six times a year on a three-year rotational cycle around the state, and they are the most direct access to governance that fishermen have for their own fishery. Voting privileges are reserved for BOF board members, who are appointed by the state governor and confirmed by the state legislature for three-year terms. Fishermen can also informally pass information along to fishery managers about their catch or thoughts on the fishery at any hour. One of the sources interviewed in this study asserted that this collaborative relationship is one that fishery managers strive to encourage, as it helps them make better-informed decisions. When it comes to having a hand in the future of their fishery, however, fishermen in Bristol Bay have two other qualities that are often absent in fisheries in other regions of the United States: numbers and representation.

Bristol Bay commercial salmon fishing permits are tightly regulated by the State of Alaska, with about 1,860 in circulation, approximately 80% of which are fished in a typical year[34]. These permits persist year to year and can be bought and sold much like a deed to a house or title to a car. Their restricted numbers create a capitalistic market where price is influenced by the biological and economic strength of the Bristol Bay salmon fishing industry, as well as the strength of other salmon fishing industries such as aquaculture operations or salmon harvests in other regions. Bristol Bay's limited entry permit system requires that anyone who fishes with a permit must be the in-name owner of that permit, with limited options to lease the permit out annually due to medical hardship or other emergencies (however, some boats have two permit-holders on board, meaning that they are allowed 200 fathoms of fishing gear instead of 150 fathoms). This means that, unlike other fisheries where potentially absent groups and individuals own permits which

fishermen must lease out with no option to buy, Bristol Bay has at least 1300 owner-operator boat captains ("skippers") fishing every year[32,34].

Each of these 1300 owner-operators employs several deckhands; and this is just related to harvesting operations. Add to this the processing, handling, shipping, and marketing of the fish, and the economic importance of this industry is clear. For example, fish processing companies in Bristol Bay employ thousands of workers, and support businesses employ thousands more. What this means is that the financial benefits of the Bristol Bay commercial sockeye fishery are spread between tens of thousands of people – and thus there are tens of thousands of people who are intimately aware of and invested in the sustainability of Bristol Bay's future as a viable salmon fishery and source of income.

While income is a powerful motivator, it is not the only driver of fisherman involvement; social equity and community well-being also has a strong influence[35]. This social equity stance, from a bottom-up perspective, might be rooted in the independent nature that fishermen are well known for. From an institutional perspective, however, this is a deliberate policy decision that revolves around efficiency versus equity. In terms of economic, ecological, and mechanical efficiency, Bristol Bay is not optimized. Each boat in Bristol Bay is allowed to be 32 feet long, with 900 feet of gill net that hang down 12 feet in the water. Drift gill nets catch salmon by entangling them around the head or body as they attempt to swim through them – this requires fishermen to spend time and energy extracting them, sometimes harming the fish in the process. Seine nets catch salmon by essentially scooping them up out of the water en masse, greatly reducing the work that must be done per fish and reducing the chances of injury to the fish. However, this still requires hundreds of boats to use fossil fuels and other inputs to bring in the catch. The *most* efficient way to harvest salmon would be a fishing weir, a device that redirects fish already in a stream into collection areas. Because salmon always return to their natal streams, it would be possible to employ as few as roughly a

thousand people using only a handful of fishing weirs and industrial engines for the whole fishery if weirs were used.

So why not do these more mechanically and economically efficient things? The answer is that such approaches would greatly reduce the number of people gaining employment from the fishery, and would greatly reduce the economic benefit to the region. The takeaway point is that the fishery structure of Bristol Bay is at least partially designed on normative social policy, rather than mechanical, ecological, or economic efficiency[27]. These individual, regional, and institutional values of efficiency, sustainability, and normative policy are at the heart of the conflict between fishing interests and mineral extraction interests in the region, epitomized by the proposed and highly controversial Pebble Mine, which was an emergent theme in this research.

2.4: Pebble Mine

While the deep ties between Bristol Bay as a regional community and Bristol Bay as a commercial salmon fishing industry seem stable and static, both have some unknowns in their futures. Bristol Bay as a regional community carries the inherent uncertainty of a region that is entirely dependent on a single industry. Bristol Bay as a salmon fishery has a similar degree of uncertainty due to the external pressures of global ecological change, ocean acidification, commercial salmon farming, and proposed local mineral extraction plans. One of the main unknowns in Bristol Bay's future as an economic, social, and ecological entity and viable commercial salmon fishery is the proposed Pebble Mine[12].

Figure 3: Pebble Mine
Image Credit: resourcefulearth.org

Pebble Mine, seen in Figure 3, is the name for a very large undeveloped copper, gold, and molybdenum deposit. While Pebble Mine is the largest proposed mineral extraction project in the Bristol Bay region, it is only one of many. It has an estimated economic value of $300-$500 billion in 2012 dollars over its projected lifetime, which could last between 20 and 100 years[12]. As currently designed, it would eliminate between 38km and 151km of stream habitat, would be the largest open pit mine in North America, and would require the construction of two earthworks dams, the largest of which would be some 200-meter-high and 7km-long earthworks dam to hold the mining effluent, which would have to be kept and monitored into perpetuity due to the persistent toxicity of its contents and the sheer volume of water and sediment contained behind the dam[12]. The location of the mine and dam would straddle the headwaters of both the Nushagak and Naknek/Kvichak watersheds, which together account for a little over 50% of Bristol Bay's salmon runs on any given year[32].

Pebble Mine was first explored as a mineral deposit in 1987 and has changed ownership multiple times since then. Its construction was first challenged as a threat to Bristol Bay's fisheries in the early 2000's by Native Alaskan and environmental groups due to its placement, estimated lifetime of operations (i.e., perpetual), and design, which was cited as particularly worrisome in an area with harsh freezing winters and high seismic activity. Intense discussion and opposition characterized the subsequent years. In July of 2014, the Pebble Mine issue took to the national stage when the Environmental Protection Agency (EPA) invoked Section 404(c) of the Clean Water Act to effectively prohibit the project. The issue remains undecided as of June 2015.

