# Fairbanks
# Fish & Game Advisory Committee (FAC)

***Interior Region***
***Fish & Game Advisory Committees***


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Central
Delta Junction
Eagle
Fairbanks
GASH
Koyukuk River
Lake Minchumina
McGrath
Middle Nenana RIver
Middle Yukon River
Minto-Nenana
Ruby
Stony Holitna
Tanana-Rampart-Manley
Upper Tanana Fortymile
Yukon Flats

Date: January 10, 2024

To: John Wood, Chairman, Alaska Board of Fisheries
Märit Carlson-Van Dort
Tom Carpenter
Stan Zuray
Greg Svendson
Mike Wood
Gerald Godfrey

From: The Fairbanks Fish and Game Advisory Committee (FAC)[1]

Re: Alaska Board of Fisheries action December 1, 2023 regarding FAC Proposal #59 to reduce enhancement egg production of pink salmon at Kitoi Bay Hatchery, Kodiak Island and related hatchery issues

Dear Chairman Wood and Members of the Board of Fisheries:

The Fairbanks Fish & Game Advisory Committee (FAC) is writing to request clarification of authority in regard to the Alaska Board of Fisheries action on the FAC *Kodiak* Proposal #59 (Kitoi Bay Hatchery/ KBH[2] egg reduction) on December 1, 2023 at the Lower Cook Inlet Board (LCI) meeting in Homer.

This action effectively removed Proposal #59 from the Kodiak proposal book. It was noticed late on December 1st in RC073 as a Miscellaneous Business Agenda, Proposal 59 *Correction.* It was deliberated at 3:55pm for about 25 minutes only and passed in a 4-2 vote, with one Board member absent. The Board adjourned almost immediately after at 4:25pm so there was no opportunity for reconsideration. There was no attempted contact with the makers of the proposal.

**Because of the unprecedented action of the Board to remove a properly submitted proposal, we request an explanation of why this action on proposal #59 was allowed?** This action was unnoticed at the Lower Cook Inlet meeting and is in violation of the Alaska Administrative Procedures Act (AS 44.62.330-44.62.630) and the State of Alaska's Open Meetings Act (AS 44.62.310-.312) that require all meetings of a public entity's governing body be open to the public and that the body provide reasonable notice of its meetings. The Open Meetings Act (OMA) is intended to ensure that decisions made and actions taken are public knowledge and represent the will of the public that the governing body serves.[3]

All of the proposals that the FAC (and others) are presenting on hatchery egg reduction essentially seek a greater public and systemic dialogue on PNP hatchery management and impacts. We believe there is a causal relationship between hatchery production and loss of wild salmon stocks. For this reason, we also believe that we need a comprehensive statewide and wholistic dialogue on PNP hatchery production.

In closing, we ask that the Board of Fisheries to:

1. Provide a clarification on authority for removal of Proposal #59

2. Consistent with the Joint Protocol on Salmon Enhancement (#2002-FB-215)[4], find a pathway to address the growing crisis of loss of wild salmon stocks and the increasing evidence of PNP hatchery impacts through an expanded Hatchery Committee of the Whole, including support for an independent cost-benefit analysis and independent environmental review

3. Recognize the factors we can address in salmon decline such as reduced bycatch, reduced intercept, PNP hatchery reduction, habitat restoration, better management practices

4. Support Proposal #43 at the Upper Cook Inlet Board meeting

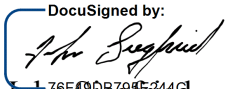
There are many causes for salmon decline. This letter focuses on only one - PNP hatchery impacts - because that is the point of the FAC proposals #43 and #59.

Fisheries health is very complex and we have a fragmented management system between and within state and federal management. Because of the allocative nature of our fisheries, we have competitive and often mutually exclusive goals for harvest but there is one thing we all have in common: If we do not take care of our wild salmon stocks and consider them a priority, we will lose those stocks, possibly in perpetuity.

Thank you for your consideration.

Sincerely,

DocuSigned by:



John Sieglfied
Chair, Fairbanks Fish & Game Advisory Committee

Cc: Aaron Peterson, Alaska Department of Law
Noah Starr, Alaska Department of Law
Art Nelson, Alaska Board of Fisheries Executive Director
Doug Vincent-Lang, Commissioner, Alaska Department of Fish and Game
Michael Dunleavy, Governor, State of Alaska
Jim Matherly, Office of the Governor, Fairbanks
Members, Fairbanks Fish and Game Advisory Committee
Members, AYK advisory committees
Members, Alaska Interior Delegation
Senator Lisa Murkowski, U.S. Senate
Senator Dan Sullivan, U.S. Senate
Representative Mary Peltola, U.S. House of Representatives
Chief Brian Ridley, Tanana Chiefs Conference
Vivian Korthuis, Association of Village Council Presidents
Melanie Bahnke, Kawarek, Inc.
Robin Samuelson, Bristol Bay Native Corporation
Karen Gillis, Amy Sparck, Bering Sea Fishermen's Association
Serena Fitka,Yukon River Drainage Fisheries Association
Shannon Erhart, Chief Karma Ulvi, Yukon River Inter-Tribal Fish Commission
Andy Bassich, Yukon River Panel
Jonathan Samuelson, Kevin Whitworth, Kuskokwim River Inter-Tribal Fish Commission

