Factors Influencing Support for Salmon Recovery Policies in Oregon

By

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AN ABSTRACT OF THE THESIS OF

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This study uses multiple regression analysis of a survey of Oregon residents to determine what factors influence an individual's support for salmon recovery policies in Oregon. Salmon today face a variety of threats, most notably from the 'four H's' (habitat degradation, hydroelectric dams, harvest practices, and hatcheries). Using the social construction theory of public policy, this paper explains how salmon benefit from current recovery policies, and examines how the perceived risk of a threat to salmon recovery effects support for policies to address the threat. Salmon in the Pacific Northwest are positively viewed by society, and as a result of numerous interest groups dedicated to their preservation, enjoy a tremendous amount of political power. The study concludes that how an individual perceives risk has an important, and statistically significant, effect on the level of support for salmon recovery policies. Other important factors include level of education, and ideology.

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Introduction

It is hard to be ignorant of the presence of salmon in the Pacific Northwest. From the supermarket seafood cases, to commercial and recreational fishing boats off the coast, to license plates advertising support for salmon habitat recovery, the sleek silver fish are very visible. Where once upon a time salmon faced threats from other predators and the fishing nets of Native Americans, they face a whole different set of challenges in the 21st century.

Today, salmon face threats from the 'four H's': habitat degradation, hydroelectric dams, harvest practices, and hatcheries (Ruckelshaus, et al. 2002; Northwest Power Planning Council, 1992). There has been little research as to how these threats are regarded by the general public. This paper will use multi-variate regression analysis of a survey of Oregon residents distributed by researchers at Oregon State University to determine what factors influence an individual's level of support for policy actions to address these threats to salmon recovery in Oregon, with a specific focus on the effect of how individuals assess the risk of these threats.

Literature Review

Today's salmon face a diverse variety of threats including hydroelectric dams on most major rivers in the Pacific Northwest, destruction of crucial spawning habitat, and the emergence of hatcheries as a means of supplementing declining fish populations. With salmon having such a ubiquitous presence in the region, there is abundant publicity devoted to the plight of salmon here. Interest groups whose mission it is to preserve healthy salmon populations for future generations are as plentiful as breweries in the

Pacific Northwest, and articles sympathetic to salmon recovery are hardly difficult to find.

Many of the threats faced by salmon today are human-caused (National Research Council 1996, Nehlsen et al. 1991), and these threats to salmon also directly benefit those who live in the Northwest. Dams provide many economic benefits, including electricity, water, and recreation. Urban development provides people with places to live and work, and many forestry and agricultural practices that threaten salmon habitat provide benefits to humans, such as timber, and fruit and vegetable crops (Blumm et al. 1998).

Salmon returns in the Pacific Northwest have fallen dramatically since human development began in the 19th century. Estimates of historic runs in the Columbia River run as high as 16 million (Northwest Power Planning Council, 1987). Today, salmon are extinct in up to 40% of their historic range in the Pacific Northwest (Levin and Schiewe 2001), and returns to the Columbia River dropped below one million in the 1990s. The National Marine Fisheries Service (NMFS) currently lists 26 (out of 51) Evolutionarily Significant Units (ESU) of Pacific Northwest salmon as either Threatened or Endangered under the Endangered Species Act (ESA) (Ruckelshaus, et al. 2002).

In search of causes for the precipitous decline of salmon in the Pacific Northwest, the literature often refers to "the four H's" (Ruckelshaus, et al. 2002; Northwest Power Planning Council, 1992). The most-cited contributing factors to the decline of salmon in the Pacific Northwest are habitat degradation, hydroelectric dams, harvest practices, and the emergence of fish hatcheries.

Logging, mining, livestock grazing, and other human-related activities, along with urban growth and development, have contributed significantly to the loss of much critical

salmon habitat in the Pacific Northwest. Poor water quality, a result of roads, culverts and other manmade features, further reduces available remaining habitat.

Hydroelectric dams are considered by some to be the single biggest threat to the recovery of salmon in the Pacific Northwest (Blumm, et al. 1999; Bednarek 2001). Dams block passage and access to previously accessible habitat, change river characteristics, and present mortality threats to young fish in the form of turbines. McClure, et al. (2001) point to the construction of the Hell's Canyon dam in the Snake River basin that led to the loss of 90% of the spawning habitat for returning fall-run Chinook salmon. Fish ladders and trucking programs (trucking or barging fish around dams) make some dams passable, but the efficacy of these programs has been debated (Muir et al. 2006).

Overfishing has led to the decline, and extinction, of fish stocks worldwide, and Pacific Northwest salmon are no different. Commercial harvest began in the late 19th century, corresponding with the beginning of the decline of run sizes. While Pacific Northwest commercial and recreational fisheries are more stringently managed than many, these harvests take a toll on overall numbers.

The fourth 'H', hatchery production, is considered to be the most controversial of all. While hatcheries up and down the Pacific coast release up to 1.2 billion young salmon per year (Mahnken et al. 1998), the benefit to the fisheries they are designed to supplement have been debatable at best. It is undisputed that hatcheries boost overall numbers of salmon smolt, but opponents argue that hatchery fish are not as well-equipped to handle ocean life as their wild counterparts (Levin and Williams 2002). This lack of fitness of hatchery fish becomes troublesome when hatchery fish escape and breed with wild fish, ensuring the continuation of these inferior genetics for the future generations. It

is also argued that hatchery fish can carry diseases that can harm wild salmon, and that hatchery fish are in direct competition with wild salmon, resulting in a decreased survival rate for the wild fish (Levin and Williams 2002). Taken together, these factors, along with others such as variations in ocean conditions, have contributed to a significant decline in current salmon populations.

Due to their prominence in Pacific Northwest culture, salmon have been at the center of many contentious policy debates, most focusing on addressing the 'four H's'. The social construction theory of public policy seeks to explain why certain groups benefit from policies while others are adversely affected. Any policy decision will carry with it both positive and negative effects, and social constructionists argue that "the social construction of target populations has a powerful influence on public officials and shapes both the policy agenda and the actual design of policy" (Schneider and Ingram, 1993: 334). Whether explicitly stated or not, policy decisions pick winners and losers, benefitting those viewed favorably by government and policy makers, and burdening those viewed unfavorably.

Social constructions are formed on two axes: political power and positive and negative construction. Political power is "construed as votes, wealth, and the propensity of the group to mobilize for action" (Schneider and Ingram, 1993: 335), while positive and negative construction refers to how target populations are perceived by policymakers and the general public.

