

RESEARCH ARTICLE

Non-stationary and interactive effects of climate and competition on pink salmon productivity

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Abstract

Pacific salmon (*Oncorhynchus* spp.) are exposed to increased environmental change and multiple human stressors. To anticipate future impacts of global change and to improve sustainable resource management, it is critical to understand how wild salmon populations respond to stressors associated with human-caused changes such as climate warming and ocean acidification, as well as competition in the ocean, which is intensified by the large-scale production and release of hatchery reared salmon. Pink salmon (*O. gorbuscha*) are a keystone species in the North Pacific Ocean and support highly valuable commercial fisheries. We investigated the joint effects of changes in ocean conditions and salmon abundances on the productivity of wild pink salmon. Our analysis focused on Prince William Sound in Alaska, because the region accounts for ~50% of the global production of hatchery pink salmon with local hatcheries releasing 600–700 million pink salmon fry annually. Using 60 years of data on wild pink salmon abundances, hatchery releases, and ecological conditions in the ocean, we find evidence that hatchery pink salmon releases negatively affect wild pink salmon productivity, likely through competition between wild and hatchery juveniles in nearshore marine habitats. We find no evidence for effects of ocean acidification on pink salmon productivity. However, a change in the leading mode of North Pacific climate in 1988–1989 weakened the temperature–productivity relationship and altered the strength of intraspecific density dependence. Therefore, our results suggest non-stationary (i.e., time varying) and interactive effects of ocean climate and competition on pink salmon productivity. Our findings further highlight the need for salmon management to consider potential adverse effects of large-scale hatchery production within the context of ocean change.

KEYWORDS

climate, competition, density dependence, hatcheries, ocean acidification, population productivity, salmon

[Correction added on 31-January-2022, after first online publication: The copyright line was changed.]

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REVIEW

A global synthesis of peer-reviewed research on the effects of hatchery salmonids on wild salmonids

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Abstract

Hatcheries have long produced salmonids for fisheries and mitigation, though their widespread use is increasingly controversial because of potential impacts to wild salmonids. We conducted a global literature search of peer-reviewed publications (1970–2021) evaluating how hatchery salmonids affected wild salmonids, developed a publicly available database, and synthesized results. Two hundred six publications met our search criteria, with 83% reporting adverse/minimally adverse effects on wild salmonids. Adverse genetic effects on diversity were most common, followed by effects on productivity and abundance via ecological and genetic processes. Few publications (3%) reported beneficial hatchery effects on wild salmonids, nearly all from intensive recovery programs used to bolster highly depleted wild populations. Our review suggests hatcheries commonly have adverse impacts on wild salmonids in freshwater and marine environments. Future research on less studied effects—such as epigenetics—could improve knowledge and management of the full extent of hatchery impacts.

KEYWORDS

artificial propagation, hatchery salmonids, hatchery supplementation, salmonid captive-breeding, salmonid enhancement, salmonid stocking

1 | INTRODUCTION

For over one hundred years, hatcheries have been used to propagate and release salmonids across the globe (Jonsson, 1997; Waples, 1991; Zaporozhets & Zaporozhets, 2004), largely to subsidize fisheries, attempt to mitigate for habitat loss and overexploitation (Araki & Schmid, 2010; Hilborn, 1992; Maynard & Trial, 2014) and, more recently, to try to rebuild depleted populations of wild salmonids (Berejikian & Van Doornik, 2018; Hagen et al., 2021; Hess et al., 2012). Hatchery salmonids currently underpin many recreational, commercial, and (in the lower-48 of the United States in particular) legally obligated mitigation and tribal treaty fisheries, but

the pervasive reliance on hatcheries remains contentious (Claussen & Philipp, 2022; Harrison et al., 2019; Kleiss, 2004). Although there is substantial evidence that hatchery salmonids generally have lower relative fitness than wild salmonids (Bouchard et al., 2022; Christie et al., 2014; Milot et al., 2013), continuing debate centers on the broad potential effects of releasing hatchery salmonids into nature and their potential impacts on sympatric wild salmonids (see Section 2 and Figure 1 for the definition of effect and impact), particularly when it comes to recovery of threatened and endangered populations (Araki & Schmid, 2010; Paquet et al., 2011; Young, 2013).

Evaluating and synthesizing the breadth of potential hatchery effects is complicated, however, because results may depend on

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FEATURE ARTICLE: REVIEW

From diatoms to killer whales: impacts of pink salmon on North Pacific ecosystems

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ABSTRACT: In response to a climate regime shift in 1977 and general heating of the North Pacific Ocean, pink salmon *Oncorhynchus gorbuscha* abundance reached record highs during 2005–2021, comprising 70% of all Pacific salmon. Pink salmon are approximately 25 times more numerous in odd- than even-numbered calendar years in some major North Pacific ecosystems, a unique demographic pattern analogous to repeating whole ecosystem treatment–control experiments. We found compelling examples indicating that in odd years, predation by pink salmon can initiate pelagic trophic cascades by reducing herbivorous zooplankton abundance sufficiently that phytoplankton densities increase, with opposite patterns in even years. Widespread interspecific competition for common-pool prey resources can be dominated by pink salmon, as indicated by numerous biennial patterns in the diet, growth, survival, abundance, age-at-maturation, distribution, and/or phenology of ecologically, culturally, and economically important forage fishes, squid, Pacific salmon and steelhead trout *Oncorhynchus* spp., seabirds, humpback whales *Megaptera novaeangliae*, and endangered southern resident killer whales *Orcinus orca*. In aggregate, the evidence indicates that open-ocean marine carrying capacity in the northern North Pacific Ocean and Bering Sea can be mediated by top-down forcing by pink salmon and by ocean heating, and that large-scale hatchery production (~40% of the total adult and immature salmon biomass) likely has unintended consequences for wild salmon, including Chinook salmon *O. tshawytscha*, and many other marine species. Further investigation of the effects of pink salmon on other species will increase our knowledge of ecosystem function and the important role top-down forcing plays in the open ocean



Pink salmon returning to Prince William Sound, Alaska hatcheries have contributed to record-setting abundances in recent years and to impacts on other marine species.