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## SECTION II
## Background to Board of Fisheries Action on Proposal #59

Because the action on Proposal #59 was not noticed for the LCI meeting, the FAC was not present. Our Proposal #43 is not going to be deliberated until the Upper Cook Inlet meeting, which we plan to attend. Correspondingly, we did not discuss Kodiak travel at our December meeting as planned because of the removal of #59. Funding for AC travel is very limited so we have to choose our attendance carefully[5]. Many FAC members, did, however, listen to the LCI meeting on line and did submit both on-time public comments and an RC on Proposal #43. Since the meeting, FAC has created a verbatim transcript (unofficial) of the deliberations on Proposal #59.

As noted during the deliberation on this action:

- The "correction" of Proposal #59 was necessary as an error had been created within Board Support when reviewing the original proposal, inadvertently removing the title of "Kitoi Bay' clearly evident on the original proposal and incorrectly putting the proposal under a Statewide, rather than Kodiak, section. This error was noted for the record by Board Support at the LCI meeting.

- After the title error was noted, the Board shifted toward the regulation cited. The motion to remove Proposal #59 from the Kodiak proposal book seemed to be predicated on the proposal being more appropriate for statewide action as Kitoi Bay Hatchery does not have a basic management plan.

    - The original proposal cited a statewide hatchery regulation 5AAC 40.820[6] precisely because Kitoi Bay did not have a basic management plan. Board deliberations noted that this was a reasonable assumption.
    - The FAC had assumed that Kitoi Bay Hatchery (KBH) had a basic management plan (BMP) as required by regulation 5 AAC 40.820. Basic management plans [7]. In the 2022 KBH Annual Management Plan, there is a reference to a BMP but it seems it does not exist.
        - The hatchery is operated in accordance with AS 16.10.400–480, the *KBH Basic Management Plan* (BMP), *KBH Annual Management Plan* (AMP), and private nonprofit (PNP) hatchery permit #29.
    - The Board General Counsel, Aaron Peterson, noted: [8] "I want to clarify one thing. The basic management plan is cited, I believe, because the permit the proposal is seeking to address is not in regulation. So, by what other mechanism would someone be able to bring that issue to this body, for the board to exercise its statutorily granted authority, for citing a basic management plan to amend this particular permit."

- The question might be asked why this proposal was not questioned at the October Work Session if there was a concern over the placement?
    - The second question then might be why wasn't it noticed for a discussion at the Lower Cook Inlet meeting which would have then given the proposers time to make the necessary corrections?

- The Board Chair noted he was inclined to give less leniency to the proposes of #59 because of their "experience."
    - Advisory Committee members are public servants who serve their regional constituency without benefit of staff, except for Board Support.
    - *It has been the policy for decades that the Board assist proposers in applying the correct regulatory citation as necessary.* The intent of the proposal was very clear.

- During the deliberations the Board mirrored comments from the Kitoi Bay manager and from the Kodiak Regional Aquaculture Association comments in PC124, dated November 13, 2024, citing a "duplicative" action to Proposal #43, which it was not. Proposal #43 is specific to Cook Inlet hatcheries (Tutka Bay and Port Graham.)

- The Executive Director for the Board of Fish, noted: "In my experience with the proposal process, the request of the proposal is what the proposal is, even though the regulation cited may be wrong. That goes through the proposal review process. The proposal that was submitted to us in a timely fashion had language that clearly spoke to the Kodiak Area Kitoi Bay management. I am not trying to presuppose the board to any outcome but in my opinion this was a timely received proposal. The language got dropped from it somehow through the proposal book development process. When we discovered (the error), as when brought to our attention in the past, we make the correction and post it to the Board meeting web site. "

- The General Counsel for the Board (Department of Law), noted just before action was called: "I just want to clarify that the proposal as submitted was proper. It is the direction of the Department of Law to this Board *for decades* that the Board has authority, pursuant to its statutory authority under 16.10.440(b) to amend the terms of permits. That's what this proposal sought to do. The Dept of Law would NOT say "here is something that the Board statute says the Board can do but we are not going to let it into the proposal book", we are not going to do that. This conversation about the proposal should be had at Kodiak, where the proposal is noted for. I don't know what procedural mechanism there is to remove it from the meeting here as it has been submitted properly. Now there was an administrative error and that has been rectified, but I don't know what administrative procedure there is to remove it here that wouldn't likely generate more issues than having it addressed at the Kodiak meeting. So I would have concerns with removing it here after people have presumably assumed they have the ability to debate it in Kodiak."