The framework further breaks down populations into four groups: advantaged, contenders, dependents, and deviants. Advantaged populations are those with both political power and a positive construction, and include the elderly and the business

community. Contenders have an abundance of political power, but a negative construction, and include unions and the wealthy. Dependents lack political power, but have a positive construction, and include children and mothers. Deviants both lack political power, and have a negative construction, and include criminals.

Social construction theory further breaks down policy decisions and examines benefits and burdens. Every policy places both benefits and burdens on varying populations. Due to their political power and positive construction, advantaged target populations generally enjoy the benefits of a policy decision, while avoiding many of the burdens. Deviants, meanwhile, shoulder much of the burden, without reaping the benefits of policy decisions (Schneider and Ingram, 1993).

While social construction theory began as a way of explaining why policies are bestowed on various human population groups, it has also been extended into the animal kingdom. Czech et al. (1998) apply the theory, on a broad level, to animals covered under the Endangered Species Act. To form one axis (positive/negative construction), the authors used a nationwide survey to determine which types of animals (birds, fish, insects, etc.) were most valued among the general public. To form the second axis (political power), the authors determined how many nongovernmental organizations (NGOs) whose mission was to protect each species. Using these axes, the authors classified three groups as advantaged: birds, mammals, and fish (Figure 1).

Salmon are well represented by NGOs (Czech et al., 1998), especially in the Pacific Northwest. As explained by Czech et al., having a large contingent of NGOs equates political power for an animal, and salmon are no different. Schneider and Ingram write that those in the advantaged category “have considerable control and will find it

easy to get their issues on legislative agendas" (1993: 337). Legal battles are currently being waged over Columbia River salmon, and the frequency of legislation concerning salmon being brought forward by the Oregon Legislature shows this to be very true in Oregon. As an advantaged group that is not expected to share in the policy burdens, salmon often benefit at the expense of other groups. Farmers are often unable to irrigate their crops due to water being diverted to ensure minimum flows for healthy salmon runs (Huppert 1999). Hydroelectric dam operators are forced to release more water from their reservoirs, sometimes resulting in power shortages (Huppert 1999). While these groups are burdened by these policies, salmon are the benefactor.

On a federal level, the Endangered Species Act (ESA) has a provision for 'citizen suits', which allow a citizen to sue the government if they feel that the ESA is being violated. Environmental groups often use this provision, as a means of preventing policies that they feel would harm the species that they are trying to protect. While there is no such thing at the state level, as is the case with many environmental issues, the salmon recovery policy agenda in Oregon is indisputably driven by advocates for conservation. Groups such as the Native Fish Society, Trout Unlimited, the Wild Salmon Center, Save our Wild Salmon, and others, are constantly pushing policymakers and legislators for further measures to protect salmon in Oregon. This leaves interests that compete for resources with salmon, such as power companies, farmers, and the logging and mining industries, constantly fighting to protect their interests.

According to Schneider and Ingram, "the easiest problems for elected officials to address will be those for which advantaged segments of the population are the logical recipients of beneficial policies" (1993: 337). Presidents, members of congress, and other

politicians have come to the Pacific Northwest to announce many a new salmon recovery policy. These announcements create positive press for the politician, and more money is dedicated to salmon recovery.

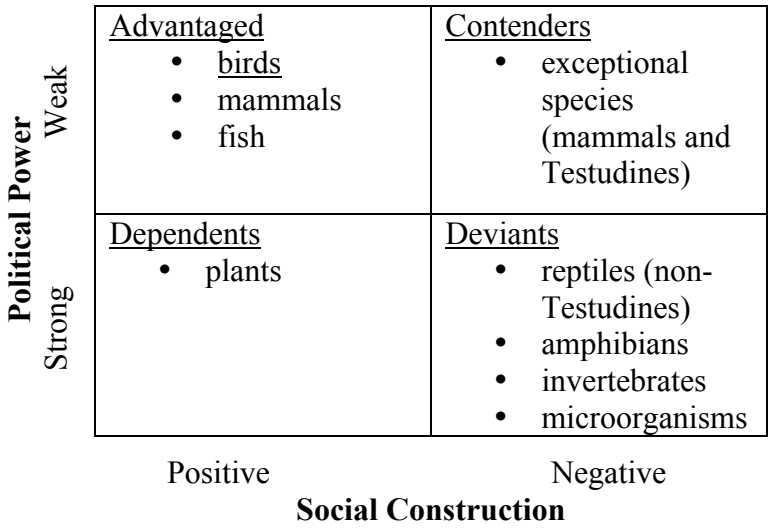

Figure 1 – Social Construction Matrix

Salmon have long been an economic lifeblood for communities in the Pacific Northwest, which rely on them for both food and income, and as a result enjoy an almost mythological status there. The life cycle of any species of salmon conjures up heroic visions of a majestic fish navigating what is an increasingly dangerous journey to the ocean, returning to the same stretch of gravel years later to lay their eggs and die. Ruckelshaus et al. find it "important to emphasize that Pacific salmon are of enormous economic, cultural and social value, and the extinction of any Pacific salmon species would be viewed as a tragedy by the public" (2002: 666). As a result, more so than virtually any other animal, salmon are valued in the Northwest. Loomis and White (1996) estimate that the annual willingness to pay (WTP) for households in the United States to

be $63 for salmon conservation programs, second only to the Northern Spotted Owl and preserving its old growth habitat. As such, the idea of saving salmon from extinction clearly enjoys public support, and gives salmon a positive construction (Czech et al. 1998; White and Hall 2005; Garber-Yonts et al. 2004).

Deborah Stone, in *Policy Paradox*, suggests that symbols play a role in the policy process: "Any good symbolic device, one that works to capture the imagination, also shapes our perceptions and suspends skepticism, at least temporarily" (2002: 137). Pacific Northwest salmon could be considered the quintessential policy symbol. The image of a salmon swimming hundreds of miles upstream, past dams, predators and other dangers, to spawn in the same small stream in which it was born, is a powerful one. As Schneider and Ingram write, "advantaged groups have the resources and capacity to shape their own constructions and to combat attempts that would portray them negatively" (1993: 337). As an advantaged group, salmon clearly enjoy a positive construction, and benefit from policy actions while shouldering little of the burden.

Populations that fall within one category do not necessarily remain there indefinitely (Schneider and Ingram 1993). Perceptions change, and the balance of political power is constantly shifting. While salmon can be considered advantaged today, it has the potential to change in the future. As such, maintaining a positive construction is essential to enjoying the benefits of falling in the advantaged category.

