The Salmon Restoration Economy of Puget Sound: History, Drivers, and Future Predictions

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Abstract

In the Pacific Northwest, USA, the cumulative impact of human development has caused decades of salmon habitat degradation and the listing of multiple populations under the US Endangered Species Act. As a result, the need for implementation of recovery goals has encouraged the development of an economy focused on salmon habitat restoration; a microcosm of the greater *restoration economy*. In order to define the *salmon restoration economy*, this case study summarizes the history of salmon restoration in Puget Sound, WA, and describes the drivers leading to the funding of these restoration actions. As recovery of salmon is not being accomplished by one party alone, this study utilized a survey sent to multiple sectors of restoration professionals within the region. Through this, key players involved in the *salmon restoration economy* were given a voice to describe how they view drivers of restoration funding both now and in the future. The survey responses revealed the potential for a shift from the most common driver, grant availability, to other drivers in the future, as well as both positive and negative reactions to the overall direction of the *salmon restoration economy*.

Introduction

Multiple species of imperiled salmonids are present in the Pacific Northwest, USA, reflecting decades of salmon habitat degradation and overfishing (WDFW 2011a, WSRCO 2020a, WSRCO 2018). This has led to the listing of certain salmon populations under the US Endangered Species Act (ESA) since 1991 (WDFW 2011a). The need for implementation of recovery plans to restore habitat and resilience for these fishes has encouraged the development of an economy focused on salmon habitat restoration; a microcosm of the greater *restoration economy*

(BenDor et al. 2014). This case study explores multiple aspects of the *salmon restoration economy*, in Puget Sound, WA, including the drivers leading to the funding of restoration actions. This is accomplished through a review of the cultural history of salmon use and management in Washington state, a discussion of the importance of restoration, the definition of a restoration economy, and how the *salmon restoration economy* is unique. Further, a survey sent to multiple sectors representing restoration professionals involved in the Puget Sound *salmon restoration economy* was conducted to better understand their perspective of drivers of restoration funding both now and into the future. Opinions of the key players surveyed in this study showed how drivers such as grant availability may be considered a common current driver, how drivers may shift in the next 25 years, and that there are shared topics of both positive and negative opinions on the current and future status of the *salmon restoration economy.*

History

Salmon are both an ecological and cultural keystone species, essential to the function of Puget Sound ecosystems and a key component in the history and culture of past and present Pacific Northwest societies (Garibaldi and Turner 2004). Found in both fresh and marine waters around Washington state, native salmon have historically been used for food and commercial purposes, as well as traditional ceremonies. Salmon are especially fundamental in Puget Sound's economy, environment, and culture for local tribes. The lives of Native American tribes were reliant upon the abundant natural resources found in western Washington, particularly depending on the harvest of all five native species of Pacific salmon (NWIFC 2020a). As the colonization of North America spread west and north, booms in shipping, agriculture, and

disease greatly affected local Native Americans (Wilkinson 2015). During Washington's transition into statehood in the 1850's, treaties were negotiated with the regional tribes (NWIFC 2020b). However, the influx of Europeans and newer technology challenged the Native Americans' ability to fish in their accustomed way. As tensions grew over time, the battle over fishing rights between tribes and the U.S. government came to a turning point during the Fish Wars of the late 1960s and early 1970s (NWIFC 2020b). In 1973, an inflammatory call by the Washington Department of Fisheries proposed designating only one-third of fish to the Native American tribes, sparking unrest and leading to the case of *US v. Washington* (Wilkinson 2015). From this trial, the 1974 Boldt Decision moved from their previous allocation of one-third to a 50-50 share of fishing rights between tribes and non-tribal fishermen. The surprising division, which designated half of the harvestable surplus of salmon and steelhead in their traditional fishing grounds to the tribes, also established tribes as co-managers of fishery resources with the State of Washington. As co-managers, the State and tribes now develop management strategies for fisheries and hatchery programs, including restoration efforts, defining salmon fishing seasons, and establishing hatchery production targets (NWIFC 2020a). In 1985, the Puget Sound Salmon Management Plan was created to help implement the principles set out in the Boldt Decision (NOAA 2020a).

Management

As issues surrounding the protection of salmon runs and habitat continued in Puget Sound, the need for partnership and strategic management intensified. The state of salmon in Washington state arrived at a new tipping point in 1991 when the reality of diminishing stocks lead to the ESA listing of the Snake River sockeye salmon (*Oncorhynchus nerka*) (WDFW 2011a). This was

the first time a Pacific Northwest salmon met the concerning criteria for ESA listing. Later in 1999, the Puget Sound Chinook salmon (*O. tshawytscha*) was listed under the ESA (NOAA 2020a). Fueled by the continuous downward trend of federally listed salmon runs, despite efforts to improve populations, the Salmon Recovery Act was enacted in 1999 by the Washington State Legislature setting up project funding, review boards, and a framework for volunteer efforts (RCW 77.85.005). By 2005, the Puget Sound Salmon Recovery Plan (PSSRP) was enacted, which was consolidated and expanded upon in the subsequent 2017 Chinook Salmon Implementation Plan (CSIP). Both plans were aimed to spur action within the same region, with the PSSRP designed for restoration on specific Chinook salmon habitats and the CSIP supporting individual watersheds in implementing their own actions (PSP 2020). It is important to note that there have been efforts by many agencies to provide structure to salmon restoration within Puget Sound, beyond what is discussed here. For example, between the creation of the PSSRP and the CSIP, Washington Department of Fish and Wildlife (WDFW) published their 21st Century Salmon and Steelhead Initiative in 2009, working to create an integrated management framework for salmon recovery (WDFW 2009). With a multitude of projects, programs, and restoration groups working towards similar goals, efforts to track recovery actions and their efficacy have also been established. Examples of this include WDFW's SCoRE (Salmon Conservation and Reporting Engine) working to keep track of data associated with salmon recovery (WDFW 2011b) and the Effectiveness Monitoring Program led by the Puget Sound Partnership (PSP), a Washington state agency focused on managing the development and implementation of ecosystem recovery goals within Puget Sound (PSP 2020).

The Importance of Restoration

Partnerships and recovery plans have become particularly important as modernization continues to take its toll on sensitive fish habitat. In the freshwater and estuarine systems of Puget Sound, salmon populations are especially vulnerable to nearby human impacts. As anadromous fish, salmon return to their natal streams by relying on olfactory cues to navigate from marine waters to their freshwater spawning grounds (Dittman and Quinn 1996). This strong biological drive to revisit their natal stream, regardless of habitability, creates an unfortunate opportunity for spawners to return to altered or destroyed habitats where they may be unable to successfully reproduce. While some individuals will stray to different locations (Labelle 1992), and stray at higher rates where disturbance is greater (Quinn 2005), the broad-scale modification of stream habitats throughout river networks results in reduced habitat that is available for successful reproduction. Beyond availability of quality spawning habitat, human alterations of nearby land can reduce important habitat, negatively alter estuaries and eelgrass beds, and introduce harmful pollutants such as polychlorinated biphenyls (PCBs) (Simenstad and Cordell 2000, Mumford 2007, O'Neill and West 2009). US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) suggest the degradation of rearing and spawning habitat as the leading cause of diminishing populations. Additional factors, including overfishing and structural barriers such as dams or culverts that limit movement, further constrain recovery of imperiled populations of salmon (WDFW 2011a). The cumulative impact of intentional and unintentional negative interactions with the habitat of these keystone species has created a need for managing and implementing

recovery goals. In an effort to attend to this need, an economy focused solely on salmon habitat restoration developed: the *restoration economy* (BenDor et al. 2014).