2.5: Policy Theory and Fishermen

Before discussing the public policy theory that guides this paper's research, it is worth establishing what is meant by public policy. Because it encompasses virtually anything the government chooses to do or not do, public policy is surprisingly hard to define. However, Birkland offers a slightly more targeted definition when he states that a policy "is a statement by government – at whatever level – of what it intends to do about a public problem.[36]" Whatever the government decides not to do, he continues, may be taken as implied public policy. Moving forward with this idea of what public policy is, we now have to understand how fishermen fit into public policy endeavors.

As set forth in "best practices" and sometimes statute, the public is often or always consulted when setting policy related to sustainable practices, such as invoking of the Clean Water Act to regulate environmental effects of industrial efforts. However, thanks to the previously mentioned historical precedent of overharvest[3,4], fishermen as a group are not often viewed in a positive light by policymakers when it comes to fostering sustainable fisheries. This relationship between positive-

negative perceptions and high-and-low power is the focus of the social construction theoretical framework (SCTF)[37], which guides the policy interpretations of this paper.

The SCTF tells us that "public policymakers typically socially construct different populations in positive and negative terms and distribute benefits and burdens so as to reflect and perpetuate these constructions.[37]" This means that groups are broken down into those with positive construction and high power, called "Advantaged" (examples: small businesses, upper middle-class citizens); positive construction and low power, called "Dependents" (examples: mothers, children); negative construction and high power, called "Contenders" (examples: "Big Oil," large banking institution CEOs); and negative construction and low power, called "Deviants" (examples: criminals, terrorists)[37]. These categories are not absolute, but rather represent different extremes of two intersecting sliding scales. These relationships are depicted in Figure 4.

	High Approval	Low Approval
High Power	*Advantaged* Small businesses Upper middle-class	*Contenders* "Big Oil" CEOs
Low Power	*Dependents* Mothers Children	*Deviants* Criminals Drug Addicts

Figure 4: Social Construction Theoretical Framework

In the U.S. context, fishermen have previously been viewed as closer to the negative side of social construction than the positive due to things like fisheries collapse and fish piracy[38]. This may be because their efforts are easily quantifiable; it is relatively easy to know which boat caught how many fish, but more difficult to know which rancher's cows fouled a stream. This influence on policy making and regulatory

power in the contiguous United States can be seen in the messy and often-lopsided interplay between silviculture, agriculture, energy generation, and fisheries[39].

This research is fundamentally focused on how Bristol Bay fishermen define sustainability, but this line of questioning also indirectly asks how important something like sustainability is to those fishermen. This would have a powerful impact on whether Bristol Bay fishermen should be accorded a more positive social construction and thus more social capital and power (as opposed to regulatory power). This has a bearing on the policy input process of other commercial fisheries because of the traits that Bristol Bay fishermen have as a group, which they may have in common with other groups of fishermen: owner-operator status, large numbers, small size of individual operations, and a recent history of opposition to ecological threats to their fishery. In such cases, perhaps participants of other commercial fisheries should be brought into their own policy conversations about creating a sustainable future for their fisheries.

With the world's continuing population growth and attendant increase in food requirements, marine fisheries seem like a tempting solution, requiring no input to receive an output, no husbandry to yield a bounty. That paradigm has brought the world's fisheries to the brink of collapse. We cannot afford to ignore what the people who are closest to fisheries have to say about their, and our, future.

3. Methods:

3.1: Research Questions

The three research questions of this study are:
1) How do Bristol Bay commercial salmon fishermen define a sustainable Bristol Bay salmon fishery?

2) What do Bristol Bay commercial salmon fishermen see as their role in making the ideal of a sustainable Bristol Bay salmon fishery a reality?
3) What do Bristol Bay commercial salmon fishermen actually do to make the ideal of a sustainable Bristol Bay salmon fishery a reality?

The first question seeks to answer how commercial salmon fishermen in Bristol Bay conceptualize a sustainable Bristol Bay fishery. Goals are defined by how both the challenge and the solution are framed, and so understanding Bristol Bay fishermen's definition of "sustainability" is very important; too many sustainability efforts have been unsuccessful due to various groups talking past one another. The second question is directed at what Bristol Bay fishermen believe their role to be in making the ideal of a sustainable Bristol Bay fishery a reality. This question attempts to access their optimum collection of actions towards meeting the goal of a sustainable Bristol Bay salmon fishery. The third question is concerned with what they actually do to forward that goal. The second and third questions attempt to triangulate the best possible and the best practicable actions that fishermen can take to work towards a sustainable Bristol Bay salmon fishery. This triangulation is necessary because there is often a mismatch between what people believe "ought" to be done about a problem, and what actions they actually take to solve a problem.

3.2: Research Participant Identification/Engagement

Interviewees were initially selected by asking members of a particular group of fishermen who fish cooperatively with one another (known as a "radio group") whether they were interested in being interviewed for the project. Radio groups are a common practice in Bristol Bay, as they raise the level of safety and fishing effectiveness of everyone involved. This particular radio group was selected as one that was known in the Bristol Bay fishing community as a "high-production" radio group and was also known to have several members that had been personally

involved in regular Board of Fisheries meetings. Thus, this was a purposive sample[40]. A snowball method was then used to select additional fishermen to interview until informational saturation was reached[40,41]. Of 20 fishermen approached for an interview, 12 agreed and were available for interview, for an interview rate of 60%.

3.3: Research Participant Characterization

Total interview subjects	12
Minimum Age	28
Maximum Age	63
Median Age	51
Median Years as a skipper	22
Median Years in Bristol Bay fishery	26
Median years in any fishery	28
Ethnicity (Caucasian)	All
Bristol Bay residents	1
Alaska (non-Bristol Bay) residents	3
Non-Alaska residents	8

Figure 5: Interview Subject Demographics

It must be noted that the demographics of the case study group, shown in Figure 5, are not entirely representative of the Bristol Bay resident population or fishing community. This point will be discussed at the end of the methods section. Demographic information about the former fishery manager interviewee is withheld for confidentiality. Though some of the interview subjects were female, all subjects

will be referred to as “fishermen,” an occupational title that research and experience has shown to be the preferred title among fish harvesters regardless of gender[42,43].