Salmon enjoy the benefits of being considered an advantaged group, but they continue to face threats from the 'four H's'. Public support for salmon recovery is essential for salmon to continue to benefit from policy decisions. Determining levels of

perceived risk and support for salmon recovery policies addressing the 'four H's' can also be helpful to policymakers in determining a course of action.

Any decision made at any level carries with it some form of risk assessment: What will be the consequences of said decision? The decision-maker must weigh the pros and cons of any decision, and determine its potential efficacy. In today's world, policymakers can be considered generally risk-averse. Any policy decision considered controversial brings with it many negative effects, including potential loss of power for the policymaker. Elected officials are concerned about re-election campaigns and popularity ratings, and are unwilling to do anything that could be perceived unfavorably by some. Generally, policy decisions are made rationally. Starr writes, "the public generally assumes that the decision-making process is based on a rational analysis of social benefit and social risk. While it often is, we have all seen after-the-fact examples of irrationality" (1969: 1234). Many issues, very much so including salmon recovery policy in the Pacific Northwest, have become politicized, and decisions can be made for political reasons, rather than for rational reasons.

Social scientists have long studied risk assessment: how individuals determine the level of risk for a particular outcome. In other words, how do individuals determine which policies to support, and which to oppose? Chauncy Starr's groundbreaking 1969 essay, entitled "Social Benefit versus Technological Risk: What is our society willing to pay for safety?" is one of the earliest examples of researchers attempting to explain how individuals assess risk. Starr quantified just how safe (in terms of numbers of acceptable fatalities) various 'voluntary' and 'involuntary' activities had to be in order to be considered acceptable by the general public.

There are various theories that explain why people make the decisions that they do, and are best summarized in Wildavsky and Dake's 1990 article "Theories of Risk Perception: Who Fears What and Why?" The most widely held theory, according to Wildavsky and Dake, is knowledge theory: we fear most what we understand best. In the case of technology (hydroelectric dams, etc.), we perceive certain technologies as risky because we know them to be risky. This harkens back to Maslow's "hierarchy of needs": our needs at a given time are directly related to the risks currently presented to us. Only when these risks are dealt with can we move on to the next 'level' of needs in Maslow's hierarchy (Maslow 1943). Several studies have hypothesized that while knowledge is important, it is also confidence in the decision-making entity that plays a large part in risk assessment (Wildavsky and Dake 1990; Bord and O'Connor 1990). Having confidence in the science being done by a federal agency, for example, will lead individuals to perceive lower risk in a policy decision based on that science. Confidence in decision-making entities usually comes from knowledge of the subject matter in question.

Political theory holds that all decisions are made for political reasons: "controversies over risk [are] struggles over interests, such as holding office or party advantage" (Wildavsky and Dake 1990). In this theory, demographic characteristics such as gender, age and ideology play a large role in shaping decisions.

Demographic characteristics also play a large role in shaping the perceived risk among cultural theorists. Cultural theory holds that risk perception is strongly tied to cultural biases – "worldviews or ideologies entailing deeply held values and beliefs" (Wildavsky and Dake 1990). While there are many other theories of risk perception, (economic, personality, etc.), this paper will focus on the three described above.

Methods

The "Oregon Ocean & Coastal Policy Survey 2008" was conducted by mail between April and June 2008 among a random sample of households in Oregon. Each contacted household was issued the following request for participation: "If available, we would prefer the person, 18 years old or older, who most recently celebrated a birthday to complete the survey." Three waves of mail surveys were distributed, followed by a final telephone reminder if necessary. By using a multiple contact survey design, a total of 3,088 completed surveys were collected in this period (out of 6,100 households), resulting in a 50.6 percent response rate. Among a wide array of topics of relevance to the Oregon coast, questions were asked pertaining to salmon recovery policies in Oregon, and respondents' level of perceived risk and level of support for each individual policy.

The data were entered into SPSS, a statistical modeling software program. All equations and statistics were calculated using SPSS.

Results/Discussion

Surveys were mailed to residents throughout the state. In order to compare the views and beliefs of those who live on the coast and those who live inland, a dummy variable was created to divide respondents into two categories: "residents of coastal county" and "resident of non-coastal county." Of the 3,088 respondents, 1,027, or 33.3%, were residents of a coastal county.

Respondents were asked various demographic questions relating to political beliefs, age, gender, and education level. On a scale of 1 (very liberal) to 5 (very conservative), respondents were asked, "On domestic policy issues, would you consider yourself to be?" Twenty-three percent of respondents identified themselves as either

'liberal' or 'very liberal,' while 31.7% identified themselves as 'conservative' or 'very conservative.' Education was scaled from 1 (grade school) to 7 (graduate school), and 41% of respondents had at least a bachelor's degree. The demographics of the respondents are summarized in Table 9.

The survey asked respondents to self-identify their level of knowledge of coastal and ocean policy issues, theorized to be a key indicator of perceived risk. On a scale of 1 (not informed) to 4 (very well informed), respondents were asked, "In general, how well informed would you consider yourself to be concerning ocean and coastal policy issues – such as fisheries, beach erosion, pollution, etc. – in Oregon?" Only 20.7% of respondents identified themselves as either 'informed' or 'very well informed.' (Table 1)

Table 1
Level of knowledge of ocean and coastal policy issues in Oregon

Question: In general, how well informed would you consider yourself to be concerning ocean and coastal policy issues – such as fisheries, beach erosion, pollution, etc. – in Oregon?

23.3%	1. Not informed
56%	2. Somewhat informed
17.4%	3. Informed
3.3%	4. Very well informed
N=2,986	

In addition to asking how often respondents visit the coast for recreation or leisure time, the survey asked participants to list how often they participate in specific recreation and leisure activities on the coast, including: beachcombing/walking, boating, biking, camping, fishing or clamming, hiking, sightseeing, shopping and restaurants, swimming

or surfing, viewing or photographing nature and wildlife, and whale watching. Only 25.7% of respondents recreate on the coast once a month or more. (Table 2)

Table 2
Frequency of recreation at Oregon coast

Question: How often, if ever, do you visit or use Oregon's coastal areas for recreation or leisure time?