Photo: Preston and Teresa Cole, <https://taps-photography.pixels.com/>

KEY WORDS: North Pacific ecosystems · *Oncorhynchus gorbuscha* · Competition · Trophic cascade · Carrying capacity · Climate change · Ocean heating · Ecosystem services

1. INTRODUCTION

Some upper trophic level species play crucial roles in the natural histories of other species and the structure and function of ecosystems. Such interactions have been well documented in terrestrial (Carpenter et al. 1995, Painter et al. 2015), freshwater (Carpenter

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Hatchery strays could increase the risk of salmon suffocation in streams across Southeast Alaska

September 7, 2023 by Anna Canny, KTOO (<https://www.ktoo.org/author/anna-canny/>)



Chum salmon migration. (USFWS/Togiak National Wildlife Refuge)

In 2013, researcher Chris Sergeant was doing some routine water quality monitoring in Sitka’s Indian River when he noticed something strange on the oxygen monitor.

“It was getting close to zero — really, really low,” Sergeant said. “And there were fish dying off. Juvenile coho and cutthroat trout. And a high percentage of the adult salmon were hatchery strays.”

The stream was choked, filled with too many fish that couldn’t get enough oxygen. Salmon die-offs like that have been documented for at least a century, but their causes have not been well-understood. Now, [a new study](https://www.sciencedirect.com/science/article/abs/pii/S0048969723038706) (<https://www.sciencedirect.com/science/article/abs/pii/S0048969723038706>) by Sergeant and his research team suggests that a booming population of hatchery-raised salmon in Southeast Alaska could put pressure on thousands of miles of salmon streams that are already vulnerable due to climate change.

“We have too many salmon breathing too much oxygen,” Sergeant said. “It’s an unnaturally high population.”



The water in rivers and streams has dissolved oxygen in it, which salmon and other fish breathe through their gills. When those fish can't get enough oxygen, they can suffocate. In less extreme cases, low oxygen can slow salmon down on their strenuous trip upstream.

"They may not make those spawning grounds in time or have enough time to spawn," Sergeant said. "So there's a lot of really subtle effects in addition to just massive die-offs."

Scientists have long-warned that hatchery salmon can compete with wild fish for resources, including oxygen. And for more than half a century, hatchery production across Alaska has boomed, especially for pink and chum salmon.

Those populations are supposed to return to their hatchery when they spawn, but they commonly stray into wild streams. According to the study's authors, that could put wild salmon — including more desirable species like chinook, coho and sockeye — at a higher risk of smothering.

The study maps more than 10,000 miles of wild salmon habitat in Southeast Alaska that are close to hatchery release sites, creating the potential for overcrowded streams.

And salmon's risk of hypoxia is made worse by human-caused climate change. Rising water temperatures across the region have been linked to [salmon die-offs \(https://alaskapublic.org/2019/07/12/record-warm-water-likely-gave-kuskokwim-salmon-heart-attacks/\)](https://alaskapublic.org/2019/07/12/record-warm-water-likely-gave-kuskokwim-salmon-heart-attacks/) in recent years, and warm water holds less oxygen.

When hot temperatures are accompanied by drought, salmon streams are even more primed for hypoxia. That's because an ideal salmon habitat is rough and fast-flowing. That kind of water is oxygen rich.

"The more the water tumbles and foams, like a rapid, the more opportunity it has to exchange with the atmosphere," Sergeant said. "That tumbling motion of the water is basically injecting oxygen."

Climate change is expected to bring more precipitation to Southeast Alaska overall, but the region still faces a growing risk of drought. Extreme rainstorms are likely to be punctuated by longer dry periods, especially in summer. And declining snowpack in the mountains could also cause drought.

According to Ryan Bellmore, a US Forest Service researcher who co-authored the study, snowpack is like a bank account for the watershed.

"And we're more likely to go into the red," Bellmore said.

Water is saved in the high mountains in the winter and then melts gradually throughout spring and summer, feeding the rivers and streams. Without it, salmon streams could dry up and slow down in the summer heat, which could lead to low oxygen levels.

And as climate change puts pressure on Southeast Alaskan watersheds, cramped conditions may continue to strangle wild salmon.



Statewide Hatchery (1 proposal)

PROPOSAL 59

5 AAC 40.820. Basic Management Plans .

Amend Basic Management Plans as follows:

Reduce hatchery production to 25% of the year 2000 production as promised in 2000.

What is the issue you would like the board to address and why? There is an over-production of hatchery pink salmon that threatens wild Alaska stocks.

In 1996 Elfin Cove Advisory Committee put in a proposal to restrict hatchery production according to the original intent of rehabilitating wild salmon runs. They wanted a substantial reduction in current hatchery production. The hatchery managers complained the Board did not have the authority to set their production. After a thorough examination (approximately one year), the Attorney General ruled the Board does have the authority to regulate the number of eggs taken for production. The Board deferred the proposal and formed a hatchery committee to gather information. This committee was comprised of Board members Dan Coffey, Virgil Umphenour and Grant Miller. It took three years, a full Board cycle, with meetings in every region of the state, to complete the report.