3.4: Data Collection

Semi-structured qualitative interviews of Bristol Bay salmon fishing boat captains were identified as the best method for gathering in-depth data about the beliefs and actions of Bristol Bay salmon fishing boat captains[40,41]. Interviews were conducted by phone immediately after the 2014 fishing season ended. Interviews lasted between 30 and 180 minutes. All interviews used an identical interview protocol, with situation-appropriate follow-up and probe questions. All interviewees were fully informed of the nature of the study and guaranteed confidentiality.

In order to get a broader picture of fisherman definition and involvement in Bristol Bay, as well as fact-check[40,41] statements made by fishermen about their attendance at Alaska Board of Fisheries meetings, the study also draws on secondary data in the form of public record of Alaska Board of Fisheries meetings related to salmon fishing in Bristol Bay between 2003 and 2014, and also draws on an interview with a former ADF&G Bristol Bay salmon fishery district manager. The syntax of the interview protocol was modified where necessary for the former district manager interview in order to be context-relevant[40].

The secondary data of the public record of Alaska Board of Fisheries meetings was pulled from the Alaska Board of Fisheries website. Meetings were selected for analysis if they contained the phrase “Bristol Bay finfish” in their subject lines. This yielded a total of five meeting records. Because the Alaska Board of Fisheries only meets every three years to discuss Bristol Bay finfish, this accounted for all of the meetings about the Bristol Bay salmon fishery between 2003 and 2014.

3.5: Data Analysis Methods

Because this research sought to understand a single case (the Bristol Bay salmon fishery) more fully and without preconceived notions, the research effort was designed as a case study using qualitative interviews, and so a theoretical approach that emphasized inductive processes was required[40,41]. This approach suggested use of the Grounded Theory Method, a social science method whereby theories are generated from an examination of data rather than derived deductively[41].

Interviews were transcribed and then coded, using first an open coding methodology to identify initial key concepts and then re-coded using an axial (or "pattern") coding technique to identify the recurring ideas in the study[40,41]. Overarching themes were then developed from these recurring ideas by looking for consistent threads of logic between the recurring ideas[40,41].

3.6: Limitations

In order to have a more productive discussion about the implications of this study's findings, it is necessary to examine the limitations of the research. The main limitations of the research are: 1) no Native Alaskan fishermen were interviewed and thus were underrepresented in the analysis; 2) only one Bristol Bay resident fisherman was interviewed, and thus resident fishermen were also underrepresented in the analysis; 3) the study draws on a small number of in-depth interviews, which represent less than 1% of the total number of permit holders and were also mostly known to one another in a cooperative fishing arrangement; and 4) only one former fishery manager was interviewed. The first and second issues are intimately tied together, as are the third and fourth.

With regard to the first and second points of limitation, this particular study was constrained in several ways: 1) this study was performed as part of the researcher's Masters degree, and so resources and time were quite limited; 2) the Institutional Review Board (IRB) review process required of all academic research can become especially protracted when certain groups like Native Americans are targeted as a population of particular research interest. Due to the heavy constraints placed on the researcher's time and resources, it was decided that Native Americans would have to be excluded from the study with the understanding that this was not the ideal research design. Native Alaskan Bristol Bay resident fishermen make up an important ideological and economic population segment of Bristol Bay fishermen. Bristol Bay resident fishermen and particularly Native Alaskan Bristol Bay resident fishermen make up approximately 20% of the Bristol Bay fishing fleet[34], and must be targeted for future Bristol Bay fisheries studies. This is particularly important in the face of the precipitous decline in Bristol Bay resident permit holder numbers without a concurrent drop in Bristol Bay resident population numbers[34], and also in light of the influence of Pebble Mine on the interviewed fishermen's perceptions of sustainability. As interview subject "Bravo" put it:

> "*It wasn't the state who decided that Pebble was a bad idea; it was tribes and commercial fishermen who said it was a bad idea and they're the ones keeping bad decisions like that from happening. But that kind of thing won't happen if you don't have local people in the fishery. Without that you'll end up with a locally-owned mine that completely destroys a fishery owned solely by outside interests, and nobody will care."*

On the third and fourth points of limitation, this study relied on a modified snowball method to find research subjects, and so recruitment was fairly low. The researcher acknowledges that broad recruitment may have been better directed through established Bristol Bay fisherman communication channels and entities such as the Bristol Bay Regional Seafood Development Association (BBRSDA), the Bristol Bay Native Corporation (BBNC), and standing fishery managers. As interview subject "Bravo" points out in the above quote, local and native fishermen and other grassroots organizations were the spearhead of the resistance to Pebble Mine and

are a powerful voting bloc in BOF meetings, and would offer valuable insight into how all population segments of Bristol Bay fishermen define and work towards a sustainable fishery. Because most of the interview subjects were from the same radio group, it is also likely that they are ideologically aligned and would give similar answers, thus giving the impression of agreement between fishermen that may not be reflected in the fleet at large.

With regard to the dearth of manager interviews, it is worth noting that while standing fishery managers would represent a highly valuable information source, it is doubtful they would be able to speak as freely as retired or former fishery managers, even under the condition of anonymity. Therefore, while only one former fishery manger was interviewed, the subject's comments were still valuable.

In defense of the research, the small sample sizes (low N's) of this study are not a serious drawback. In the realm of in-depth qualitative case studies, a small sample size is consistent with accepted research design and field theory[41]. In such cases, the accepted justification is that while large-N (200+ subject) studies provide greater surface validity, they are far from practicable when conducting qualitative interviews with only one researcher, and so smaller-N studies are acceptable[41].

In sum, while there were limitations in this study, the research is still well within the bounds of case study methodology[40,41] and thus its findings and recommendations retain validity and can serve as not only a launching point for further research but also as a point of policy discussion.