Restoration Economy

In recent years, researchers have recognized the need for, and worked to define, the *restoration economy*. From their studies, they've shed light on an economy formed by the intention to restore ecosystem habitats; a concept encompassing a wide breadth of activities. For example, one degraded site in need of ecological restoration may require a multitude of actions such as: construction companies to fill and grade, landscaping companies to design and install native plants, nurseries to provide vegetation, and environmental consultants to monitor growth (BenDor et al. 2014). While some may use the term *restoration economy* to define a period of time where site restoration is more dominant than site development (Cunningham 2002) or to quantify the money produced by environmental restoration actions (BenDor et al. 2014), the definition has morphed over time. In 2002, Storm Cunningham's breakthrough definition of this concept included both ecological and non-ecological built functions of the economy. In recent years, Todd BenDor and his colleagues (2014) have refined and narrowed the term *restoration economy* to describe how acts of restoration within the natural environment have created their own economic impact. In this case study, it is argued that the term can be further distilled into specific categories within the *restoration economy*, narrowing the term to the restoration of one taxa group.

Salmon Restoration Economy

The Puget Sound basin is a prime example of how a *restoration economy* can be focused on the recovery of one taxa group: Pacific salmonids. Puget Sound, the fjordal estuary carved into western Washington state, is host to a bustling coastal community, providing Seattle with its unique waterfront views and supporting ecologically and culturally significant fish and wildlife. It is also host to freshwater and marine habitat important for the five Pacific Northwest salmon species that are found within its waters (Simenstad et al. 1982). Additionally, protections are in place for ESA-listings, and salmon have high cultural significance for native communities in this area. All these elements make restoring salmon in this vast Pacific Northwest estuary of high importance. Furthering the need for restoration efforts, there is an ongoing, increasing clash between the preservation of natural habitat and the accommodation of the booming Seattle-area demand for office and living space. As remote working options and housing prices increase, the drive to move further into the suburbs and nearby rural areas places a strain on the region's balance of nature and people. Beyond new construction projects built to accommodate population growth, there is also a demand to replace past engineering efforts, such as bulkheads, that are known to potentially alter the behavior of salmon populations (Toft et al. 2007). Negative influences on salmon habitat can be seen in shoreline armoring, human development within habitats, population growth, and loss of shade-producing vegetation, amongst others (WSRCO 2018). With these problems come the opportunity for both humanitarians and opportunistic businesses to mend lost habitat through restoration work. In Puget Sound, the term *restoration economy* can be applied and narrowed to the *salmon restoration economy*, defined as: investments in the development and implementation of

restoration projects for the purpose of recovering salmon species. While research has supported defining and quantifying the general *restoration economy*, diving into the specifics of the *salmon restoration economy* may provide fresh insights for restoration professionals. The goals of this case study and research are to learn: 1) what currently drives the funding of salmon habitat projects within Puget Sound, 2) who the key players in this economy are, and; 3) how drivers may shift in the future.

Research Objectives

Research Purpose

The purpose of this case study is to define and discuss the *salmon restoration economy* in Puget Sound. By defining this topic, the case study will also summarize the history of salmon restoration in Puget Sound, describe the major drivers of funding these restoration efforts, and synthesize professional opinions presented in survey results about how these restoration funding efforts may change in the future. Therefore, this paper is a combination of two efforts: a literature review helping to define the *salmon restoration economy* and a survey given to salmon restoration professionals, intended to gather the opinions of those directly involved in the *salmon restoration economy*.

Research Questions

The initial literature review was conducted with the purpose of gaining a better understanding on the following questions:

- What is the history of salmon restoration in Puget Sound?
- What is the definition of the *salmon restoration economy*?

- Who are the "key players" associated with the *salmon restoration economy*?
- What factors drive the funding decisions associated with the *salmon restoration economy*?

The survey, as well as its subsequent analysis and synthesis, aimed to answer the following:

- Where is value currently highest in the *salmon restoration economy*?
- Is the *salmon restoration economy* benefitting salmon?
- Where do key players see the *salmon restoration economy* going?
- What are the important next steps for the *salmon restoration economy* and its funding?

Methods

Literature Review – Sectors and Drivers

To understand salmon restoration efforts and their connected economy in Puget Sound, it is important to recognize that there are multiple sectors, with associated individuals who work within each sector as key players. These sectors work both separately and together to reach the regional goal of sustainable habitat for salmon. In order to name each sector within the *salmon restoration economy*, there first needed to be an understanding of groups involved in salmon recovery projects, using a literature review and consolidating ideas from sources such as agency websites and publications, peer-reviewed journal articles, textbooks, news articles, and tribal associations (Appendix A).

After designating the sectors (Table 1), it was clear that the demand for an action, such as funding salmon habitat restoration projects, is created by a driver (BenDor et al. 2014). The driver literature review incorporated research from similar sources such as agency websites and

publications, peer-reviewed journal articles, BenDor et al. 2014, PSP 2020, and Bell et al. 2003 (Appendix A). The driver names were then extrapolated from the presenting topics (Table 2).

Key Player Survey

Within each sector identified by the literature review, individuals with expertise in salmon restoration were recruited based on their job title (e.g. fisheries biologist, habitat program manager, assistant professor) and work experience stated on their employer's website. These individuals were considered key players and were targeted for the survey exploring their perspectives with regard to the past, present, and future of the Puget Sound *salmon restoration economy*. In this study, each individual who was contacted for the survey was considered a key player, associated with their current employer and the sector that their place of work fell within. It is possible that participants have historically worked in multiple sectors during their career. In some cases, the opinions presented by one individual may be a sum of their career experiences, rather than an opinion formed purely within one sector. All key players contacted for the study work for groups, and on projects, located within the Puget Sound region. Recognizing that the geographical definition may differ between who is using the term, for the purpose of this research the Puget Sound region includes the coastal area of the Salish Sea from Olympia, WA up to the Canada-U.S. border. Utilizing this extent allowed for the inclusion of regional salmon restoration groups and businesses throughout Washington's Puget Sound area that often interact with one another in regional goal setting and recovery programs.