The proposal was scheduled for the January- February 2000, a super meeting of Bristol Bay, AYK and Area M. The hatchery management met with the Governor and proffered that if the Board would not take up the proposal they would reduce their production by 25%. The Board meeting lasted 26 days, 10-16 hours a day, accepting the promise from the hatchery managers in the interest of time.

The marine productivity is currently in a very low cycle. The wild salmon are starving, many small systems are extirpated. Most of AYK stocks are not meeting escapement goals and have very little or no harvest of Chinook, chum and coho salmon. Hundreds of science papers indicate over production of hatchery pink salmon as a potential cause of declines in run strength and size for Alaska wild salmon stocks.

The purpose of this proposal is strictly conservation, to hold the hatcheries to their 2000 promise. The Board should require a substantial reduction in hatchery production so wild fish don't have to compete with hatchery fish for food.

PROPOSED BY: Fairbanks Fish and Game Advisory Committee (EF-F23-152)

State studies the potential for hatchery-only king salmon sport fisheries in Southeast Alaska

October 5, 2023 by Angela Denning, CoastAlaska



A king salmon is displayed outside a fish processor in downtown Petersburg in 2019. (Photo by Angela Denning/CoastAlaska)Audio Player

Wild king salmon stocks are in decline all over the North Pacific Ocean and Alaska. Outside Alaska, some are trying to conserve the fish by limiting sport fishermen to hatchery-only kings. That's being studied as a possibility for Southeast Alaska, too, but the idea is receiving a chilly reception so far.

British Columbia, Washington, and Oregon use what's called mark-selective sport fishing to help conserve wild king salmon or chinook. Anglers can only keep hatchery kings that have their fins clipped, a marking practice done at hatcheries before the juvenile fish are released.

"It's really about trying to vet another approach," said Judy Lum, the Alaska Department of Fish and Game's supervisor for sport fishing in Southeast Alaska. "So it was, 'Okay, well, they do it down here. Can it work for us? And if it can work for us, in what situations? What conditions? Or can it be broad brush? Or does it have to be very specific?'"

Lum stresses that they are only studying the possibilities. They don't know if a mark-selective fishery would help or hinder king salmon stocks or whether the benefits outweigh any potential costs.

“We have all these tools in our toolbox, so to speak for management,” said Lum. “And this would be just one additional tool to the toolbox.”

The question originated with the [Pacific Salmon Commission](#). The commission is a regulatory group of U.S. and Canadian governments overseeing the fairness of salmon management in both countries. Alaskans involved with the commission asked the state's Department of Fish and Game to consider the potential for a mark-selective fishery in Southeast. The department contracted with the University of Washington to do the study using grant money.

But so far, Alaskans haven't been receptive to the idea. The state has held community engagement meetings in Juneau, Ketchikan, Klawock, and Sitka. And Lum says they've heard a lot of concerns.

Derek Anderson attended the meeting in Klawock.

“A lot of people are upset,” he said.

Anderson and his wife own a fishing lodge in Craig on Prince of Wales Island. He says the meeting was standing room only and full of emotion — subsistence, commercial and sport users came together.

“The main voice was no, this is not a good program for Southeast Alaska, in any way, shape, or form,” he said. Anderson says they'd rather keep things the way they are and fish by [harvest limits](#), which recently has been a few fish per day for residents and two to three fish per season for non-residents. He says targeting just hatchery kings would hurt more fish. “There's just not enough hatchery fish in our waters to make that whole thing viable,” Anderson said. “If you're out there having to fish for hours on end to look for hatchery fish, and you're turning back wild fish after wild fish after wild fish, a lot of those fish end up dying.”

Fishermen in Sitka felt the same. Roughly three dozen people participated in the community meeting, including 74-year-old Eric Jordan. He is a life-long troller and says everyone was cordial, but no one wanted the program. “I think there was a lot of skepticism in the audience that this would be a good way to go here,” said Jordan. Jordan is a self-described conservationist and has participated in fish policy for decades, from local fish advisory councils to the state Board of Fish. He says for the program to work, it would have to address the harm of catch and release. “In the salt waters of Southeast Alaska, you're going to need to change the rules to minimize mortality,” he said.

How many kings in Southeast are wild or come from hatcheries varies by location. It's complicated because most of the kings (63%) originate in non-Alaska areas — both wild and hatchery stocks — and not all hatchery fish are marked.

Lum, with Fish and Game, says incidental bycatch is also a big concern for the state. Starting up a mark-selective sport fishery would be a years-long process that would require a lot of buy-in.

And there isn't hard data that the program is working elsewhere. Mark-selective fisheries have been ongoing for about 20 years in some locations in Washington. But has it really been successful? The jury is still out, according to Anne Beaudreau. She's an associate professor at the University of Washington conducting the state's study.

"There's so many different variables to that," she said. "And it's actually been a really hard question to answer."

So she says something like a mark-selective sport fishery may or may not work in Alaska. "Mark-selective fisheries are not a one-size-fits-all approach," said Beaudreau. "The way that they have been implemented, and the way that they've been managed has been different, depending on where they've taken place."