4. Results:

Results are reported as 1) recurring ideas which came up repeatedly both within individual interviews and across interview subjects, and 2) groups of recurring

ideas with common threads of logic, referred to as "themes." Exemplary supporting quotes from individual interviews will also be used to illuminate recurring ideas and themes[44]. At the end of this section are four summary tables (Figs. 6-9) of recurring ideas and themes.

4.1: Research Question 1: How do Bristol Bay commercial salmon fishermen define a sustainable Bristol Bay salmon fishery?

The fishermen who participated in this study shared their conceptualization of the word "sustainable" in terms of the salmon resource adhered closely to the common sense definition of ensuring that current fishing efforts did not undercut future potential[17]. All fishermen spoke passionately about ensuring the viability of the Bristol Bay fishery for future generations, an idea that was labeled "future generations." Five interviewed fishermen (41.6%) stated that what makes their salmon fishery sustainable is a commitment to putting ecological requirements ahead of socio-economic wants or needs. This recurring idea was labeled "ecology before economy." These recurring ideas were grouped together as the theme of "fish before fishermen." Interview subject "Tango" exemplified the connection between these these ideas by stating:

> *"If you fish the stocks down to where you're not getting enough up the river, that's wrong on a lot of levels: economically, spiritually, environmentally. We've got a good thing going. The fish come first. The fishermen come second in line."*

All interviewed fishermen (100%) assigned intense personal importance to having a sustainable fishery. Three fishermen (25%) also gave the opinion that the individual fishery managers were entirely and solely responsible for the biological sustainability of the salmon fishery, a recurring idea labeled "managerial responsibility." Interviewee "Xray" encapsulated this recurring idea when he said:

> *"Fishermen are essentially a tool of the biologists. We're the throttle on the engine."*

Five interviewees (41.6%) asserted that it was Bristol Bay's vast expanses of virtually pristine habitat that were the most important factor in making Bristol Bay's commercial salmon fishery sustainable. This recurring idea was labeled as "pristine habitat." Four fishermen (33.3%) stated (without being specifically asked) that they lacked general knowledge about what made the fishery biologically or ecologically sustainable. This recurring idea was labeled "lack of biological knowledge." This recurring idea was not mutually exclusive with the recurring ideas of "managerial responsibility" and "pristine habitat." These ideas were grouped together into the theme of "biological sustainability not fishermen's purview."

Eleven of the interviewed fishermen (91.6%) generally approved of the efforts of the Bristol Bay fishery managers to make the commercial harvest biologically sustainable. This recurring idea was labeled as "managerial approval." Four fishermen (33.3%) expressed concerns over the recent behavior of some Bristol Bay district managers that the fishermen interpreted as putting the biology of the salmon run *behind* other priorities – three of whom *also* said that they generally approved of the efforts of Bristol Bay fishery managers. Thus, only one fisherman (8.3%) did not approve at all of the efforts of Bristol Bay fishery managers, stating (summarized here by the researcher) that their efforts ran counter to the sustainability practice of putting ecological requirements ahead of socio-economic wants or needs. The four fishermen who were highly critical of this alleged behavior said that they had begun to lose or had lost their faith in the scientific impartiality of specific district managers. This recurring idea was labeled "managerial misgivings." While eleven fishermen (91.6%) generally approved of fishery manager efforts, they also revealed a general lack of understanding of the powers given to, and constraints placed upon, fishery managers, particularly with regard to managers' legal obligation to avoid acting as state policy advocates. This recurring idea was labeled "misunderstand management."

All twelve interviewed fishermen stated that they generally lacked in-depth knowledge of the fish biology and population dynamics that went into managers' decisions. This recurring idea was labeled "lack of biological knowledge." Six interviewed fishermen (50%) stated a desire for more and better biological data opportunities for both managers and fishermen – an effort that they were willing to help fund. This recurring idea was labeled "fund better data."

The recurring ideas of "managerial approval," "managerial misgivings," "misunderstand management," "lack of biological knowledge," and "fund better data" were grouped into one overarching theme: "informational gap."

4.2: Research Question 2: What do Bristol Bay commercial salmon fishermen see as their role in making the ideal of a sustainable Bristol Bay salmon fishery a reality?

All interviewed fishermen emphasized the need for increased attention to product quality among their fellow fishermen. They were particularly concerned with moving the fishery towards a more lucrative individual fillet market rather than a volume-focused canned market. This recurring idea was labeled "quality first." They also expressed a strong belief that the way forward for the fishery was to have a healthy domestic high-end market rather than an international low-value (canned) market for their catch. This recurring idea was labeled "domestic market." These recurring ideas of were grouped into a single theme: "Market-based advancement."

While market-based advancement was the standout theme for fishermen's idealized role, it was not the only recurring idea/theme. The unanimous opinion from both fishermen and the former Bristol Bay fishery manager was that the role fishermen were best suited to playing involved being well informed, politically vocal, and

layman advocates for their *specific* salmon fishery. These recurring ideas were labeled as "know and speak." Five interviewed fishermen (41.6%) stated that attending BOF meetings and giving formal testimony about their fishery was an important action for fishermen to take. This recurring idea was labeled as "testimony." Five interviewed fishermen (41.6%) also expressed a sense of responsibility towards the fishery that went beyond financial security and into more intangible values like cultural or aesthetic importance. This recurring idea was termed "beyond income." The recurring idea of "beyond income" was strongly linked to the recurring ideas of "know and speak" and "testimony," and so these recurring ideas were grouped into the theme of "stewardship." Interview Subject "Echo" summarized and linked the themes of "stewardship" and "market-based advancement" when he said:

> *"If we don't protect our ocean, we don't have quality product to bring back. I think it's all linked together."*

4.3: Research Question 3: What do Bristol Bay commercial salmon fishermen actually do to make the ideal of a sustainable Bristol Bay salmon fishery a reality?