Approximately 60 survey participants from across the Puget Sound area were identified through their agency or company website. At least ten professionals were contacted to

participate from the six different sectors (Table 1) identified by the literature review, with each key player involved in the study or planning of salmon habitat restoration efforts. Each candidate was sent an email describing the study, requesting their participation in the survey, and explaining the research project, confidentiality, and providing the investigator contact information. The survey provided no monetary compensation for participants. If consent was given to participate in the survey, a follow-up email was sent with a link to the live survey. The live survey was created through the platform Qualtrics, an online surveying service provided to students through Oregon State University. The survey asked nine questions, including requests for the professional's opinion of the current status and future of the drivers contributing to the Puget Sound *salmon restoration economy.* After acquiring the survey results, the qualitative and quantitative information was compiled, analyzed, and synthesized.

Survey Questions

1) Which of the following categories best describes your organization?

- Government Agency
- Tribe
- Non-Profit/Salmon Restoration Group
- Private Sector/Consultant
- Local Government (City, County, State)
- University Researcher

2) How would you describe your role as it relates to salmon restoration projects? (ex: Fish Biologist)

3) In your opinion, what level of availability best represents current funding of general salmon restoration in Puget Sound?

- High Availability
- Medium Availability
- Low Availability

4) In your opinion, what level of efficiency best represents the total effort of all organizations in restoring salmon habitat over the last 25 years?

- High Efficiency
- Medium Efficiency
- Low Efficiency

5) Funding for restoration projects comes from a variety of sources. This funding provides the foundation for the salmon restoration economy. Which do you feel are the biggest drivers for current salmon restoration project funding? (Choose two)

- Regulatory (ESA, mitigation requirements, etc)
- Workplace Mission Statements and Initiatives
- Sales (tourism, fish markets)
- Community Interest and Pressure
- Grant Availability
- Recreational Fishing
- Other

6) Do you believe the drivers of restoration funding will change in the next 25 years?

- Yes
- No

7) What do you think the biggest driver will be for the salmon restoration economy in 25 years?
(Choose one)

- Regulatory (ESA, mitigation requirements)
- Workplace Mission Statements and Initiatives
- Sales (tourism, fish markets)
- Community Interest and Pressure
- Grant Availability
- Recreational Fishing
- Other

8) Do you have any suggestions to increase funding for salmon restoration in Puget Sound?

9) Do you have any additional thoughts on the salmon restoration economy and its future?

Results

Literature Review – Sectors

Based on the literature review (Appendix A), six main sectors involved in the Puget Sound *salmon restoration economy* were identified including: **tribes, non-profits, consultants, local governments, state and federal government agencies, and university researchers** (Table 1).

Table 1. Summary of sectors associated with the salmon restoration economy.

Sector	Description
Tribe	Before industry and settlements made their way to Puget Sound, local Native American tribes had been interacting with salmon and their habitat. Tribes have been co-managing salmon habitat and its restoration efforts with government agencies such as WDFW and the State of Washington since 1974. In the Pacific Northwest, the Northwest Indian Fisheries Commission (NWIFC) brings together 20 western Washington tribes, many of whom are situated within the Puget Sound basin and involved in restoration efforts. Tribal biologists present a unique outlook on the *salmon restoration economy*, as the impacts on salmon health ripple through their historical way of life, culture, and treaty-protected harvest rights. These tribes are also involved in the Pacific Salmon Treaty, Pacific Salmon Commission, and Pacific Fisheries Management Council, all of which aim to protect salmon stocks through management ranging from local to international levels (NWIFC 2020c).
Non-Profit	Throughout the Puget Sound region, non-profits and salmon-specific restoration groups provide education, planning, construction management, volunteer coordination and on the ground labor to help protect and restore salmon habitat. Non-profits range from those whose goals encompass regional environmental sustainability to small aquatic and terrestrial restoration projects. While some non-profits focus on designing and performing restoration projects and programs, others focus on land acquisition and volunteer events. Within this sector and in addition to traditional environmental non-profits, there are Washington's Regional Fisheries Enhancement Groups (RFEG) developed in 1990 by the Washington State Legislature. A cohort of 14 individual units, RFEGs are led by their own board and assigned to an area based on watershed boundaries. Funding of RFEGs is acquired through grants, donations, and WDFW's commercial and recreational fishing license fees (WDFW 2020).
Consultant	In the private sector, many for-profit consulting firms include aquatic habitat restoration services. Environmental consultants can range from a

	single self-employed restoration biologist to a global firm encompassing thousands of employees with wide-ranging expertise. Consultants hired to design, implement, or monitor restoration efforts typically have educational degrees, training, certifications, and project experiences that qualify them to provide expertise on restoration projects. When funding is available for a restoration project, consultants may become involved through a multitude of avenues, including their presence on a roster list, their response to a Request for Qualifications or Request for Proposal, word of mouth, recruitment from a prime contractor to be a subcontractor, and various other means. While environmental consulting firms vary vastly in their project type and size, those included in this study specifically have experience in the development or implementation of salmon studies and salmon habitat restoration projects.
Local Government	Local government entities including city and county levels have been grouped into one sector. Funding for salmon restoration and enhancement projects may come through various routes under these types of governments. Local governments can require restoration project actions within their jurisdictional limits set through regulations such as municipal code and ordinances. Council member, mayor, and employee interests may spark the creation of planning teams or initiatives. In addition to these top-down impacts on local government led restoration efforts, community members within these jurisdictions also have the power to influence their local governments to take action on pertinent environmental issues through community meetings and communication efforts.
Federal and State Government Agencies	The sector: federal and state government agencies, includes all government groups except for city and county governments. There is widespread involvement from government agencies working on salmon restoration efforts in Puget Sound region. Government agencies have helped to spur the movement to protect salmon restoration, and are influential in their ability to fund projects and manage regional efforts. There are agencies that enforce the ESA for multiple species, including WDFW, or salmon-specific groups such as Washington's Salmon Recovery Funding Board and the Governor's Salmon Recovery Office. These designated offices and advisory boards go to show fish protectors and enthusiasts that Washington State and the federal government find a strong importance in developing teams to not only plan for, but implement restoration efforts.
University Researcher	Washington state hosts over 50 university and colleges throughout the state, with many located within the Puget Sound basin. For the purpose of this case study, universities offering baccalaureate degrees in biological sciences that employ department staff with active or past research involving restoration efforts within Puget Sound were included,

	as well as Puget Sound-based satellite campuses of larger universities. These higher education institutions are reliable sources of research regarding salmon including habitat restoration techniques and efficacy. Studies may occur as part of a student thesis, project through university professional staff, or as a part of an ongoing research program within a lab. Beyond actively researching and producing peer-reviewed, published articles on restoration, these researchers are also active as experts in the field to represent the scientific community on boards and committees and in joint efforts with local and federal government programs.

Literature Review – Drivers

Multiple drivers within Puget Sound lead to funding opportunities for the various sectors developing salmon restoration projects. These drivers, identified in the literature review (Appendix A), include: **regulatory, workplace mission statements and initiatives, sales, community interest and pressure, grant availability, and recreational fishing** (Table 2).