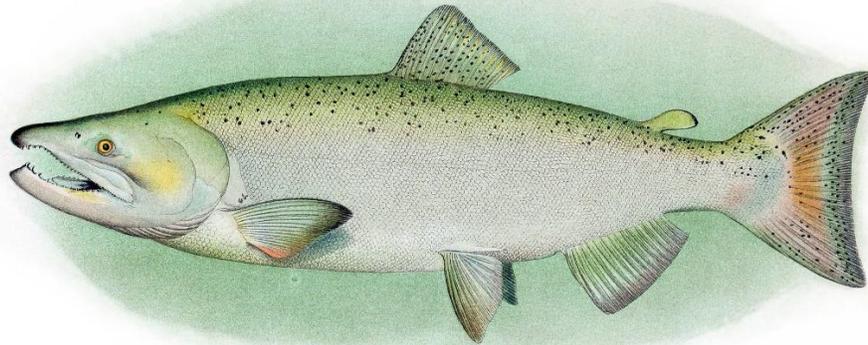
The study results are expected to be completed by next spring.

Another opportunity for Southeast Alaskans to learn about the study and comment on it is coming up Wednesday, Oct. 4 at 7 p.m.

Here is [information about meeting and the study](#).

Here is a link to the [video meeting](#).

Understanding the costs and benefits of a mark-selective sport fishery for king salmon in Southeast Alaska: A feasibility study



Background

Along the west coast, some fisheries for king (Chinook) salmon are managed as mark-selective fisheries, where special regulations allow for harvest of adipose fin-clipped hatchery fish. This management tool was established to provide opportunity to harvest hatchery-produced fish when wild-origin salmon populations are at low abundance; however, implementing a selective fishery is not straightforward.

The Alaska delegation involved in the 2019 Pacific Salmon Treaty (PST) negotiations asked the Alaska Department of Fish and Game (ADF&G) to explore the possibility of using a mark-selective fishery for king salmon management in Southeast Alaska, specifically for the sport fishery. This request was made through Alaska's Commissioner to the Pacific Salmon Commission in response to reduced king salmon allocations for all Alaska gear groups under the 2009 and 2019 PST agreements.

ADF&G Division of Sport Fish received funding through a grant from the Pacific Salmon Commission to complete a feasibility study. Through a competitive process, ADF&G contracted a team of researchers from the University of Washington (UW) with experience in community engagement in Southeast Alaska to help do the work. The UW team's role is to gather and synthesize technical information, facilitate community meetings, incorporate community concerns and feedback, and write up the results in a final report that will be shared with ADF&G and the public.

Study Objectives

1. Review mark-selective fishery programs outside of Alaska to understand how mark-selective fisheries have worked in British Columbia, Washington, and Oregon. What have the challenges and benefits been, and for whom?
2. Review the king salmon sport fish program in Southeast Alaska to understand what would need to change if a mark-selective fishery was implemented.
3. Engage Southeast Alaska fishing community members to gather local perspectives on mark-selective fisheries.
4. Evaluate potential costs and benefits of mark-selective fisheries in the Southeast Alaska king salmon sport fishery, incorporating community perspectives.

Community Engagement

In summer and fall of 2023, the project team held four meetings in Southeast Alaska communities and one online meeting. Information about the meetings was shared through email lists provided by ADF&G staff, public radio, posted flyers, and social media. During the meetings, the project team presented the goals of the feasibility study and results from the first phase of the project—a review of mark-selective fisheries (MSFs) in British Columbia, Washington, and Oregon, highlighting their benefits and challenges. Attendees provided feedback, questions, and concerns about MSFs. A goal of these conversations was to better understand community perspectives about potential costs and benefits of MSFs. Detailed questions and feedback from community members are being incorporated into the overall feasibility study.

Meeting Locations	Participation*
Juneau July 17, 2023 (5-6:30 pm) Mendenhall Valley Public Library	18 people attended, including university and agency researchers and management staff (~50%); sport (~40%), commercial (~5%), and personal use or subsistence (~20%) fishers; and other members of the public (~5%). 5 ADF&G and 3 UW project team members were also present.
Ketchikan September 18, 2023 (7-8:30 pm) ADF&G Office	13 people attended, including charter operators (~85%) and local ADF&G staff (~15%). 1 ADF&G and 2 UW project team members were also present.
Klawock / Craig September 19, 2023 (7-8:30 pm) Prince of Wales Vocational & Technical Education Center	48 people attended, including resident sport fishers (~50%), subsistence fishers (~33%), charter operators (~12%), commercial fishers (~10%), hatchery association employees (~2%), and local ADF&G staff (~2%). 2 ADF&G and 2 UW project team members were present.
Sitka September 21, 2023 (7-8:30 pm) University of Alaska Southeast	18 people attended, including local ADF&G staff (~33%), commercial fishers (~22%), charter operators (~17%), subsistence fishers (~11%), hatchery association employees (~11%), and university researchers (~6%). 3 ADF&G and 2 UW project team members were also present.
Online October 4, 2023 (7-9 pm) Zoom link provided	38 people attended, including subsistence or personal use fishers, resident sport fishers, charter operators, commercial fishers, hatchery association employees, and local ADF&G staff. 3 ADF&G and 5 UW project team members (incl. note takers) were also present.

* Percentages do not always add up to 100% because people self-identified with multiple groups.

Meeting Highlights

Meeting attendees shared a wide range of comments, concerns, and questions about MSFs. Primary themes are highlighted below and were similar across meeting locations. Overall, more opposition than support was expressed for the potential use of MSFs as a management tool for the sport fishery. The strongest concerns were voiced by Prince of Wales community members, who noted a range of potential negative impacts to the local economy, customary and traditional fishing access, and fishing experience if MSFs are implemented.