While Research Question 2 addressed the qualities and strategies that interviewed fishermen expressed as being ideal, Research Question 3 addressed the practicable, real actions taken by interviewees – and the discrepancies between them. While all twelve interviewed fishermen expressed the need for being a lay advocate to other laypeople, eight (66.6%) expressed making a conscious effort to do so on their own time. This was the most common policy outreach/influence method expressed by interviewees. Six fishermen (50%) said that they had sent postcards to policy makers. Bristol Bay advocacy and development institutions, such as the Bristol Bay Regional Seafood Development Association (BBRSDA), provided these postcards. Three fishermen (25%) stated that they contributed funds to political campaigns or

candidates that had made either explicit promises to protect Bristol Bay or had voting records that suggested they would. These actions were grouped together as a recurring idea and labeled “informal advocacy.”

One interviewee (8.3%) had lobbied directly in Washington, D.C. on behalf of the fishery, and was a significant outlier who may have had a great deal of policy influence for Bristol Bay fisheries as a whole. On a somewhat more expected note, four of the interviewed fishermen (33.3%) had been to BOF meetings in Alaska in the last ten years; two of them (16.6%) were out of state residents, one (8.3%) was an in-state resident, and one (8.3%) was a Bristol Bay resident. These assertions of attendance and public comments by both in-state and out-of-state fishermen were completely verified via BOF meeting records. Three (25%) out-of-state resident fishermen who had not attended BOF meetings said that they had not been to BOF meetings because of the expense involved in traveling for the meetings, and also because of their inability to take time away from employment or family obligations. It is worth noting that while only two (16.6%) out of state fishermen had been to a BOF meeting in the last ten years, these two fishermen were part of the initially contacted radio group. This radio group had pooled their money on several occasions to send those two particular group members to the BOF meetings with the understanding that they would represent the greater interests of the radio group. One interviewee in particular had attended BOF meetings regularly for more than twenty years. These actions were grouped together as a recurring idea and labeled as “formal advocacy.”

The advocacy actions of the interview subjects – when performed – can be summarized as a blend of sustained, concentrated efforts from a few individuals, supported by the finances of a larger group and combined with an informal outreach effort from every fisherman. The recurring ideas of formal and informal advocacy were grouped into the theme of “advocacy.”

Together, these findings gave data for answering the research questions planned from the beginning of the study. Besides the expected answers and topics, however, there was a persistent, thematic influence on the interviewees' conceptualization of their fishery as a socially, economically, and ecologically sustainable entity: Pebble Mine.

4.4: Pebble Mine

"Big things like Pebble Mine can change everything in a hurry. What happened with that mining dam in the Fraser River can hopefully give us something to point at and close this Pebble Mine thing for good and protect the Bristol Bay watershed. In my mind the two cannot coexist in any way, shape, or form."
-Interview Subject "Delta"

"I have to be an advocate for [Bristol Bay] and fight things like Pebble Mine. I have to make my voice heard to management when I can. And year-round I get to talk to people about what I do and then they want to know more about it. They like the fish and want it available in years to come. That's big. The more people know about it, the more people vote. And hopefully the more people want Bristol Bay sockeye, the more it'll help my price and bottom line."
-Interview Subject "Lima"

With each interview, it became increasingly apparent that the proposed Pebble Mine had made an enormous impression on how Bristol Bay fishermen saw not only their personal long-term viability, but also on their conceptualization of "sustainability" and the role all Bristol Bay fishermen had to play in making that concept a reality for their fishery. Ten interviewees (83.3%) and the retired fishery manager mentioned it while defining sustainability or their role in the future of Bristol Bay, and ten interviewed fishermen (83.3%) brought it up as a general subject without greater prompting than a standard "Is there anything else you would like to talk about?" probe at the end of their interview. The retired fishery manager discussed it in detail without any prompting.

The ten fishermen (83.3%) who brought up the subject of Pebble Mine repeatedly and independently articulated thougts to the effect that Pebble Mine had 1) made them realize that Bristol Bay was not a timeless place unaffected by the outside world ("not isolated"), 2) awakened them to the notion that they had an "obligation" to become politically involved in order to "save" their fishery ("No Pebble Mine"), 3) shown them that they could be politically successful and advance their own policy goals against powerful opponents ("policy power"), and 4) given them something they could agree on with virtually any other Bristol Bay skipper ("solidarity"). These recurring ideas were brought together and labeled as the theme "Pebble Mine Effect." As interview subject "Zulu" put it:

> *"Pebble Mine really scared the hell out of everybody [. . .] Saw a lot more people at the [BOF] meetings."*

4.5: Summary Tables of Recurring Ideas and Themes:

Research Question 1: Sustainability			
Themes	Fish Before Fishermen	Biological Sustainability Not Fishermen's Purview	Informational Gap
Recurring Ideas	Future Generations Ecology Before Economy	Managerial Responsibility Pristine Habitat Lack of Biological Knowledge	Managerial Approval Managerial Misgivings Misunderstand Management Fund Better Data

Figure 6: Summary Table, RQ1

Research Question 2: Fishermen's Role		
Themes	Market-based Advancement	Stewardship
Recurring Ideas	Quality First Domestic Market	Know and Speak Testimony Beyond Income

Figure 7: Summary Table, RQ2

Research Question 3: Fishermen's Actions	
Themes	Advocacy
Recurring Ideas	Informal Advocacy Formal Advocacy

Figure 8: Summary Table, RQ3

Pebble Mine	
Themes	Pebble Mine Effect
Recurring Ideas	Not Isolated No Pebble Mine Policy Power Solidarity

Figure 9: Summary Table, Pebble Mine

5. Discussion:

In the course of this study, it became clear that it would not be possible to offer a concise description of the interviewed fishermen's concept of a sustainable Bristol Bay salmon fishery. The phrase and concept of "sustainability" had great depth of personal meaning for the interviewees, a sentiment that may be surprising to some.