2%	1. Never
25.5%	2. Rarely, no more than once or twice a year
46.8%	3. Occasionally, several times a year
15.9%	4. Somewhat frequently, at least once a month on average
9.8%	5. Very frequently, at least once a week or more
N=3,022	

The survey asked respondents about their level of familiarity with, and level of trust in, various government agencies. The United States Congress and the U.S. Coast Guard were the most familiar, with 69.1% and 68.5%, respectively, of respondents identifying them as at least 'moderately familiar.' Conversely, 69.2% of participants were not familiar with the Pacific States Marine Fisheries Commission (PSFMC), while 48.1% were not familiar with the National Oceanic and Atmospheric Administration (NOAA). Agencies that were the most trustworthy (at least 'moderate trust' in) included the U.S. Coast Guard (88.2%), and university research scientists (61.1%). Those that did not garner the trust of the public (identified as having 'no trust at all' in) were the United States Congress (29%) and the Pacific States Marine Fisheries Commission (25.2%). In the case of the U.S. Congress, familiarity really does breed contempt.

To gauge the overall attitude of respondents towards the health of ocean fisheries, the survey asked, "In recent years there has been much discussion about whether Oregon's ocean fisheries – such as salmon and groundfish – are in serious decline due to

current management practices should be maintained. Others argue that these fisheries are in serious decline and require new management approaches. In general, which view best describes your opinion in this area?" (Table 3) A majority, 56.4 percent, of respondents believed that Oregon's fisheries are in decline, with at least moderate change required. Only 1.7% of respondents reported that there are no problems with Oregon's fisheries, and no changes are necessary.

The survey then asked respondents about threats to Oregon's fisheries, and the level of perceived risk of, and support for addressing these threats. The "four H's," described earlier, include hydropower, habitat, and hatcheries (and harvest, about which no questions were asked in the survey). On a scale of 1 (none or very low) to 5 (very high), respondents were asked to identify what they perceived the level of risk to be with regard to four perceived threats to "the distribution and abundance of wild salmon": hydroelectric dams, agricultural and forestry practices involving the use of pesticides, fertilizers and habitat alteration, hatcheries, and urban development. Damaging agricultural and forestry practices were identified as the most risky, with 56.2% of respondents identifying the level of risk associated with them as either 'high' or 'very high'. Hydroelectric dams are perceived as similarly risky, with 50.7% of respondents identifying the risk as either 'high' or 'very high.' Hatcheries are seen by many respondents to pose little to no risk to salmon: 56.2% of respondents believe that the level of risk associated with hatcheries is 'none or very low' or 'low'.

Table 3
Health of Oregon's ocean fisheries

Question: In recent years there has been much discussion about whether Oregon's ocean fisheries – such as salmon and groundfish – are in serious decline due to current management practices. In general, which view best describes your opinion in this area?

1.7%	1. No problems exist now; existing management practices should be maintained
9.7%	2. There are a few minor problems concerning ocean fisheries; only minor management changes are needed
32.1%	3. Uncertain
32.9%	4. Ocean fisheries are in decline; moderate changes in management practices are needed
23.5%	5. Ocean fisheries are in serious decline; drastic changes in management approaches are needed

N=2,982

Respondents were also asked to identify their level of support for addressing these perceived risks: removing hydroelectric dams, policies that would limit damaging agricultural and forestry practices, elimination of hatcheries, and urban stream protection measures. The elimination of hatcheries garnered the least support, with 81.2% of respondents indicating that their level of support for this action was 'none or very low' or 'low'. Policies that addressed damaging agricultural and forest practices received a 'high' or 'very high' level of support from 42.9% of respondents. While 50.7% of respondents identified hydroelectric dams as risky, only 15.4% identified their level of support for the removal of dams as 'high' or 'very high'. Urban development (and urban stream protection) was the only one of the four threats to receive a higher level of support than level of perceived risk. While 42.5% of respondents identified the level of risk posed by urban development to be 'high' or 'very high', 50.2% reported that their level of support

for urban stream protection fit one of those two categories. Results of these questions are reported in Tables 4-7.

The effect that dams, hydroelectric and otherwise, have on fish populations has been well documented (Blumm, et al. 1999, Huppert 1999). Likewise, the economic benefits provided by dams are such that it is difficult to begin to even think about removing dams on major rivers, let alone to get to the point of actual removal. While rivers such as the Elwha in Washington and the Sandy in Oregon have recently had dams breached, one needs look no further than the Klamath River, meandering through Oregon and California, to find an example of the social and political difficulty of removing dams. While Starr did not include dams in his groundbreaking work on how much risk individuals are willing to live with, the responses provided to the question of perceived risk of and support for removing dams provides a start example of the willingness to sacrifice something valuable (in this case, the health of salmon runs in the Pacific Northwest) for economic benefits (power, water, and recreation opportunities provided by hydroelectric dams). While the issue of dams, and the possibility of removal, has been in the public eye for decades, the threat caused by hatcheries is a relatively recent development.

As discussed previously, the practice of using hatcheries to supplement fish stocks is a controversial one, at best. While studies have been done showing that hatcheries do more harm than good to native fish stocks (Levin, et al. 2001), the science is far from concrete. Many salmon runs in Oregon exist almost solely because of hatchery-produced fish, and as a result hatcheries still have a relatively positive public perception. While the science has begun to show the dangers of these artificially reared fish, the view of the

public has been slow to change with it. Given this, it can hardly be considered surprising that hatcheries were perceived as the smallest threat to salmon recovery, and received the lowest level of support for eliminating them.

As noted earlier, only 1.7% of respondents believed that there are currently no problems with Oregon's ocean fisheries. To the contrary, 56.4% of respondents, in the same question, responded that Oregon's ocean fisheries are in decline, and at least moderate changes are needed to current management policies. This pattern seems to follow when respondents are asked about individual threats to salmon recovery, and in some cases (hydroelectric dams, urban development) the percentage of respondents who view these policies as risky is much higher than the percentage of those who believe that, in general, Oregon's ocean fisheries are in decline. Level of support for addressing these specific issues, particularly in the case of the removal of hydroelectric dams, is in many cases much lower than the 56.4% of respondents who believe that Oregon's ocean fisheries are in decline. While the majority of respondents feel that Oregon's ocean fisheries are threatened in general, there is still a hesitation among the general public to address specific challenges to salmon recovery.