The meetings also provided an opportunity for information sharing between ADF&G staff and community members on relevant details of the current Southeast Alaska sport fish program and the potential effects of implementing MSFs. Technical information discussed included the percentage of marked fish caught by sport and commercial fisheries; mark rates and number of marked fish released coastwide; differences in feasibility of MSFs in inside waters versus outside waters of Southeast Alaska; and the current use of mass marking trailers by Southern Southeast Regional Aquaculture Association and Douglas Island Pink and Chum, Inc., including their efficiency and cost. These topics will be examined in detail during the next phase of the feasibility study (Obj. 2, above).

In addition, feedback was provided by participants to the project team about ways to improve outreach and engagement with a broader group of community members moving forward. In response to these recommendations, the team improved their outreach for the online meeting and has compiled an email distribution list of more than 400 individuals and organizations. Tlingit and Haida Central Council communications staff helped to distribute the online meeting announcement through social media and other online channels.

Key Themes from Community Discussions

Ideas about potential applications or benefits of MSFs

- ❖ MSFs could be a way to maintain or increase fishing opportunity in years with low returns of wild fish, during periods of non-retention of wild fish, or in specific areas near hatcheries
 - > May be most feasible on a small scale
- ❖ Improved data due to increased marking and tagging can help with accounting
 - > May result in Alaska fishers harvesting more hatchery fish originating in Alaska
- ❖ Alaska hatchery fish do not come out of PST allocation, so may provide a way to mitigate king salmon harvest reduction that resulted from the last treaty agreements

Concerns about release mortality

- ❖ Concerns about MSF impacts on wild fish due to increased release mortality from catch and release of unmarked fish
- ❖ Questions raised about the accuracy of release mortality rates currently used in models
 - > Mortality varies by fish size, time of year, angler experience, fish handling, where fish are caught (freshwater or saltwater), hook type (e.g., barbed vs. barbless)
 - > No information on the impacts of repeated catch and release of the same individual
 - > May necessitate new Alaska-specific studies prior to MSF implementation
- ❖ Limited information on sublethal effects of MSFs on wild-origin fish, such as impact on spawning success

Concerns about impacts of MSFs on fishing experience

- ❖ Potential for increased complexity of regulations, as in other places with MSFs (e.g., WA)
- ❖ Possible shifts in fishing locations and/or increased crowding in areas with MSFs
- ❖ Reduced efficiency, longer time, and/or higher cost to catch a harvestable fish (e.g., due to increased travel time to new fishing areas, more time until a marked fish is caught, etc.)
 - > Participants noted that most fish caught in their areas are currently unmarked
- ❖ Lower satisfaction due to above factors, as well as ethical concerns about catch and release fishing
 - > The number of unmarked fish that are caught and released can be high if mark rates are low

<ul style="list-style-type: none"> ❖ Several attendees shared personal experiences of operating charter businesses under MSF regulations in WA, and the many issues they experienced (described in the bullets above)
<p>Concerns about equitable access</p>
<ul style="list-style-type: none"> ❖ Harvest of king salmon for customary and traditional use (subsistence) occurs under sport regulations, so any added challenges in accessing king salmon for subsistence is a concern ❖ Concerns that MSFs would negatively and disproportionately affect rural and Alaska Native residents <ul style="list-style-type: none"> > For example, could further complicate regulations and shift charter effort into fishing areas currently used by local residents ❖ Fears that initial increased opportunity afforded by a MSF could lead to greater restrictions in the future, such as retention of <i>only</i> marked hatchery fish <ul style="list-style-type: none"> > In WA, MSFs get shut down if rates of handling wild fish are too high ❖ Concerns that any potential benefits of MSFs would not be afforded to both sport and commercial fisheries
<p>Concerns related to implementation, feasibility, and applicability</p>
<ul style="list-style-type: none"> ❖ Studies of MSFs have been done in other contexts, and these may not be applicable broadly to Southeast Alaska ❖ What has worked in WA, or other places, may not work in AK <ul style="list-style-type: none"> > Some participants shared prior experiences with MSFs in Alaska (e.g., in commercial troll fisheries) and indicated there was little support for them overall ❖ MSFs for sport fisheries would impact subsistence and commercial fisheries, which needs to be taken into account when considering overall feasibility of a MSF program <ul style="list-style-type: none"> > Concerns that new tagging trailers will lead to a “total MSF” in all sectors
<p>Broader concerns about king salmon fisheries and management</p>
<ul style="list-style-type: none"> ❖ MSFs will do little to address larger scale king salmon issues, such as impacts of trawl bycatch <ul style="list-style-type: none"> > The benefits to this tool are not clear with respect to reducing mortality for wild king salmon ❖ Subsistence priorities are not adequately recognized with respect to king salmon in Southeast Alaska ❖ Importance of direct engagement with tribes and tribal organizations by ADF&G to discuss potential impacts of MSFs, along with other broader concerns <ul style="list-style-type: none"> > There is also a lack of Alaska tribal representation in the Pacific Salmon Treaty arena

<p>Emerging Questions</p>
<p>Meeting attendees asked a wide range of questions about the project origin and goals, mortality rates associated with MSFs, conservation impacts of MSFs, current creel sampling rates, nonlethal/sublethal effects of MSFs on wild-origin fish, details of current king salmon allocation, and more. Categories of frequently asked questions are listed below. The project team addressed some of these questions during the meetings, particularly those related to the study itself; however, they are working to address the remaining questions during the next phase of the project.</p>
<p>Questions related to this study</p>
<ul style="list-style-type: none"> ❖ What motivated the study and who is funding it? ❖ What are the goals of the funder (PSC) and ADF&G in pursuing this project? ❖ What are the project team member roles, including the role of UW? ❖ What impact will community feedback have on the end product of this study?