Due in part to the long history of overharvested fisheries, fishermen are usually not associated with the values of the New Ecological Paradigm (NEP)[45]. There are many reasons that overharvest can occur, ranging from poor population modeling techniques and stochastic events[46] to fish piracy, but it is harvesters that are the most visible culprits of overharvest or destructive harvest. On an individual level, overharvest, destructive harvest, and fish piracy derive from the notion that nonhuman species are there for human use and (often economic[45]) benefit, and that there is little or nothing wrong with taking more than is allowed; that humans are exempt from the laws of nature and the ill effects of their own behavior. In other words, overharvest and its ilk are rooted in the darker aspects of the Human Exemptionalist Paradigm (HEP). Fishermen, then, are guilty by association of this practice, and so are seen as being fundamentally in opposition to the values of the increasingly popular New Ecological Paradigm (NEP)[47,48].

As the NEP becomes an ever-more-popular worldview, the perception of fishermen as being HEP-oriented shifts them further away from social approval and thus policy power, placing them further away from "Advantaged" status in the Social Construction Theoretical Framework (SCTF). However, this perception may not be accurate for all fishermen, and certainly was not accurate for the fishermen interviewed in this study. The fishermen interviewed in this study spoke about their fishery in an intergenerational context, and explicitly talked about how the concerns of ecology and fish biology took precedence over economic considerations ("fish before fishermen"), a rather NEP-like sentiment. This suggests that the interviewed fishermen were more closely aligned with the goals and values of NEP-approved groups than they are believed to be, and thus should have a more positive social construction in the eyes of NEP-aligned groups.

While the interviewed fishermen's concept and valuation of sustainability in their fishery was based on the biology of the overall Bristol Bay salmon run, they did not have more than cursory knowledge of the science behind it ("lack of biological

knowledge"), did not claim responsibility for it ("managerial responsibility"), and saw that as an appropriate arrangement ("biological sustainability not fishermen's purview"). What was not expected was the lack of knowledge about managerial roles on the part of the interviewed fishermen ("informational gap"), particularly when it came to recognizing the restrictions placed on state fishery managers and employees with regard to policy advocacy ("misunderstand management"). This could be a serious issue because the working relationship between Bristol Bay district fishery managers and Bristol Bay salmon fishermen – an important part of the fishery's management and continued sustainability, according to the interviewed retired district fishery manager – is supported by the free flow of accurate and timely information between the two groups and the trust that this fosters. If one or both groups misrepresents or misunderstands information about either the fishery or their respective roles, as the theme of "informational gap" seems to show, this sows needless mistrust and impedes informational flow, which in turn could negatively affect the sustainability of the fishery.

Taken together, the themes of "biological sustainability not fishermen's purview" and "informational gap" show that while the interviewed fishermen may have understood what *is* district managers' responsibility, they did not necessarily understand what *isn't* their responsibility or how district managers come to the decisions that they do. In terms of SCTF, this misunderstanding about "roles" is fundamentally a misunderstanding about power. Because the interviewed fishermen's comments suggested that they accorded district area managers Advantaged status ("managerial approval"), interviewed fishermen perceived district managers as having broad *advocacy* or *policy-making* power, rather than the high *administrative* power that they truly possess. This means that interviewed fishermen did not have a complete understanding of the policy advocacy gap and who could and could not fill it. In this case, if the interviewed fishermen want to effect policy change in favor of a sustainable Bristol Bay commercial salmon fishery,

they must realize that they have to fill that policy power gap themselves. The interesting thing is that they already had idea of how to go about it.

Interviewed fishermen did not view biological sustainability as being within their scope of contributing to the long-term viability of the fishery. Instead, they felt that their role was to handle the economic and social sustainability of their specific fishery; economic via "market-based advancement" and social via "stewardship." The interviewed fishermen agreed that the economic sustainability of their fishery relied on focusing efforts towards capturing more of the high-end, high-quality domestic market. Research shows that the NEP is swiftly becoming the dominant social paradigm, particularly among the white-tablecloth/upper-end domestic market[47,48] that the interviewed fishermen expressed a desire for. As interview subject "India" said:

> *"I sell to about twenty, thirty co-ops. I also have private customers around here. Most of my customers are probably more aware than I am about sustainability. I get asked really tough questions [. . .] they ask me questions and I think 'I'd better do some more research about that.' [. . .] Honestly, they're a source of education for me."*

For the interviewed fishermen, advancing the social sustainability of the fishery ("advocacy") relies on not only convincing influential policy-makers of the importance and viability of their specific fishery ("formal advocacy"), but also of convincing the greater national population of the importance and viability of their specific fishery ("informal advocacy"). This effort to convince others hinges on having a positive social construction in the eyes of the greater society, which in turn is dependent on biologically sustainable management and harvest practices.

While the Alaska State Constitution requires natural resources to be managed on a sustained yield basis, such efforts are largely founded on single-species management and population dynamics. On the other end of the management spectrum and rising in tandem with the NEP is Ecosystem-Based Management (EBM), a management paradigm that looks at all interactions within an ecosystem,

including humans. EBM looks at and manages the "bigger picture," rather than reducing complete systems to their components and managing them in isolation. An example of EBM is managing the combined agricultural, conservation, and fishery efforts of an entire watershed, from the headwaters of a river's tributary streams out to miles offshore. If Bristol Bay fishermen want to access a more positive social construction and the attendant policy benefits, it might behoove them to consider aligning themselves with the values and ideas of both the NEP and EBM. While EBM is not explicitly practiced by the State of Alaska, it is beyond the scope of this research to say whether and how its tenets are being used or considered by state resource managers. However, it should be noted that ecosystem-based management of the marine environment was officially endorsed by the U.S. Commission on Ocean Policy[49] in 2004, and by the Interagency Ocean Task Force in 2010[50]. These reports suggested the need for strong federal and state coordination and control of all aspects of the marine environment. In the case of the proposed Pebble Mine, strong federal intervention is already in play, and seems to be present for both ecological and social reasons.