Table 2. Summary of drivers associated with the salmon restoration economy.

Driver	Description	Examples
Regulatory	With the listing of Puget Sound Chinook salmon in 1999 (NOAA 2020b), the development of the Salmon Recovery Act (RCW 77.85.005), and all subsequent implementation plans, partnerships and planning boards, regulations that ensure both ESA-listed and non-listed salmon habitat is protected has fueled the actions of many sectors.	Construction projects requiring action within or near a salmon-bearing steam may require specific environmental protection permits. Those permits provide work for consultants and reviewing agencies as well payment to agencies in the form of fees. On another development project, a mitigation plan may be required to counteract the negative impacts the project may have on salmon habitat. These regulations drive developers and consultants to create salmon restoration projects, paying into *the salmon restoration economy.*
Workplace Mission Statements and Initiatives	The Puget Sound basin is a diverse region, ranging from the state's most populated county, King County, to areas such as	In more populated areas, large tech companies such as Microsoft and Amazon have specific teams designated to focus on sustainable initiatives. An example of this is Microsoft's AI for Earth (artificial intelligence) program where

	Jefferson County which hosts less than 2% of King County's population (US Census Bureau 2020). Within this region lies many businesses, both small and large, that may have interest in supporting environmental restoration projects or developing sustainable programs.	they provide grant money to those utilizing their technology in salmon restoration projects (Pailthorp 2018, Microsoft 2020). These larger, eco-focused programs from typically non-environmental technology companies develop into opportunities to fund restoration projects. Smaller companies may not have such largescale projects, but instead utilize their money to support restoration projects and campaigns through avenues such as corporate sponsorships. An example of this is the non-profit Long Live the Kings' campaign where Miir, a reusable water bottle company, Anthony's seafood restaurants, and other local entities sponsor "Survive the Sound". This event turns salmon tracking devices into a funding campaign for their 501(C)(3) nonprofit (LLTK 2020). Furthermore, the mission of non-profits such as Washington state's RFEGs focus their project funding and efforts solely on community education and the planning and implementation of salmon habitat recovery projects as well as community education about the subject.
Sales	Sales encompass the market for salmon caught by commercial and local fishermen and money associated with salmon fishing tourism in Puget Sound. Those invested in sales associated with salmon species depend upon sustainable harvests to ensure the continuation of their business.	The economic impact of Washington's fisheries accounts for $1.4 billion annually (WDFW 2011c), which is contributed to by salmon-specific fishing and sales. Sales and tourism around salmon reaches beyond just fishing boats. It is estimated that whale watching in the Salish Sea brings in approximately $40–50 million each year (San Juan Visitor Bureau 2015 as cited in Seely et al. 2017), an activity focused mainly on seeing the ESA-listed Southern Resident Killer Whales (*Orcinas orca*), which rely on Chinook salmon (Hanson et al. 2010).
Community Interest and Pressure	The acknowledgment and interest in salmon in Puget Sound is apparent and can be seen in a range of places, including elementary school curriculums or painted on construction barrier walls in Seattle's tech-heavy	In some communities, their values create a willingness to pay for projects such as salmon habitat restoration. In these scenarios, an opportunity arises for community members to pressure their elected officials such as state representatives or city councils or local government planners to make funding choices that increase salmon restoration projects. Survey research on communities living in areas

	South Lake Union. Even if it may not align directly with a resident's highest priorities, the message is clear: salmon live here. However, among those salmon live 4 million people in the Puget Sound region (WSRCO 2018).	inhabited by salmon have indicated that the restoration of salmon and their habitat is strongly supported. In one study, the greatest support was shown by young, urban individuals (Smith and Steel 1997), characteristics that aptly describe Puget Sound's most active metropolitan area: Seattle. Beyond the city and its demographics, a 2003 study showed that coastal residents were willing to pay for coho salmon (*O. kisutch*) enhancement projects in their community (Bell et al. 2003).
Grant Availability	Stimulating many of the salmon restoration projects occurring in Puget Sound is grant funding. Whether it comes from Washington's Governor's Salmon Recovery Office and its Salmon Recovery Funding Board, or through a corporation such as Microsoft, grants provide the basis for many small and large recovery efforts. Grants acquired through agencies can be seen functioning throughout the region.	Through PSAR and the Salmon Recovery and Puget Sound Acquisition and Restoration grant funding tracker, co-managers the WA State Recreation and Conservation Office and the PSP are working to connect applicants with $124.5 million in salmon recovery grants. This funding is sourced from NOAA's Pacific Coastal Salmon Recovery Fund (WSRCO 2020a).
Recreational Fishing	Puget Sound provides an exceptional opportunity for salmon fishing, and with it the drive to protect salmon stock. Whether it is off a boat or throwing a line off a public fishing pier, the interest in recreational fishing is another driver of the *salmon restoration economy*.	Money invested into recreational salmon fishing is transferred from angler to WDFW through the purchase of a fishing license. Other examples of money from recreational fishing include equipment and the economic opportunity for fishing guides and business opportunities to assist local anglers in salmon fishing.

Key Player Survey

In the key player survey, 62 individuals were invited to participate in the study exploring economic drivers of the Puget Sound *salmon restoration economy*. Of the final number distributed, 27 individuals responded to the survey, giving the study a response rate of 44%. Out of the sectors from which key players were affiliated (Table 1), the highest response rate was from the government agency and non-profit sectors, while the lowest participation was from private sector consultants (Table 3).

Table 3. Number of participants involved in key player survey from each sector.

Sector	Participant Count	Percentage
Tribe	3	11%
Non-Profit	6	22%
Consultant	2	7%
Local Government	5	19%
Federal and State Government Agencies	6	22%
University Researcher	5	19%

Although the target population in this study focused on participants with experience specifically in salmon habitat restoration, the individual roles each participant plays in their respective sector led to a wide variety of job titles such as project managers, fish biologists, ecologists, habitat managers, and planners. After inquiring about the participant's sector and role, the survey included three questions specific to the funding of projects within the *salmon restoration economy*, seeking opinions on the current, past, and future of this funding. When asked about the current level of funding availability, 48% of respondents answered that there is low availability of funding for salmon restoration projects, 41% answered medium availability, and 11% answered high availability. Among sectors, only consultants and university researchers

described the funding availability as high. Both medium and low options saw responses from nearly all sectors, with medium availability chosen from all except consultants, and low availability from all except university researchers. The highest percentage of all responses came from government agency and local government sectors with the selection of low availability (Figure 1).