- ❖ Why is this feasibility study directed only at sport and not commercial fisheries?
- ❖ How will this study address potential impacts on customary and traditional use of king salmon (subsistence)?

Questions related to release mortality

- ❖ What release mortality rate is used and how was it determined? What relevant parameters were considered (e.g., fish size, hook type, etc.)?
- ❖ How would release mortality differ for guided versus unguided fishing, particularly considering the high concentration of non-resident, guided anglers in some areas?
- ❖ How would a possible change in fishing behavior related to MSF implementation affect release mortality?

Questions related to MSF implementation and feasibility

- ❖ Would an MSF actually increase opportunity in reality and not just on paper? Does Alaska release enough hatchery-produced king salmon to see a benefit from MSFs?
- ❖ Mark rates are low and some wild stocks are marked in Southeast Alaska; is an MSF really feasible in this area?
 - > Would mark rates have to be near 100% in order for this to be effective?
- ❖ What would MSF sport regulations in Southeast Alaska actually look like (e.g., area, timing, bag limits)?
 - > What is the functional difference between MSFs and additional opportunities provided in terminal harvest areas?
- ❖ How would an MSF change fishing behavior? Could this be avoided? How would it be accounted for in management?
- ❖ Most hatcheries in the Southern U.S. are federally funded, which is part of what makes MSFs possible. How would a program like this work with private non-profit hatcheries in AK? How would funding of MSFs work? Who would be responsible?
- ❖ Will there be pushback from other parties in the Pacific Salmon Treaty arena if Alaska is to propose a new MSF?
- ❖ Would allowing MSFs in Southeast Alaska open the door for them to be used extensively?

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How can you share your questions and ideas?

1. Attend future meetings—we will hold two online meetings in early 2024 to share a project update and seek additional feedback. Please contact Anne if you would like to be added to our email list.
2. Email or call Judy or Anne directly.
3. Provide anonymous feedback through [this online form](#). Only project team members will see your responses, which will be anonymous and not linked to your name *unless* you choose to provide your contact information.

Stewardship, Advocacy, and Knowledge in Juneau-area Fisheries

Stewardship in fisheries

Stewardship in fisheries can be viewed in many ways by different people and communities. Sometimes it may refer to actions to protect or conserve the environment. Stewardship can also describe actions that sustain human relationships with and *use of* the environment. In other words, how are people taking care of the environment and natural resources that they rely on for social, cultural, and economic needs?

Stewardship in fisheries involves actions taken by fishers that are informed by their **place-based knowledge** and helps to support the resilience of their fisheries.

This study focused on the **small-boat commercial fisheries in Juneau, Alaska**. The major commercial fisheries in this area target salmon and crab (Dungeness, king, and tanner), many of which are already being impacted by climate change.

In Juneau and other areas of Alaska, fisheries are affected by environmental, socioeconomic, and regulatory pressures that may affect fishers' abilities to participate in these fisheries in the future.



Research goals and approach

A goal of this research was to explore the ways that Juneau-area commercial fishers and other seafood industry professionals are caring for their fisheries and working to make them continuously viable. We also aimed to better understand the role of fishery management agencies in facilitating collaboration and communication with local fishers, and identifying areas where stewardship actions could be better supported.

We **interviewed 22 commercial fishers, agency staff, and leaders of seafood associations** to understand their perspectives on stewardship in Juneau fisheries. Using qualitative research methods, we identified key themes from the interviews.

Fishers care for their fisheries in many ways

Fishers shared a variety of stewardship actions they take. These actions fall into three main categories:

- **Conservation actions** include fishing practices to avoid bycatch and decrease release mortality, knowledge sharing with Alaska Department of Fish and Game (ADF&G), and choosing to participate in lower bycatch fisheries.
- **Knowledge sharing** includes assisting with sampling, sharing observations and knowledge with ADF&G, and advocating for improvements in data collection and population models.
- **Political engagement** includes engagement with ADF&G, participation in local Advisory Committee (AC) meetings, participation in Board of Fisheries (BOF) meetings, and participation in fishing and advocacy organizations. This was by far the most common form of stewardship fishermen engaged in.



Fishers expressed the importance of stewardship to preserve the fishery, and how political engagement plays a crucial role in contributing their knowledge to management.

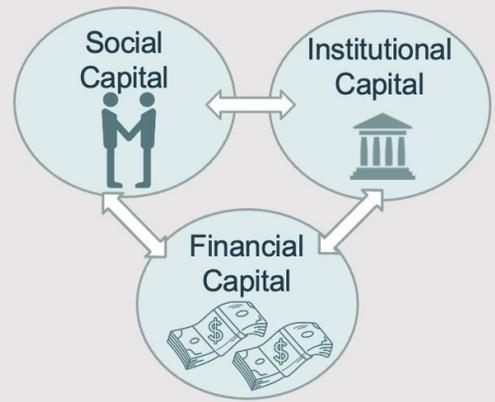
“For me, it's just so fundamental— the resource comes first, taking care of the resource... that's always my bottom line, which is, you know, why I put in [the petition to ADF&G].”

-Juneau Commercial Fisherman

Various forms of capital influence stewardship in fisheries

Social, institutional, and financial capital all influence fishers' abilities to take stewardship actions. For example, higher financial capital may allow a fisherman to more easily switch gear type while higher social capital may make them more comfortable expressing knowledge and concerns to management.