Pebble Mine was clearly a theme, but teasing apart *why* became its own challenge. When Pebble Mine began making serious headway towards approval and construction, fishermen and local resident activists responded to it with strong opposition. This in turn placed them on high alert to other potential challenges for their fishery. Three interviewed fishermen (25%) credited Pebble Mine for their recent penchant for reading fisheries magazines, scientific articles, and popular science books; a habit that alerted them to broader influences at play, such as the threat of ocean acidification. This pattern of political engagement and self-education resulting from an external stimulus or threat is a common one in the history of environmental and broad political activism[51], and so it should be no real surprise that the mine proposal elicited this sort of reaction from area residents and fishermen once they perceived it to be an external threat.

Each of the ten fishermen (83.3%) who brought up Pebble Mine stressed the importance of not only their personal efforts in opposing Pebble Mine, but also the need for all Bristol Bay fishermen to actively oppose it. When pressed on the point about their rationale for this need, answers differed but centered on the point that because their livelihood was made from the fishery, it was their responsibility to "protect" it. It was usually at this point that the interviewed fishermen showed their lack of understanding about the role that managers were able to play in this role of "protector." Four interviewed fishermen (33.3%) were confused as to why standing fishery managers were not speaking out against Pebble Mine when they (the fishermen) felt that the evidence for its destructive potential was overwhelming. These sentiments echoed and reinforced the theme of "informational gap" and highlight the confusion the interviewed fishermen had regarding the Advantaged status of district fishery managers. This seemed to trouble the interviewed fishermen in the light of their views on Pebble Mine and its developers, which they described using terms like "powerful," "disaster," and "horrible," along with colorful negative descriptors.

This combination of policy power and social disapproval would place Pebble Mine into the Contender category according to SCTF. This places Pebble Mine in opposition to Advantaged groups (such as fishery managers), and so the managers' silence on the matter was particularly confusing for the interviewed fishermen. As a result of this miscommunication, the perception of Bristol Bay salmon fishery managers by the interviewed fishermen may be shifting towards a more negative, less powerful position.

The actions of EPA in the matter of Pebble Mine were simultaneously welcome and somewhat surprising for the interviewed fishermen. Welcome in that it was what they wanted, and surprising in that they did not expect to get what they wanted. Pebble Mine has by no means gone away and is not the only proposed resource extraction development in the greater Bristol Bay area. However, seven of the

interviewed fishermen (58.3% of the total, 70% of those who had brought up Pebble Mine) made points to the effect that the 2013 EPA report and 2014 EPA decision gave Bristol Bay fishermen a general sense that their efforts could have real-world effects on policy via media focus, public opinion, and the garnering of political support and administrative attention. This, they said, made them wonder what further (policy) gains they could get as a group. The final point, political cohesion, was novel for the interviewees. All twelve interviewed fishermen (100%) and the former fishery manager described the Bristol Bay fishing experience as one of aggressive individualism and anarchistic attitudes. Thus, having a touchstone on which virtually every fisherman or resident could agree (i.e., "No Pebble Mine," as their ubiquitous bumper stickers say) was both highly unusual and firmly unifying for interviewed fishermen. The idea of cohesion with other fishermen made them aware of the fact that they shared positive qualities with their peers, a trait that shifts them closer to both the positive social perception and high political power ends of the social construction theory framework.

There is some precedence for this sort of unified action. One example is the funding and development of the Port Moller Test Fishery by Bristol Bay commercial fishermen. The PMTF is a test fishery located several day's travel (at fish speed) south of Bristol Bay, and provides genetic data to Bristol Bay area fishery managers, who then provide it to Bristol Bay fishermen. This genetic data helps biologists forecast the development of the salmon run, and helps fishermen make decisions on which district to fish in. The six fishermen (50%) who expressed a desire for more and better fisheries data in addition to the PMTF also indicated a willingness to help pay for it. This willingness to pool resources and act in unison opens up avenues for policy and management recommendations to fishermen, managers, and policy makers.

6. Conclusion:

"Bristol Bay is a gift to all of us. You really are a small voice, but nonetheless a voice in where this fishery is gonna go in the next twenty, fifty, one hundred years. And you can help guide it. You need to take care of it. You need to nurture it. Whatever you do, don't take it for granted. Don't turn your back on it. And don't just take and give nothing back. That goes along with the general lesson in life: try and give back as much if not more than you receive."

-Interview Subject "Zulu"

Several targeted recommendations can be made in light of the results of this study and a review of the literature. These recommendations fall into two categories: research and policy. The first three recommendations focus on future research, and the final recommendation is concerned with policy action.

6.1: Research Recommendations

1) Interview Native Alaskan Bristol Bay resident fishermen and non-Native Alaskan Bristol Bay resident fishermen.

This recommendation is the top priority for all subsequent research on Bristol Bay fishermen and the Bristol Bay salmon fishery. Without the insight of both Native and non-Native Bristol Bay resident fishermen, the findings of this research are incomplete. This course of action will be very difficult without the help of local fishermen, Native Alaskan leaders, and local research assistance. Local research assistance is particularly necessary due to the physical and logistical challenges of the region and the moral imperative of a research design that respects deep knowledge[2].

2) Tag and track out-migrating salmon with GPS-capable equipment in order to learn more about their habits while developing at sea. Make efforts to attract and support research institutions in this effort.

This recommendation follows from ecosystem-based management and its emphases on place and scope. Six interviewed fishermen (50%) as well as the former area manager expressed the recurring idea of "desire for better data." Much of this need was focused on salmon life cycles and the effects of broad influences like ocean acidification and at-sea harvesting that does not target salmon, but does get them as bycatch. Relatively little is known about the habits of salmon while at sea, other than that they develop and grow before coming back to their natal river system. With increased knowledge of at-sea behavior and location, managers, scientists, and fishermen will better understand the relevant regulatory, economic, and social groups that must be brought into the conversation and funding sources for EBM-style husbandry of the regional ecology, its species, and its communities.