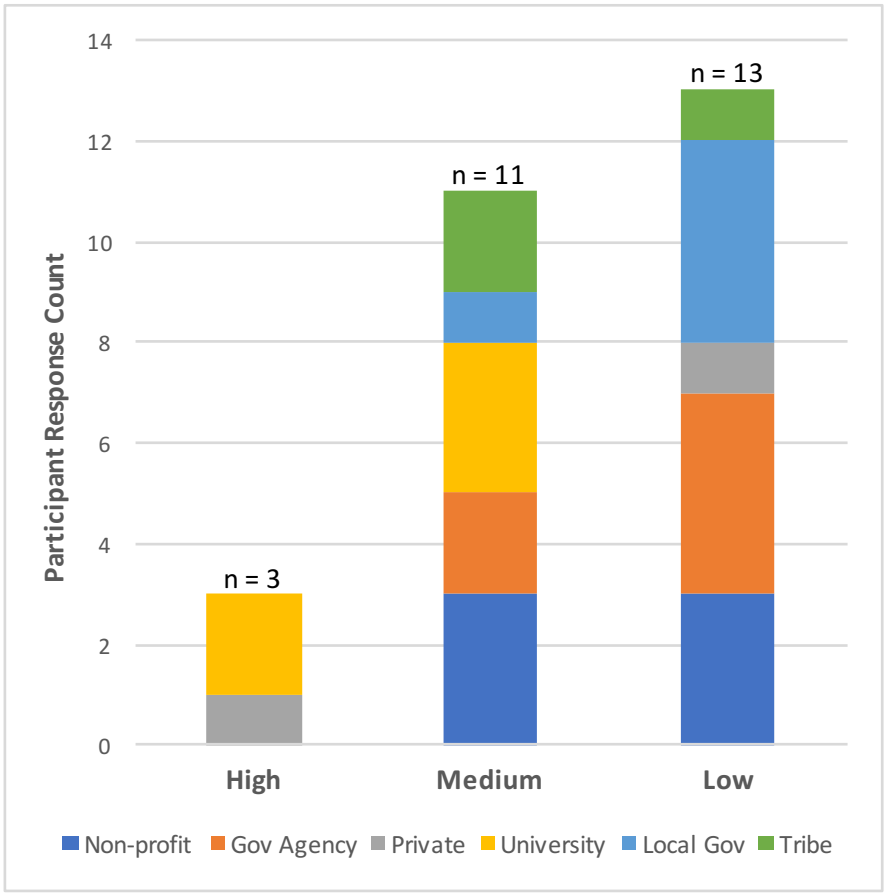

Figure 1. Participant responses to the availability of funding for salmon restoration projects in Puget Sound.

Over the last 25 years, the majority of respondents (74%) felt that the total effort of all organizations in restoring salmon habitat could be characterized as having medium efficiency. This is in contrast to the 22% who answered low efficiency and the 4% who answered high efficiency. All sectors responded in varying ways to this question, with minor patterns seen in

the data. The non-profit sector had one respondent choose high, medium, and low, whereas tribes and local government key players purely chose medium efficiency. The remaining sectors, government agency, consultant, and university researchers, spread out between medium and low efficiency, with all favoring medium over low efficiency except consultants who equally chose medium and low efficiency (Figure 2).

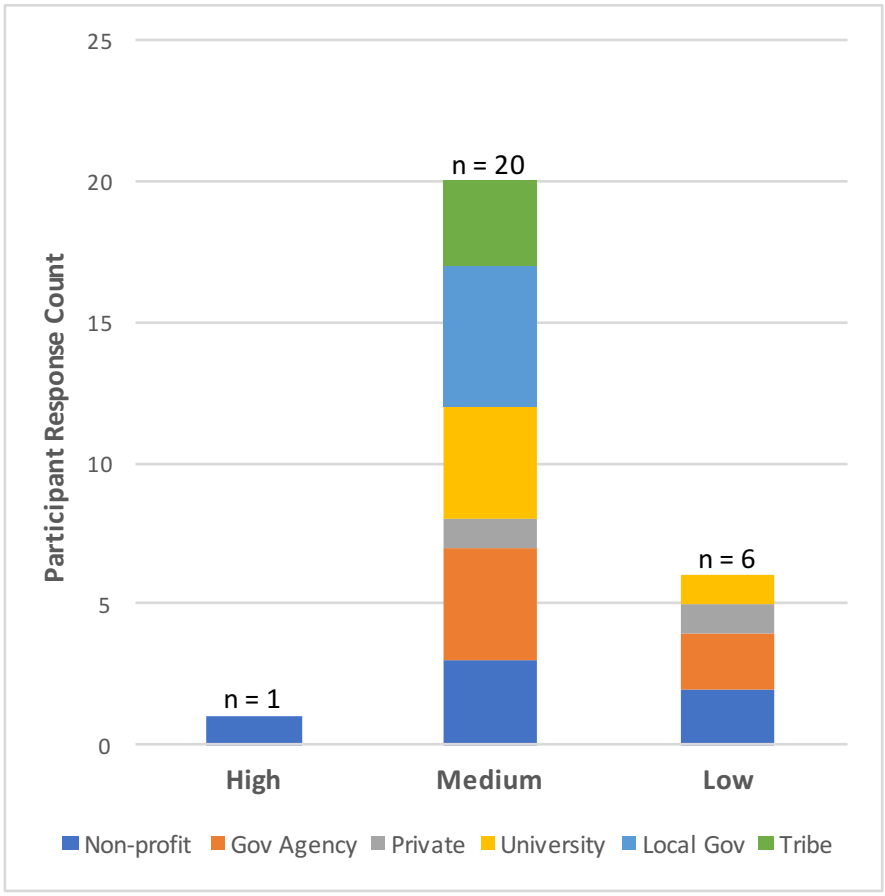

Figure 2. Participant responses to the funding efficiency of salmon restoration projects in Puget Sound.

Survey participants were asked to identify funding drivers (Table 2). Respondents chose two drivers, with the option to write in one of their own drivers under "other". Of the drivers listed, the most commonly selected driver was grant availability (43%), which every key player from the government agency, tribe, consultant, and local government sectors chose as one of their

two choices. The next highest selection was regulatory at 26%. Every key player, from each sector within the survey, chose either grant availability, regulatory, or both. Third was community interest and pressure at 15%. The least common drivers were workplace mission statements and initiatives (5%), sales (2%), and recreational fishing (2%). Four participants (7% of total answers) utilized the "other" option (Figure 3). Their alternative drivers included: 1) federal and state funding, 2) money, 3) strong tribal commitment and funding, and 4) treaty obligations. Of the six drivers plus the "other" option, all drivers were selected at least once by the participants.