Table 4
Perceived Risk of Hydroelectric Dams and Support for Removing Them

Question: What level of risk do hydroelectric dams pose to the distribution and abundance of wild salmon?		*Question:* What is your level of support for the removal of dams in order to restore wild salmon populations in Oregon?
3.6%	1. None or very low	37.7%
13.9%	2. Low	24.5%
31.8%	3. Moderate	22.5%
32.3%	4. High	8.4%
18.4%	5. Very high	7%
N=2,802		N=2,820

Table 5
Perceived Risk of Agricultural and Forestry Practices and Support for Limiting Them

Question: What level of risk do agricultural and forestry practices that involve the use of pesticides, fertilizers, and habitat alteration pose to the distribution and abundance of wild salmon runs?		*Question:* What is your level of support for policies that would limit such agricultural and forestry practices?
4.3%	1. None or very low	12.9%
12.9%	2. Low	15.7%
26.5%	3. Moderate	28.5%
32.8%	4. High	25.1%
23.5%	5. Very high	17.8%
N=2,853		N=2,870

Table 6
Perceived Risk of Hatcheries and Support for Eliminating Them

Question: What level of risk do hatcheries pose to the distribution and abundance of wild salmon runs?		*Question:* What is your level of support for the elimination of hatcheries?
20%	1. None or very low	49.9%
36.2%	2. Low	31.3%
30.5%	3. Moderate	12.9%
9.6%	4. High	3.8%
3.8%	5. Very high	2.1%
N=2,686		N=2,751

Table 7
Perceived Risk Urban Development and Support for Urban Stream Protection

Question: What level of risk does urban development pose to the distribution and abundance of wild salmon runs?		*Question:* What is your level of support for urban stream protection measures?
5.1%	1. None or very low	7.6%
15.4%	2. Low	11.5%
37%	3. Moderate	30.6%
30.3%	4. High	29.5%
12.2%	5. Very high	20.7%
N=2,871		N=2,911

To begin data analysis, correlations were run between levels of risk of and levels of support for the four threats discussed above (Table 8). All four were significant at the $p \leq 0.01$ level. Agriculture and forest practices had the highest correlation, at .757, while hatcheries recorded the lowest correlation, at .561. Due to the relatively low level of support identified for the elimination of hatcheries, this low correlation is not surprising.

Table 8
Correlations of Level of Risk Associated with and Level of Support for Salmon Recovery Policies

N=2,711	.630*	Risk of hydroelectric dam/support for dam removal
N=2,812	.757*	Risk of ag. & forest practices/support for policies to address
N=2,671	.561*	Risk of hatcheries/support for eliminating
N=2,865	.677*	Risk of urban development/support for urban stream protection

Significance levels: * $p \leq .001$

While there is discrepancy between the level of correlation of risk associated with and support for addressing these four threats, and correlation certainly doesn't imply causation, the fact that all four are significant at the $p \leq 0.01$ level indicates a strong connection between the risk assessment of and support for these four salmon recovery policies.

Three separate indices were created from the data. The first index was created from a series of 10 questions asking respondents to self-report their level of trust (from 1 = No trust at all, to 4 = Great deal of trust) in the following four different government entities with direct responsibility for fisheries management: National Marine Fisheries Service, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, and the Pacific States Marine Fisheries Commission. The four responses were combined in to an index, which ranks, on a scale of 4-16, how much trust respondents have toward many of the entities involved with salmon recovery policy. This index was used as an independent variable in the regression equations, to test the hypothesis brought by several authors writing on the knowledge theory of risk assessment that trust plays a large role in an individuals' determination of risk.

The second index created combined respondents' self-reported level of perceived risk of the four threats to salmon recovery in the Pacific Northwest. As a means of analyzing perceived risk in general and how it affects support of a given policy, this index was used as an independent variable in the final regression equation presented in this paper.

Similar to the second, the third and final index combined respondents' self-reported level of support for addressing the four threats to salmon recovery in the Pacific Northwest. This index summarizes an individual's support for salmon recovery policies in general, and was used as the dependent variable in the final regression equation.

A reliability test was run on the variables used in each of the indices. Reliability tests determine how well the index captures the individual responses that it contains. A score of 1 means that the index perfectly captures individual responses, while a score of 0 means that it does not capture any of the responses. Generally speaking, a reliability score of .5 or above constitutes a statistically sound index. The 'trust' index had the highest score of the three, with a .820. The 'support' index scored .794, while the 'risk' index scored .784, meaning that all three indices were accurate representations of the questions that they were summarizing.

Table 9
Control Variables for Risk Assessment of and Support for Salmon Recovery Policies

		Mean (s.d.)
Gender	*Dummy variable for respondent gender* 1= female; 0= male	.49 N=3,054
Coast	*Dummy variable for respondent county of residence* 1 = coastal county; 0 = non-coastal county	.33 N=3,088
Informed (coastal issues)	*Self-assessed informedness concerning coastal and ocean policy issues in Oregon* 1 = not informed to 4 = very well informed	2.01 (.734) N=2,986
Frequency of visits	*How often does the respondent recreate on the Oregon Coast?* 1 = never to 5 = once a week or more	3.06 (.94) N=3,022
Views on ocean fisheries	*How healthy are Oregon's ocean fisheries?* 1 = no problems exist to 5 = fisheries are in serious decline	3.67 (.996) N=2,982
Ideology	*Self-assessed political orientation* 1 = very liberal to 5 = very conservative	3.1 (.888) N=2,967
Education	*Dummy variable for Bachelor's degree or higher* 1 = Bachelor's degree or higher; 0 = no Bachelor's degree	.4054 (.491) N=3,088
Age	*Dummy variable for respondents aged 55 and over* 1 = respondent is 55 or over; 0 = respondent under 55	.3815 (.485) N=3,088
Risk – Hydroelectric Dams	*Perceived risk of hydroelectric dams* 1 = none or very low to 5 = very high	3.48 (1.056) N=2,802
Risk – Forest & Ag policies	*Perceived risk of certain forest and agricultural policies* 1 = none or very low to 5 = very high	3.58 (1.108) N=2,853
Risk - Hatcheries	*Perceived risk of hatcheries* 1 = none or very low to 5 = very high	2.41 (1.029) N=2,686
Risk – Urban Development	*Perceived risk of urban development* 1 = none or very low to 5 = very high	3.29 (1.032) N=2,871

To continue analysis, I ran four regression equations, using 'level of perceived risk of…' as the dependent variable in each of the four (Table 10). Nine independent variables were included in each regression: a dummy variable for residency within a coastal county (0 = resident of non-coastal county, 1 = resident of coastal county), respondents' self-reported level of knowledge concerning ocean and coastal policy issues (1 = not informed, to 4 = very well informed), frequency of visits to the Oregon coast (1 = never, to 5 = very frequently, at least once a week or more), respondents' views on the current health of Oregon's ocean fisheries (1 = no problems exist now, and no changes are needed, to 5 = fisheries are in serious decline, and drastic change is needed), respondents' stance on domestic policy issues (1 = very liberal, to 5 = very conservative), education (1 = bachelor's degree or higher, 0 = no bachelor's degree), age (1 = 55 or higher, 0 = under 55), gender (male = 0, female = 1), and the 'trust' index. Education and age were dichotomized to eliminate any bias in how they were scaled originally. The dummy variable for residency in a coastal county, and frequency of visits to the Oregon coast were both included in the regression to test whether a physical familiarity with an area leads to a difference in perceived risk about threats to that area. In other words, would those who spend more time at the coast be more likely to: a) perceive a greater risk associated with these threats to salmon recovery, and b) be more supportive of policies to address these threats?