The interviewed fishermen and the manager who brought up the desire for better data were quick to relate their expressed need with the necessity for greater funding, but they were not entirely sure how to go about attaining it. With state funding for basic research either stretched thin or nonexistent, this seems like an unlikely sector to approach for funding. One method for doing exploratory research is through research institutions and the human and economic resources they can muster. Additionally, research institutions are well known for their innovative approaches to difficult challenges. The prime example of such a marriage of talent and resources in Bristol Bay research is the Fisheries Research Institute of Seattle, Washington (FRI). It was FRI who first devised and tested the usage of counting towers as a viable means of tracking salmon escapement in Bristol Bay. Such institutions should be courted to do at-sea salmon research in Bristol Bay and the Bering Sea.

3) Fishermen should aggressively pursue options for better funding for ADF&G research in the form of research grants, state tax legislation, or BOF proposals that would result in self-taxation of Bristol Bay fishermen.

While the knee-jerk idea may be to self-tax as was the case for the Port Moller Test Fishery, there are possibilities for other funding sources that should be explored. Additionally, research funding should be at least partially directed at species besides the economically dominant sockeye salmon, particularly at Bristol Bay's various habitats and the recently embattled Chinook or "king" salmon, *Oncorhynchus tshawytscha*. Biological diversity is an important aspect of population resiliency and ecological sustainability.

6.2: Policy Action Recommendations:

1) The BBRSDA, BBNC, ADF&G, and BOF must coordinate before the next fishing season on how to educate *all* fishermen and district managers about their respective powers, responsibilities, and limitations when it comes to policy advocacy. Clear language must be laid down that establishes lines of communication and the roles of all parties and all organizational levels, and those results must be communicated to stakeholder groups.

This recommendation is important to accomplish immediately because of the potential damage to fisherman-manager relations that could otherwise occur. Where there is misunderstanding and miscommunication, distrust and confusion are sown. Finally, it is in the interest of a democractic society that fishermen and managers have the opportunity to understand their rights, responsibilities, and the "rules of the game," no matter what set of policies they choose to advocate for or against. Their democratic and passionate involvement in Bristol Bay's future become ever more important as the stakes in wild fisheries climb ever higher.

6.3: The Bigger Picture

Global human population and lifestyle expectations continue to rise, and with them rises total resource use. In climate terms, this results in more emissions. In terms of nutrition, it means that there are more mouths to feed that increasingly desire foods that come from higher in the trophic chain, with a far higher rate of animal protein consumption – a trend that is both alarming and beyond the scope of this paper. What is certain is that a great deal of that animal protein will be coming from wild fisheries[1]; the very fisheries that are essentially in ecological free-fall.

So what is to be done about the matter? One option is to ignore the needs of future generations for the desires of our own. Another option is to let the despair consume us and trudge along with doom in our hearts, waiting for our turn on the chopping block. Of course, there is a third path. It's hard. It's rocky. It takes not only work, but also teamwork. It means that nobody can sit on the sidelines anymore and be content with simply "making a buck" or conducting business as usual, from processor to manager to fisherman. Sustainability must be more than a buzzword; it must be agreed upon as *the* yardstick by which we measure success in fisheries management.

In commercial wild fisheries, this "third option" means bringing fishermen into the conversation about the sustainability of not only their economic well-being[35], but also the ecological foundation on which it is built. Occupational outsiders often view fishermen as greedy, knuckle-dragging, indiscriminate reavers of nature. And admittedly, there are a few of those in both the historical record and recent memory. But, by asking one group of fishermen how they define and work towards sustainability, we have gained insight into their desire for a bright future and their willingness to limit their present usage for the sake of that future. By asking that same group what role fishermen have to play in that future, we have seen that while they know and believe in several avenues towards gaining policy support, they are

unaware of just how much of their fishery's future depends on their own collective action. By asking them what they actually do to effect desirable policy and outcomes, we have seen that they become involved when they perceive a present or future threat to their harvest and their grandchildren's harvest.

All of this tells us that Bristol Bay fishermen have the will and capacity to move and act in the policy arena – but perhaps they do not realize that this is their responsibility. Perhaps they do not realize that they are neither Dependents nor Deviants. At the moment, they are somewhere in the middle of the four extremes, with the ability to move up into the realms of high policy power or sink lower. It's up to them to decide if they want to be Contenders, with low public approval but high policy power, or Advantaged, with high public approval and high power. Some of their future depends on how they portray themselves and whom they align themselves with or against. However, it is my opinion that much of that outcome depends not on how they portray themselves, but how they think of their roles, themselves, and one another. They are, in their own words, stewards of our fish, our oceans, and our collective futures. Their voices must be both lifted and listened to; today, tomorrow, and every day after that.

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APPENDIX

Appendix A: Interview Instrument

Opening Questions
1) Can you please state your name and age?
2) How did you get started fishing in Bristol Bay, and how did you become a skipper?

Sustainable Salmon Run
1) Since you began fishing in Bristol Bay, you've probably noticed that the word "sustainable" has being thrown around a lot. How would you describe a "sustainable" salmon fishery?
    *Probe: Talk to me about the importance of a sustainable salmon fishery for you.
    *Probe: Do you see a course towards a more sustainable salmon fishery?
    *Probe: Can you describe it to me?

Bristol Bay Salmon Decision-Making
1) Let's say that tomorrow you woke up and you were the new Bristol Bay Area Manager for the fishery. What would your priorities be, and why are those your priorities?
    *Probe: How would you improve management?
    *Probe: What do you feel is the proper role of management?
2) What do you feel is the proper role of fishermen when it comes to the future of the fishery and ensuring its sustainability?
3) Describe your personal role in ensuring the future of Bristol Bay.
4) Let's say that someone you know becomes a new skipper. You'd probably give them all kinds of advice. What would you tell them about being engaged in shaping how Bristol Bay works?

Closing Questions
1) What was Bristol Bay like in the past?
2) What do you think Bristol Bay *will* be like in the future?
3) What do you think Bristol Bay *should* be like in the future?
4) Is there anything else you'd like to talk about?
5) Do you have any questions for me?