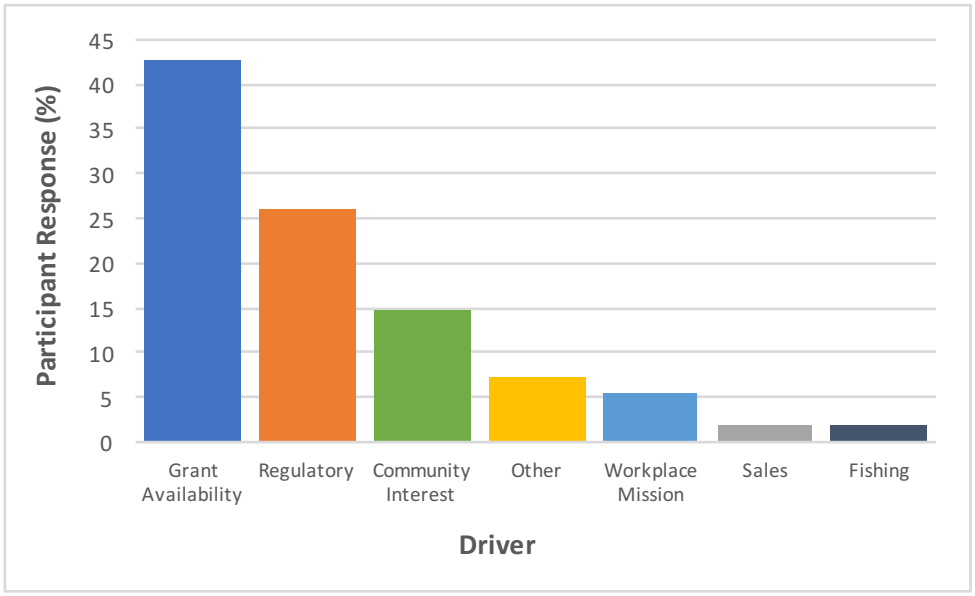

Figure 3. Participant responses on the main drivers of the current salmon restoration economy.

In response to whether the drivers may change in 25 years, 41% believed they would not change. Of the 59% who did believe that the drivers will change in the future, 44% answered that community interest and pressure will become the largest driver of the *salmon restoration economy*. Other respondents chose grant availability (25%), regulatory (12%), and other (19%) (Figure 4). For the three participants that chose to write in a driver under the "other" option,

their answers stated that they: 1) hope environmental justice and equity will become a driver of the *salmon restoration economy*, and that this driver may address both salmon habitat and other community needs consecutively, 2) think a future driver will be climate change related, and 3) are hopeful that state and local funding will increase as federal funding begins to diminish.

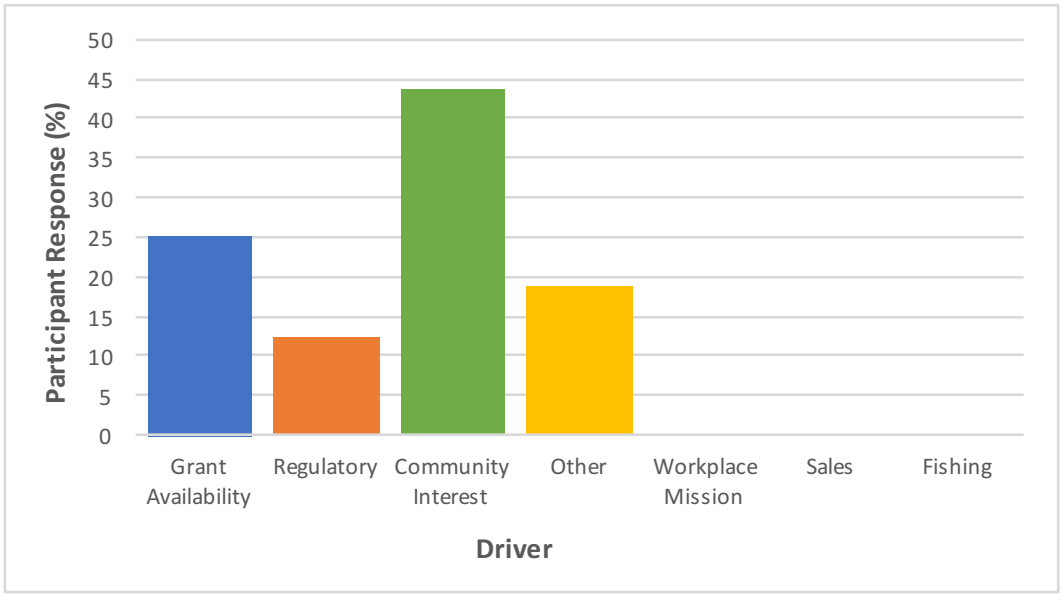

Figure 4. Participant responses on the main drivers of the future salmon restoration economy in 25 years.

The last two questions of the survey allowed participants to write in their opinions on salmon restoration project funding and the future of the *salmon restoration economy* within a text box. When asked if participants had any suggestions to increase funding of salmon restoration projects in Puget Sound in Question 8, five main topics emerged. To report the results of this write-in question, the responses under these five topics have been summarized in Table 4.

Table 4. Summary of participant responses to Question 8 regarding increasing funding for salmon restoration in Puget Sound.

Topics	Suggestion Summary
Alteration of Mitigation Practices	Four participants from government agency, university researcher, and consultant sectors discussed how current mitigation practices could be altered to better suit the needs of salmon restoration in Puget Sound. It was recommended that additional in-lieu fee programs should be added. Regulatory factors such as improvements to regulation and fines, as well as reducing regulatory barriers for small and medium size mitigation banks in order to reduce the high cost of their creation were suggested. Additionally, one consultant advocated for the establishment of salmon-specific mitigation banks to offset negative impacts from development near salmon habitat.
Private Sector Involvement	Four participants based in the non-profit, tribal, and government agency sectors recommended encouraging businesses and large donors to become more involved with the funding of salmon recovery projects. This could be a result of their corporate philanthropy policies, reduction of barriers such as match requirements, and increased public/private partnerships.
Education and Messaging	Five participants out of the consultant, non-profit, local government, and university researcher sectors discussed the importance of education. It was proposed that additional funding may be acquired if the public was more aware of the relationship between salmon and the survival of other local keystone species such as killer whales. There should be more messaging about how restoration is relevant to specific communities, how community members can help salmon, and how salmon recovery affects multiple facets of our region such as economy, culture, and environment. Another suggested that increasing available case studies on successful projects could help spur funding.
Changes to Funding Avenues	Ten participants from the tribal, local government, government agency, and non-profit sectors discussed changing funding avenues. Examples of their recommendations include developing fees associated with various forms of Puget Sound usage such as boating, increasing grant match requirements, developing a salmon restoration beneficiary program, and creating ways for those who negatively affect salmon resources to pay for their impacts by placing a monetary value on salmon habitat. Other suggestions include increasing federal, state, and local funding and incorporating programs that use fees or taxes for support. Also, it was

	recommended to create an initiative similar to 1% for the arts, utilizing capital funding specifically for salmon habitat restoration.
Political Pressure	Three participants from the university research and local government sectors discussed politics and their effect on the funding of salmon restoration projects. From their perspective, the community needs to value these projects and pressure their elected officials to do the same. However, it was mentioned that salmon and their habitat may need to be combined with other pressures such as flood capacity to be successful.