R-square values for these four regressions were relatively low, with a high of .204 (for Forest and Agricultural Practices) and a low of .112 (for Urban Development). These low R-squared values indicate that much of the change in respondents' perceived risk is not captured by these models.

Four variables are statistically significant to at least the $p \leq .05$ level in all four 'risk' regressions: respondents' perceived view on the health of Oregon's ocean fisheries, ideology, having a bachelor's degree or higher, and the 'trust' index. Age, gender, and self-reported level of knowledge of ocean and coastal issues were relatively insignificant overall. Level of knowledge of ocean and coastal issues and gender were only statistically significant in one equation each ('urban development' and 'agricultural and forestry practices', respectively), while age was not significant in any of the four equations. It can hardly be considered surprising that how respondents perceive the health of Oregon's ocean fisheries is positively correlated, and statistically significant, in all four 'risk' regression equations.

A strong (statistically significant at $p \leq .001$) negative correlation associated with ideology exists throughout the four equations. As respondents trend toward conservative, the level of perceived risk for each specific threat drops considerably. Conversely, education has a strong positive correlation with perceived risk of each of the four threats. Both of these results follow from numerous studies that show that as ideology trends toward conservative, economic benefits tend to be valued over environmental benefits. Studies have also shown that as education increases, the opposite is true: environmental benefits become more highly valued.

Respondents' level of trust was positively correlated at $p \leq .001$ in each of the first four regressions, lending credence to the knowledge theory of risk assessment, in which it is argued that level of trust plays a role in determination of risk. This positive correlation indicates that there is some validity to the hypothesis put forward that trust in decision-making bodies leads to a lower perceived risk of decisions made by said entities.

Table 10
Regression Estimates for Perceived Risk of Threats to Salmon Recovery

	Hydroelectric Dams Coefficient (Std. Error) **Standardized β**	**Ag. & Forest Practices** Coefficient (Std. Error) **Standardized β**	**Hatcheries** Coefficient (Std. Error) **Standardized β**	**Urban Development** Coefficient (Std. Error) **Standardized β**
Coastal Resident (0 = non-coastal, 1 = coastal)	.029 (.059) **.013**	-.105 (.061) **-.045**	-.181** (.059) **-.087**	-.119* (.058) **-.056**
Informed	.048 (.036) **.032**	-.012 (.037) **-.007**	.054 (.035) **.039**	.187*** (.035) **.130**
Frequency of visits	.093** (.030) **.084**	.199*** (.031) **.170**	.055 (.030) **.052**	.111*** (.030) **.102**
Health of fisheries	.142*** (.026) **.128**	.189*** (.027) **.161**	.121*** (.026) **.113**	.114*** (.026) **.105**
Ideology	-.361*** (.027) **-.303**	-.362*** (.028) **-.289**	-.245*** (.027) **-.216**	-.267*** (.027) **-.231**
Bachelor's degree	.216*** (.048) **.102**	.195*** (.049) **.087**	.126** (.048) **.062**	.107* (.047) **.051**
55 & over	-.085 (.050) **-.039**	-.119* (.051) **-.052**	-.126* (.050) **-.061**	-.088 (.050) **-.042**
Gender	-.083 (.050) **-.039**	.170** (.051) **.076**	.057 (.050) **.028**	.069 (.049) **.033**
'Trust'	.047*** (.009) **.114**	.041*** (.010) **.094**	.036*** (.009) **.092**	.038*** (.009) **.094**
F test =	38.117***	49.408***	23.085***	28.391***
R-square =	.163	.204	.112	.127

Significance levels: * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Next, regressions were run with levels of support for policies addressing each of the four threats as dependent variables (Table 11). The same nine independent variables

used previously were included in each regression: a dummy variable for residency within a coastal county (0 = resident of non-coastal county, 1 = resident of coastal county), respondents' self-reported level of knowledge concerning ocean and coastal policy issues (1 = not informed, to 4 = very well informed), frequency of visits to the Oregon coast (1 = never, to 5 = very frequently, at least once a week or more), respondents' views on the current health of Oregon's ocean fisheries (1 = no problems exist now, and no changes are needed, to 5 = fisheries are in serious decline, and drastic change is needed), respondents' stance on domestic policy issues (1 = very liberal, to 5 = very conservative), level of education (1 = bachelor's degree or higher, 0 = no bachelor's degree), age (1 = respondent aged 55 or over, 0 = respondent aged 54 or younger), gender (male = 0, female = 1), and a 'Trust' index. Level of perceived risk with the associated policy was also included in these regressions.

R-square values, which indicate how well the model explains change in the dependent variable, ranged from .374 to .618. Of the 10 independent variables in the hatchery support regression, only six were statistically significant at the $p \leq .05$ level (frequency of visits to the coast, views on domestic policy issues, age, gender, 'trust' index, and level of perceived risk of hatcheries), resulting in the lowest R-square (.374) of the four equations. Respondents' views on domestic policy (ideology) were statistically significant at the $P \leq .001$ level in all four regressions, as was the level of perceived risk of the corresponding threat. Those were the only two variables to be statistically significant in all four equations. The health of Oregon's fisheries was statistically significant in three of four equations (all but elimination of hatcheries), as was the 'trust' index (all but elimination of hatcheries).

As was shown in the correlation matrix presented earlier, there is a strong positive association between perceived risk of each threat and support for addressing it.
As was the case in the previous regression, there is a statistically significant negative correlation associated with ideology in all four equations. However, the results for education are quite different. Education is only significant in two equations (forestry and agricultural processes, and elimination of hatcheries), and it is a negative correlation in one and a positive in the other, which limits any insights that can be gleaned.

The first two regression equations looked at each individual threat to salmon recovery in the Pacific Northwest individually. While there are insights that can be gained from looking at each one separately, the 'risk' and 'support' indices were created to allow for generalizations about how risk perception affects respondents' support for a given policy action in regard to salmon recovery. The final regression utilized these indices, with the 'support' index serving as the dependent variable (Table 12). Independent variables included the same demographic variables that appeared in the first two regression equations, as well as the 'trust' index.