A strong capacity in any one of these was described by interviewees as having a positive influence on the others. Conversely, a limited capacity in one area was seen as having a negative effect on the others. Many interview participants identified low social, financial and institutional capital within some sectors of the Juneau commercial fleet as additional stressors that limited the ability of fishery participants to take stewardship actions.



Management can help support stewardship

Interview participants identified a number of concrete ways that management agencies could support stewardship happening within these fisheries, particularly in the context of engagement in the public process of management. Suggestions made by many participants include:

- Providing more informal, day-to-day opportunities for engagement (e.g., during license renewals and pre-season meetings)
- Empowering fishermen to be more involved in data collection for the agency
- Increasing opportunities for collaborative research

These were identified as ways to increase knowledge exchange and trust-building among fishermen, scientists, and decision-makers. Participants offered examples of how these activities are already happening for some fisheries and could be improved for others.

A fisherman explains the importance of financial capital in gaining representation in management decisions:

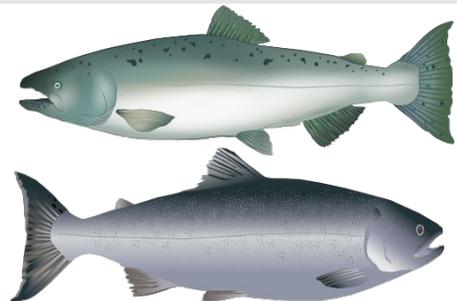
“In all politics, it's the same thing...whoever has the most money and can buy the most time is going to get the best representation.”

-Juneau Commercial Fisherman

Stewardship in a hatchery supported fishery?

A majority of fishers we interviewed participated in the salmon drift gillnet fishery, in which harvest primarily consists of hatchery-origin chum salmon. This adds important nuances to the understanding of stewardship within this system, because fishers may take different types of stewardship actions depending on whether they are targeting hatchery-origin or wild-origin salmon.

This may explain why many interviewees described stewardship as more than “fishing clean” and releasing bycatch. In particular, interviewees identified broader stewardship actions — such as reducing carbon emissions, advocating to support fishing community viability, and exchanging knowledge across institutions — as important in this fishery.



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Top Alaska tourist attraction Mendenhall Glacier to hit capacity for visitors by late summer



July 8, 2023 by Andrew
Kitchenman, Alaska Beacon

Mendenhall Lake in Juneau is
seen on Nov. 6, 2021. (Photo
by James Brooks/Alaska
Beacon)

Alaska's top tourist
attraction, the [Mendenhall
Glacier](#) in Juneau, is
reaching its capacity for
commercial tours this year

sooner than in previous years, due to the growing number of visitors.

This means tour operators are also facing limits in the second half of the summer season on how many tours have permits to visit the Mendenhall Glacier Recreation Area, which is overseen by the U.S. Forest Service.

The Forest Service said in a statement that it is asking for the public's patience and understanding.

The commercial-tourism limits are in place to protect the local [ecosystems](#) and natural resources, as well as the experiences of visitors, according to the Forest Service. A limit of 517,650 visitors was set in 2015 after an environmental analysis of the area. But with the exception of the pandemic – which shut down the industry for nearly two years – the number of cruise-ship visitors has grown. The cruise-ship industry projected 1.65 million visitors to Alaska this year.

Business owners knew this day was coming, but it still stings, said Serene Hutchinson, general manager of Juneau Tours, which has operated for more than 20 years.

“Mostly, it’s hard to be disappointing people all day long,” she said.

She said her business plans to carefully manage its remaining permits for glacier visits. But she’s also trying to make up for the limits with additional city tours of Juneau and with whale-watching tours. She acknowledged that for Juneau visitors, the glacier is iconic.

“I’ve kind of made it through all five stages of grief and you’re catching me at ‘acceptance,’” Hutchinson said.

She added that she feels sympathy for Forest Service staff facing public criticism: “We’re a small town and we know them all personally. ... I’m grateful for them and I trust them to make the right decision.”

The glacier’s visitor capacity was adjusted slightly upward in 2019, adding 55,000, after restrooms and other facilities were expanded. The Forest Service is considering further expanding facilities as a longer-term solution. That proposed project is under review by the public.

Juneau Deputy District Ranger Laura Buchheit, in a statement, described the [public engagement](#) with the proposal as being “in the final stretch.”

“Protecting this special place while adapting to unprecedented increases in visitation is a significant challenge, and we appreciate everyone’s patience as we move through the process,” Buchheit said.

[This story originally appeared in the Alaska Beacon and is republished here with permission.](#)

Alaska breaks cruise ship passenger record as tourism rebounds from the COVID-19 pandemic

November 3, 2023 by James Brooks, Alaska Beacon

The state of Alaska broke its 2019 record for cruise ship tourism this summer, with Alaska's capital city recording 1.65 million passengers this year, according to figures released Thursday at a meeting of the Juneau Chamber of Commerce.

Most Alaska tourists arrive via cruise ship, and Juneau sees all but a handful of the cruise ships that visit Alaska each summer, making the city's figures a proxy for the industry as a whole.

The newly published figures mark a rebound — and then some — from the COVID-19 pandemic emergency.

Juneau recorded 1.2 million cruise ship tourists in 2022, 124,600 in 2021, 48 in 2020, and 1.33 million in 2019. The 2019 figure was the previous record.

“This is a 23% increase from our best season ever before,” said Meilani Schijvens, director of Rain Coast Data, the economics firm that published the numbers.

“It ended up being a really, really strong season here in Southeast Alaska,” Schijvens said.

The figures, based on per-passenger head tax figures calculated by the City and Borough of Juneau, were released as part of an annual report commissioned by Southeast Conference, the regional economic development organization for Southeast Alaska.