Key players were also asked if they had any additional thoughts on the *salmon restoration economy* of Puget Sound and its future in Question 9 of the survey. From these responses, five main topics emerged and were summarized (Table 5).

Table 5. Summary of participant responses regarding additional thoughts on the salmon restoration economy and its future.

Topics	Suggestion Summary
Population Growth and Competition for Space	Four participants from university researcher, local government, consultant, and non-profit sectors commented on the degradation of local habitat and shorelines due to the rapidly expanding population, urban growth, limited housing, and the resulting loss of habitat around the Puget Sound region. It was noted that the preservation of habitat integrity is more effective than restoring degraded habitat.
COVID-19 Pandemic	The current COVID-19 pandemic has created an uncertainty around the future of funding, mentioned by four participants from non-profit, government agency, tribal, and university researcher sectors. Due to the potential for new restrictions, cutbacks, and shifting budget priorities, there lies the potential for a loss in salmon restoration funding.
Update Funding Methods	Five participants from the consultant, university researcher, government agency, and local government sectors had creative ideas to update the methods used in salmon restoration project funding. For example, they suggested that regulation and the enforcement of resource management need to have aligned, clear goals. Additional suggestions include the reduction of complexity in grants and funding processes, increased regulatory reform to protect pristine habitat, and strongly pursuing restoration through litigation under already established acts and treaties. Moreover, one comment focused on changing the narrative from only salmon habitat restoration to

	broader watershed restoration projects as these initiatives have benefits that reach beyond just salmon, such as improved hydrologic processes and wetland ecosystem enrichment.
It Isn't Enough	From the non-profit, local government, and tribal sectors, five key players showed concern over whether the actions of restoration sectors in Puget Sound will ever be enough to truly restore salmon habitat. These concerns came from a lack of patience for long-term projects, too little funding for monitoring, small overall budgets, and a shortage in funding for projects at their larger, more appropriate scale. There was also a comment on the overwhelming impact of other environmental issues such as carbon input and fishing regulations.
Education and Messaging	From the non-profit and government agency sectors, two participants wrote that using education, outreach, and consistent messaging will help in the success of salmon habitat restoration project funding.

Discussion

The *salmon restoration economy* in Puget Sound incorporates funders and practitioners from diverse government sectors, non-profit organizations, private consultants and universities. To better define and understand how these participants utilized restoration funding in the past, and to assess their perspectives about the future of restoration funding in Puget Sound, this work focused on a review of the history of salmon restoration and its drivers in the Puget Sound region and a survey of organizations currently involved in habitat restoration efforts. Our historical review found that salmon are fundamental in Puget Sound's economy, environment, and culture. The history of salmon restoration in Puget Sound originated with local Native American tribes. Eventually, through the Boldt Decision, a co-management agreement developed between Washington state and the native tribes (NWIFC 2020b, NWIFC 2020a). While these two entities provide irreplaceable perspective on the protection and restoration of salmon habitat in Puget Sound, several additional key players are in the fight to protect and

restore native salmon habitat. In addition to government agencies and tribes, these key players work in multiple sectors of the *salmon restoration economy*, including local government, non-profit groups, consulting firms, and universities (BenDor et al. 2014, Cunningham 2002, NOAA 2020b, PSP 2020, WDFW 2020, Puget Sound Institute 2020). Each sector has their own experiences working within the Puget Sound *salmon restoration economy*. This study was designed to include the opinion of each sector in order to form a more cohesive understanding of the *salmon restoration economy*. After utilizing a literature review to discover which key players need to be represented in the study of the *salmon restoration economy*, a list of drivers that motivate the funding of salmon restoration projects was developed. These drivers, including regulatory, workplace mission statements and initiatives, sales, community interest and pressure, grant availability, and recreational fishing, create funding opportunities and push the key players in the *salmon restoration economy* to plan and implement salmon recovery projects.

In order to capture a broad set of perspectives about the past and future of the *salmon restoration economy*, experts from around the Puget Sound region were requested to participate in an online survey. The development of this 9-question survey created an opportunity for key players to contribute their opinions on whether their experience working in the *salmon restoration economy* supported the drivers proposed by researchers. If their experience pointed to similar drivers, the study could decipher the main drivers. If not, researchers would gain a better understanding of what should have been considered. Along with current drivers, the survey encouraged feedback on how drivers might change in the future and comments on the concept of the *salmon restoration economy* and funding of

projects in Puget Sound. In this study, opinions from each sector were utilized to better define this specific subgroup of the greater restoration economy, the *salmon restoration economy*. The results indicated some patterns of consistency among sectors, including equal agreement between government agency and non-profit respondents that the drivers of the *salmon restoration economy* will change in the future. While only two consultants participated in the survey, both consultants spoke of the need to reform mitigation bank programs to better enhance the ability of their sector to accomplish restoration projects.

Survey results further showed that those involved in the *salmon restoration economy* see the greatest funding driver as grant availability, a concept of importance also noted in studies such as Bates 2013 and Christian-Smith and Merenlender 2010. It was also pointed out by respondents that larger restoration projects tend to be a result of grants from government agencies. Every government agency, tribe, consultant, and local government member chose grant availability for one of their two driver choices. Non-profits and university researchers tied between grant availability and regulatory and university researchers. Surprisingly, no consultants chose regulatory as a driver. This was unexpected based on the job opportunities in consulting that result from regulatory needs such as ESA regulations and environmental permitting requirements. However, it is difficult to make a generalization about this due to the lack of participation in the consulting sector (Table 3). Overall, each sector and their key players showed a strong preference for both regulatory and grant availability as the drivers leading to salmon restoration projects in Puget Sound. This finding is consistent with the earlier literature review outcomes and the survey answers provided by participants which indicate a strong reliance on federal and state money to provide funding for restoration projects. Even with this

strong reliance, at least one participant from every sector indicated that support of this type of funding could waver in the future or that it needs to be reformed.

The inability to trust the future of funding, as well as the effects of the COVID-19 pandemic, may have led to 59% of respondents who thought the drivers may shift by 2025. While 44% supported the shift to community interest and pressure, grant availability still remained as the second highest choice of grant availability (25%) indicating that grant availability, regardless of an uncertain future, is still deemed a large driver of the *salmon restoration economy*, both now and in the future. The results also suggest that the habitat recovery projects being implemented are not highly efficient and have room to improve in order to better benefit salmon and their habitat. Other studies indicate that this may be due to a variety of reasons, driven by political (Wu et al. 2003) or ecological factors such as mismatching between habitat issue and restoration action (Barnas et al. 2015).