As was the case with previous regressions, ideology is negatively correlated and significant, but while education is positively correlated, it is not statistically significant. Health of Oregon's ocean fisheries is positively correlated and significant, which falls in line with the previous two sets of regressions equations.

Table 11
Regression Estimates for Support for Salmon Recovery Policies

	Dam Removal Coefficient (Std. Error) **Standardized β**	**Forest & Ag. Policies** Coefficient (Std. Error) **Standardized β**	**Elimination of Hatcheries** Coefficient (Std. Error) **Standardized β**	**Urban Stream Protection** Coefficient (Std. Error) **Standardized β**
Coastal Resident (0 = non-coastal, 1 = coastal)	-.026 (.057) **-.010**	-.152** (.048) **-.058**	-.039 (.047) **-.020**	.068 (.050) **-.028**
Informed	.062 (.035) **.034**	.082** (.029) **.047**	-.006 (.028) **-.004**	.130*** (.030) **.080**
Frequency of visits	.057 (.030) **.042**	.078** (.025) **.059**	-.051* (.024) **-.051**	-.036 (.026) **-.030**
Health of fisheries	.073** (.025) **.054**	.096*** (.021) **.072**	-.009 (.021) **.009**	.087*** (.022) **.072**
Ideology	-.334*** (.028) **-.230**	-.200*** (.021) **.072**	-.160*** (.022) **-.150**	-.140*** (.023) **-.108**
Education	-.046 (.047) **-.018**	-.104** (.039) **-.041**	.080* (.038) **.042**	.071 (.041) **.031**
Age	-.148** (.049) **-.056**	-.034 (.040) **-.013**	-.069 (.040) **-.035**	-.101** (.042) **-.043**
Gender	.032 (.049) **.013**	.013 (.040) **.005**	-.150*** (.040) **.079**	-.148*** (.042) **-.064**
'Trust'	-.009 (.009) **-.017**	-.024** (.008) **.048**	-.016* (.007) **-.043**	.029*** (.008) **.065**
Risk of Hydroelectric Dams	.673*** (.023) **.555**	N/A	N/A	N/A
Risk of Agricultural and Forestry Practices	N/A	.777*** (.019) **.689**	N/A	N/A
Risk of Hatcheries	N/A	N/A	.493*** (.019) **.523**	N/A
Risk of Urban Development	N/A	N/A	N/A	.702*** (.020) **.626**
F test =	156.082***	277.787***	98.689***	169.317***
R-squared =	.484	.618	.374	.492

Significance levels: * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

The null hypothesis being tested in this paper assumes 'perceived risk has no effect on support for a salmon recovery policy.' There is a significant (at $p \leq .001$) and positive correlation associated with the 'risk' index in this equation, indicating that perceived risk plays a large role in an individuals' support for salmon recovery policies in the Pacific Northwest. The high R-squared value (.712) indicates that this set of independent variables does a very thorough job of explaining the change in the dependent variable ('support' index).

Several variables were statistically significant throughout many of the nine total regressions, indicating they play a large role in both risk perception and level of support for the policy actions outlined in this survey. Ideology was the only variable to be statistically significant in all nine equations, while the perceived health of Oregon's ocean fisheries was significant in all but one of the equations.

As discussed earlier, knowledge theory of risk assessment maintains that an individual's level of knowledge of a subject matter plays a large role in their perceived risk of an action. The regression equations do not support this theory in terms of salmon recovery policies in Oregon. The 'informed' variable is statistically significant in only one of the four 'risk' regression equations (urban development).

Table 12
Regression Estimates for Support for Salmon Recovery Policies Index

	'Support' index Coefficient (Std. Error) **Standardized β**
Coastal Resident (0 = non-coastal, 1 = coastal)	-.093 (.129) **-.012**
Informed	.222** (.079) **.042**
Frequency of visits	-.004 (.067) **-.001**
Health of fisheries	.218*** (.058) **.055**
Ideology	-.581*** (.064) **-.138**
Education	.189 (.105) **-.025**
Age	-.312** (.110) **-.041**
Gender	.099 (.110) **.013**
'Trust'	-.002 (.021) **-.001**
'Risk' index	.848*** (.018) **.753**
F test =	383.954***
R-squared =	.712

Significance levels: * $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

While knowledge theory of risk assessment does not adequately capture the way respondents of this survey perceive risk, both the political theory and cultural theory of risk assessment both rely heavily on ideology to explain how individuals perceive risk. As has been discussed previously, ideology has been definitively shown to be statistically significant in all regression equations presented in this paper. Education, another demographic variable tied in with political theory, is significant in all four risk regressions. Age is significant in two equations, and gender in one, so it is difficult to draw any firm conclusions from these results. However, age, and ideology were all significant in the final regression equations, indicating that these variables do play a large role in an individual's support for a given salmon recovery policy.

I showed earlier that salmon in the Pacific Northwest can be classified as 'advantaged' according to social construction theory: they are positively constructed and possess political power. The results presented here show that salmon are positively constructed among members of Oregon's general public. There is a strong correlation between level of risk associated with a threat, and level of support for policies to address that threat, indicating that when the public perceives a threat to salmon, there is a willingness to address that threat.

Removal of hydroelectric dams still does not enjoy vast public support (while 50.7% of respondents identified dams as presenting a 'high' or 'very high' level of risk to salmon, only 15.4% identified that same level of support for removal of dams). Even without a high level of public support, policies are being enacted to address this threat, indicating salmon still possess a great deal of political power. While the removal of large dams (e.g., those on the Klamath River) still is a political and financial quagmire, many

small dams (e.g., Marmot Dam on the Sandy River, Oregon, and Elwha Dam on the Elwha River, Washington) have been removed, to the benefit of salmon.

As noted earlier, any policy decision carries with it both benefits and burdens, and salmon recovery policies are no exception. Many of the policies that benefit salmon have a negative economic impact on other industries (Huppert 1999). As a result, such high levels of support for the recovery of salmon stocks necessarily indicate a willingness to sacrifice economic benefits in other areas.

Salmon recovery will continue to be a prominent, and complicated, issue in the Pacific Northwest. As has been shown previously, many factors go into determining how individuals perceive risk associated with threats to salmon recovery, and whether they support policies to address these threats. It has been shown in this paper that perceived risk is directly, and strongly, associated with level of support.