They include only “manifested passenger numbers,” said Juneau Port Director Carl Uchytel, so they don’t include the thousands of crew aboard ship. The figures also don’t differentiate between passengers who disembark in the city and those who stay aboard ship.

Brian Holst, director of the Juneau Economic Development Council, said the figures are “absolutely” good news for his community “because economic sectors like tourism have come back solid” since the pandemic emergency.

“Businesses are reporting either a good year or a great year,” he said.

An annual panel survey of 370 Southeast Alaska business owners found 73% had a positive view of the region’s economy, the highest mark since the survey began in 2010.

Almost 80% of survey participants said they have positive expectations for 2024 as well.

Tourism accounts for 15% of Southeast Alaska’s jobs but only 9% of its wages; most tourism jobs are seasonal, occurring during the cruise ship season that runs from April through October.

Government work — state, federal, local and tribal — accounts for more than a third of the region’s jobs and wages and is the leading economic sector.

While the number of visiting tourists is above what it was in 2019, the number of tourism-related jobs in Southeast Alaska remains below what it was in the prior record year, as do wages. Tourism-related employment accounted for 12% of all wages in Southeast Alaska in 2019 before declining during the pandemic.

Employers across the region continue to report a workforce shortage, with construction workers in particular being hard to come by.

“Really, we could use a lot more foreign workers coming into the United States and coming into Alaska to bolster our economy,” Schjivens said.

According to her firm’s survey, more than half of the region’s business leaders said a lack of housing has cost them employees.

Survey respondents also said the cost and availability of child care was a major factor in their inability to hire and retain workers.

Over the past 12 years, the price of an average single family home in Juneau has risen 52%, 22 percentage points above inflation during that period, Schjivens said. Average wages in the city rose 38%, 8 points above inflation, during the same period.

Juneau Mayor Beth Weldon said of the 2023 cruise ship season, “We are happy with the numbers for the tourism numbers, but at the same time, we understand that the community has felt a little tension this year.”

Concerns about traffic and overcrowding have risen along with passenger volume, and the city has reached a voluntary agreement with the cruise industry to cap the number of ships per day.

No more than five large ships will be permitted on any given day, starting next year. According to preliminary data shared by Schjivens, 50 ships have planned a combined 660 voyages to Southeast Alaska in 2024, with the first ship due in Juneau April 8, and the last on Oct. 26.

That’s an extension of this year’s record-long cruise ship season, which began in mid-April, and Schjivens expects 1.7 million tourists in the capital city next year, another record.



This is a photo of the only crossing between the Juneau mainland and Douglas Island. On Thursday the City and Borough of Juneau Public Works and Facilities Committee hosted an open forum about a potential second crossing. (Clarise Larson / Juneau Empire)

Salmon Creek site emerges as preference during second crossing meeting

“I feel like salmon creek has the least financial impacts, the least wetland impact.”

By Clarise Larson

Friday, May 19, 2023 5:24pm | NEWS CITY AND BOROUGH OF JUNEAU LOCAL NEWS

A proposal that would place a second crossing between the Juneau mainland and Douglas Island in the Salmon Creek area proved to be the most popular among residents who spoke at a recent city meeting.

In an open forum hosted by the City and Borough of Juneau Public Works and Facilities Committee Thursday evening, more than 20 residents from both Juneau and Douglas made public comments regarding the six

preliminary alternatives outlined as potential crossing options in the Planning and Environmental Linkages study currently underway.

The six options are at the Mendenhall Peninsula, West Sunny Point Area, Sunny Point Area, Vanderbilt, Twin Lakes and Salmon Creek.

Of the more than 20 people who testified, around 10 indicated that they preferred the Salmon Creek alternative, citing its lower cost and distance from the wetlands as the biggest factors. A similar number of people also spoke out against the Mendenhall Peninsula alternative, citing its potential negative impacts crossing the Mendenhall Wetlands State Game Refuge as the biggest reason.



Nancy Waterman point to a map of Juneau and Douglas during an open forum about a second crossing between the Juneau mainland and Douglas Island hosted by the City and Borough of Juneau Public Works and Facilities Committee Thursday evening. (Clarise Larson / Juneau Empire)

That opinion wasn't shared by everyone, however, and some said they didn't want a crossing built at all.

"I do not think a second crossing is necessary, and I think that we have been falsely led to choose a crossing alternative," said Frita Westman.

Tom Williams said he supported the Mendenhall Peninsula alternative because it would have less impact on property owners and could open up more opportunities for housing and tourism development.

"Obviously the cost is the biggest drawback here," he said. "But you need to think about the marginal cost because they're all going to be expensive. And I think if you think about the marginal cost and the marginal benefit, the

Mendenhall Peninsula is clearly the best option here.”

However, other residents like Albert Shaw did not share the same view.

“Mendenhall Peninsula gets a big no from me,” he said.

Alex Wertheimer, said he thinks Salmon Creek is the superior option in terms of medical transportation.

“The Salmon Creek crossing stands out as the best alternative to provide reduced transport response with it placing you at the intersection of the hospital,” he said.

Kathy Coghill agreed, and said she is most in favor of the Salmon Creek alternative, but expressed concerns about the likely high cost of the project.

“It’s going to be horrendously expensive and we can’t afford this, we’ve got so many projects that we need to fund — we shouldn’t be funding a luxury,” she said. “I feel like salmon creek has the least financial impacts, the least wetland impact.”

• Contact reporter Clarise Larson at clarise.larson@juneauempire.com or (651)-528-1807.

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