Participants provided strong opinions on the next steps of the *salmon restoration economy* and its funding. While some focused on the need for increased social programs such as education and outreach, others wanted to see a change in natural resource management and regulations. When designing the text box answers, community education and outreach was assumed to be mainly associated with non-profit restoration groups (WDFW 2020). However, these education comments came from four different sectors: private, non-profit, local government, and university researcher. This suggests that promoting community interest is seen as a way to influence future funding from many sectors, which may be why seven participants felt that community interest and pressure would transition into the highest scoring driver in 2025. Non-

profits such as Skagit Fisheries Enhancement Group, a local RFEG that was not included in this study, are familiar with hundreds of community members showing interest in salmon habitat restoration, utilizing this awareness in community-based habitat restoration projects and strengthening their relationship with the community around them (Murphy 2014).

This survey brought to light barriers associated with the *salmon restoration economy* and their ability to negatively affect the future of salmon recovery in Puget Sound, a concept similarly recognized in co-management studies (Pinkerton 1999) and studies on restoration monitoring in Washington State (Bash and Ryan 2002). The results from this survey study revealed a wide breadth of reactions to these barriers. A consultant and one university researcher spoke positively, using words like "hope" to describe how drivers may shift in the future. In the middle, respondents advocated for change in the current system. However, at the opposing end, several restoration professionals believe barriers may just be too high for success.

At least one representative from each sector wrote about either COVID-19 or Puget Sound's rapidly expanding population and urban growth as a barrier to salmon restoration project funding and implementation. Respondents from the local government, consultant, and university sectors spoke to this issue, describing salmon recovery as an uphill battle compared to the region's voracious need for developable land. Moreover, the COVID-19 global pandemic may alter where key players once saw the *salmon restoration economy* going. Several respondents on behalf of the non-profit, government agency, tribes, and university researcher sectors brought up the potential issues in funding that may occur over the next several years in reaction to the pandemic, potentially precluding future restoration projects. Additional barriers

included grant processes for government agencies and the high cost of creating mitigation banks for consultants. However, with a reduction in barriers that have the capacity for change, more restoration projects may be able to move forward and be successfully completed. Each sector represented in this study brought together different experiences and opinions, strengthening the conversation on Puget Sound's *salmon restoration economy.*

Lastly, multiple respondents supported the call for corporations to step up to the plate to assist with the barrier: lack of diverse funding sources. While key players currently suggesting the main driver as grant availability, the potential shift to community interest and pressure is supported in the respondents' awareness of a gap in funding opportunity. Private partnerships and corporate philanthropy projects associated with salmon restoration projects could help fund projects, while still benefiting the business by advertising their positive impact on the region. Although revealing a wide variety of opinions, within and between sectors, this study affirmed how important it is to include all key players, without which we may have lost important viewpoints as well as the topics and drivers they agree on.

While the survey results provided a window of understanding into how several professional sectors view the *salmon restoration economy* and its future, there are limitations associated with this study. These limitations include, but are not limited to: 1) A study with a larger sample size may provide a more complete dataset to analyze. Achieving equal representation of all sectors, by requiring the final count of the number of professionals under each sector be the same, may allow for the data to be divided by each sector and compared against each other for similarities and differences. 2) Other limitations were found in the wording and structure of the

survey. For example, in Question 1, the option local government listed city, county, state as examples. While the intention behind this was to refer to smaller government within the state of Washington, the word "state" should have been removed to avoid any confusion between the local government and government agency option, the latter of which should have included state agencies. This opened the opportunity for a respondent to choose their incorrect organization category. Due to the confidentiality of the survey it is impossible to tell exactly which name was associated with the Question 1 selection, however, for purpose of this study it was assumed that the participant chose their sector correctly. 3) Additionally, in Question 1, the option "other", with a mandatory write-in, should have been included in case the respondent had any confusion over which option to select. The write-in option would have allowed the survey reviewer to evaluate why the respondent felt that their sector did not fall in line with the presented options. Furthermore, collecting "other" write-ins may inform future studies on additional sectors that had been previously omitted, yet should be considered a member of the key players in the *salmon restoration economy.* 4) Additionally, Question 3 and Question 4 would have benefited from utilizing a Likert scale of 1-5, instead of low, medium, and high designations. This change would have been easier for the participant to quantify their answer, and more effective for the study when it came to comparing the final results. 5) Question 5 aimed to identify the drivers of the *salmon restoration economy*, however the meaning behind each term may have been misconstrued and could have used a more thorough definition. For example, a participant may have assumed that the grant availability driver meant that their sector could only work on projects if grants were available, versus reading it with the understanding that they noticed an opportunity in grant work and therefore chose to do a

project with a grant instead of alternative funding. Within the same Question 5, the driver recreational fishing may have overlap with sales when tourism is spurred by visitors who come to Puget Sound to fish. The potential overlap of drivers may have created a difficult choice for the participants. 6) The survey overall would have benefited from a small paragraph at the beginning of the survey that described the *salmon restoration economy* in detail so that each respondent could make their survey selections with the same concepts in mind. 7) Lastly, this survey was finalized and implemented during the COVID-19 pandemic. Even though the recruitment and survey were planned to be executed virtually, the ramifications of the pandemic may have affected the study. Multiple recruitment emails were returned as undeliverable, which may have been due to layoff. At least one email was returned as a result of designated government furlough days. Complications from the pandemic were also noted in the write-in comments from multiple participants due to potential shifts of funding and the government's prioritization of future funding shifting from natural resources to public health issues. In addition to problems posed by COVID-19, the answers provided in the midst of the pandemic may have been different than survey answers collected in late 2019 or early 2020.

Based on the survey, the *salmon restoration economy* is a concept that is, and will continue to be, relevant to the Puget Sound region. The restoration professionals involved in this survey provided thoughtful feedback on how to increase funding for salmon recovery in Puget Sound in the coming years. Those interested in the *salmon restoration economy* may utilize the lessons learned in this study and apply them to future research. In order to build upon the literature review and survey research accomplished in this study, it may also be of interest to research the *salmon restoration economy* in other regions of the Pacific Northwest or Canada,

and compare the survey results between Puget Sound and neighboring regions. Additional studies may help to supplement this research and strengthen the understanding of the *salmon restoration economy* and several follow-up studies are recommended: 1) This research project focused on the qualitative nature of the *salmon restoration economy*. A future study could be developed that focused on quantitative findings of a similar study, including the calculation and estimation of the sum of money involved in the *salmon restoration economy*. There may be potential to break down these findings into the estimated amount of money within each professional sector of the *salmon restoration economy*. 2) With the possibility of large implications on the *salmon restoration economy* from the COVID-19 pandemic and the ensuing economic impact, additional research into how funding has been affected by COVID-19 may be necessary as the situation continues to unfold. This new information may shift the current and future drivers of the *salmon restoration economy*. 3) As climate change progresses, there may be additional, unforeseeable consequences for the *salmon restoration economy.* These consequences may alter the drivers, funding, design, or other factors related to salmon habitat recovery projects. 4) In the future, a follow-up study could be designed to compare the predicted future drivers suggested by participants in survey Question 7 with the actual drivers of the *salmon restoration economy* in 2045.

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Appendix A: Literature Review References by Category

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