Policy recommendations

Social construction theory of public policy holds that advantaged target populations are the recipient of beneficial policies from policymakers. One needs look no further than the current debate about whether to euthanize sea lions in the Columbia River to protect salmon populations to see a policy that benefits salmon, while burdening another target population (in this case, California sea lions).

As noted above, target populations are not static. Political power shifts, and constructions change, and target populations move from one category to another. For salmon populations to continue to be considered advantaged, they need to maintain political power and a positive construction. While political power remains relatively steady (the number of NGOs devoted to a type of animal is fairly constant), public

perception can change rapidly. As this study has shown, there is a very strong correlation between the perceived risk associated with a threat to salmon recovery, and level of support for policies that would benefit salmon. As long as they are considered advantaged, salmon will continue to benefit from policy decisions. The ability to increase the perceived risk of threats from the 'four H's' will go a long way to ensuring that salmon remain in the advantaged category.

At first glance, if one hopes to increase support for many salmon recovery policies, the commonsense solution would be to educate the general public about the risks associated with these threats to salmon recovery. This, however, is not the case. To say there has been a concerted effort to provide this education in the Pacific Northwest would be an understatement. As demonstrated by the high numbers of respondents perceiving many of these threats as high risk, the general public is clearly aware of the dangers posed by these manmade conditions.

Threats posed by hatcheries are the exception to that rule. Only 13.4% of respondents classified the risk posed by hatcheries to be 'high' or 'very high', and only 5.9% of respondents expressed a similar level of support for the elimination of hatcheries. As illustrated earlier, research is beginning to more clearly show the dangers posed by hatcheries, and with increased education will likely come an increase in perceived risk.

It has been shown conclusively in this paper that when it comes to salmon recovery policy, ideology affects an individual's decision-making at every level: it influences, to a statistically significant level, both their perceived risk and level of support for a given policy. A set of values and beliefs, ideologies, by their nature, frame the way an individual views an issue. Any ideology, whether conservative, liberal, or

moderate, frames the issue of salmon recovery in a certain manner. These values and beliefs are usually firmly ingrained within an individual, and do not change easily. While increased education may lead to a higher perceived risk with regard to certain salmon recovery policies, there will be a constant conflict between what an individual knows about a certain issue (and how risky it is), and what their ideology says about that issue. This dynamic can make changing salmon recovery policies more difficult.

If healthy salmon populations are the desired outcome, then there is a need for policies that directly address all four H's. Until these policies are implemented, there is likely to be little to no change. In order for this to happen, the general public needs to be supportive of addressing these threats. This paper has shown that having a bachelor's degree significantly affects how an individual perceives risk, and that ideology, along with perceived risk, are significant factors in determining whether an individual supports these policy actions. Oregon is known for its progressive politics and liberal tendencies, and has an above average (nationally) percentage of the population with a bachelor's degree or higher (U.S. Census Bureau). These conditions seem to indicate that if there is to be real policy change enacted to aid salmon recovery anywhere, Oregon is a likely candidate to be leading the way.

This is a process that will have to happen gradually; the views of the general public do not change overnight. Given this data, perhaps the best course of action is to begin by addressing the policies that received the most support among respondents. Urban stream protection and policies that address forestry and agricultural process both had a level of support (those responding 'high' or 'very high'), and policymakers would be wise to address those issues that garner the highest level of public support. Once these

issues are addressed, the challenges of tackling the issues with lower levels of support (dam removal and elimination of hatcheries) can begin to be addressed.

Limitations

As with all surveys, question wording, refusals, and other difficulties encountered in the implementation of surveys can result in some measure error or unintended bias in responses. While the researchers who designed the survey tailored it to meet their needs, the questions asked did not perfectly fit with the analysis contained in this paper. The scope of this analysis was limited to the questions asked through the survey. There were demographic variables not included in the survey that may have been useful in determining levels of support, including occupation, and membership in an NGO.

The design of the survey could lead to bias in the reporting of perceived risk and levels of support. The survey is laid out so that respondents are asked to indicate their level of support for a given policy immediately after indicating their perceived risk. After indicating their level of perceived risk, respondents may be inclined to list a corresponding level of support, in order to ensure a socially acceptable response. In the future, questions addressing perceived risk and level of support could be listed on different pages, in order to minimize respondent bias.

When analyzing the literature, the four H's appear time and time again. While this survey addresses three of the four, the fourth (harvest) does not appear. Ideally, all four main threats to salmon recovery would have been included in this analysis.

While the literature has shown that salmon are considered advantaged, it could be argued that salmon be considered dependents. Dependents often are the benefactors of symbolic policy. Symbolic policy seems beneficial, and makes the policymaker look

good, but in reality offers little benefit to the target population. In today's world, the benefits of restoring salmon populations must be balanced against the realities of economic and social interests when it comes to the "four H's".

Dependents regularly receive an inordinate portion of the burdens created by a given policy. As Schneider and Ingram (1993) write, "burdens for powerless groups who are positively constructed…may be justified as an efficient mechanism to protect the individual from harm or to achieve public purposes" (340). This statement rings especially true in the case of salmon in the Pacific Northwest. Even when listed under the Endangered Species Act, there is an acceptable mortality level from threats to salmon, including dams, habitat destruction, and many forestry and agricultural practices. Salmon are clearly positively constructed, which both advantaged and dependent groups are. However, the abundance of NGOs that exist to protect salmon runs seems to indicate a wealth of political power that does not exist in dependents.

Conclusion

Salmon recovery is certainly an issue that is hard to avoid in the Pacific Northwest. The many interests competing with the fish (electric companies, developers, etc.) create a strain on salmon that has proven difficult for those who manage fish populations to balance. I have mentioned studies that show those who live in the Pacific Northwest are willing to pay a substantial amount to ensure the survival of salmon here, and shown a strong relationship between perceived risk and level of support for addressing threats to salmon recovery.

The stated purpose of this paper is to determine the effect that risk perception has on the level of support for various salmon recovery policies in the Pacific Northwest. The

regressions presented previously show that very few factors consistently affect the decision-making process of individuals in regard to salmon recovery. Ideology conclusively affects both perceived risk of certain threats to salmon recovery, and support for policies to address this recovery. In each case, those identifying themselves as liberal are more likely to have a higher perceived risk, and a higher level of support. Level of education and how respondents view the health of Oregon's ocean fisheries are also important determinants in how they perceive risk associated with threats to salmon recovery. Perceived risk does play a significant role in determining an individual's level of support for a given salmon recovery policy action.

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