- Removal of Proposal #59 effectively removes the conversation to the next Kodiak Board cycle in three years unless relocated to the Upper Cook Inlet meeting in 2024.

Aside from the fact that both the attorneys for the Board as well as Board Support clearly cautioned there was no evidence for removing Proposal #59 from the Kodiak Proposal book, the Board reiterated their previous history of dismissing hatchery egg reduction proposals.

**<u>Relationship to Proposal #43, scheduled for Upper Cook Inlet February 2024</u>**

Action on Proposal #59 may have been prompted by Staff Comments of the Commissioner for the Alaska Department of Fish and Game, who has the most supreme authority over hatchery

permitting. In the Staff Comments for Proposal #43 to reduce pink salmon production in Cook Inlet, the Department wrote:

> Proposal #43 DEPARTMENT COMMENTS: The department OPPOSES this proposal. Hatchery egg take levels are established through an iterative process involving department staff and stakeholders. Hatchery operations are permitted in a way that minimizes impact on wild salmon stocks and the commissioner can amend a permit if conservation concerns arise related to hatchery production. If there is a compelling reason to amend terms of a hatchery permit, **t**he amendment should be based on analysis of data and there should be clear evidence the amendment will have a positive impact on wild salmon stocks. No evidence has been presented in this proposal to support the proposed reduction in permitted pink salmon egg take level.

Since Proposal #43 has not yet been deliberated (scheduled for Upper Cook Inlet in February), the background to Prop #43, submitted by Fairbanks AC Fisheries Sub-Committee Chair as RC021, was not discussed. RC021 contains many references to peer-reviewed papers supporting the concern over the production of hatchery fish having negative impacts on wild salmon stocks. AC04, submitted as an on-time Advisory Committee comment from the Fairbanks AC would also have illuminated the critical need for hatchery egg reduction in both the FAC minutes of November 8, 2023 and the citations of several peer-reviewed papers.[9] RC021 had the following comment on the "iterative process" discussed in the Departments comments on Proposal #43. It can only be assumed that the Department would have had similar comments on Proposal #59 but they had not been published prior to the Board's decision to rescind.

> FAC opinion in RC021: The "iterative process" that the Department describes is a fully integrated system of hatcheries, fishermen who depend on those hatcheries, Department staff who are supportive of those hatcheries, state loan departments, processors, marketers and other stakeholders who are hatchery dependent.[10] It is a process that does not include anyone outside of the hatchery bubble. This is extremely problematic for stakeholders who see a clear connection between hatchery production and threats to declining wild salmon stocks.

## Only one voice evident during Prop#59 discussion

Board of Fish proposals are submitted normally 1.5 years ahead of the specific Board meeting. There are, perhaps, hundreds of proposals over the years that have needed more evidence and clarification and that is usually presented at the Board meeting.

The proposers of #59 acknowledge that the proposal was low on detail but the intent was clear and based on the growing evidence of over-production of pink salmon having negative impacts on wild salmon stocks. The proposers fully expected to have significant evidence presented as RCs and testimony at the Kodiak meeting. The voices of the proposers and those who supported it or had more questions about it will now not be heard.

The complication of the proposal being published without the appropriate title (Board support error) compounded the confusion for reviewers. For instance, the Anchorage AC, in their on-line public comments, noted:

> "The growth in hatchery production for pinks has coincided with the drop in King Salmon numbers. There are a lot of factors in the decline of King Salmon in Alaska, this has to be factored in at some point. Other arguments are that the pinks and Kings feed at different depths. It's hard to know what the right answer is but lowering the number of pinks released might help. Hatcheries also need to be able to do their cost recovery so they need a minimum number of fish released to stay profitable. The proposer should have provided more hard numbers so we know how many pinks they are talking about reducing. We don't have enough knowledge to really address this. We believe that the issue needs to be considered but we don't know what the right answer is."

Both RC021 and AC04 would also have educated the discussion around Proposal #59. While these comments were not considered, the Department comments (RC02) and testimony and RC061 comments from the Kodiak Regional Aquaculture Association (KRAA) were.

In their RC124, KRAA expressed the following sentiments which exemplify the gulf of understanding between some members of the Board, the Department, PNP hatchery managers and the non-hatchery world. These comments, while meant to be defensive of the PNP hatchery system, wrongfully interpret the nature of the problem and could be the basis of why a statewide dialogue is so critically needed.

> "Proposal 43 is duplicated as Proposal 59 slated for the Kodiak meeting in January where it appears to be geared toward all of the state's hatchery programs. Why the duplicative proposal, which will now be heard at *three* Board meetings during this cycle and ignores the fact that it has already been offered and rejected at least twice in the last 5 years? The proposal(s), and its contentions, in this new iteration, continues to rely on the same speculative "ocean ranching" thesis without accounting for the multiple variables that occur each year that impact food availability—ocean temperature, currents, mixing through storms, etc.—and also fails to address spatial distributions of salmon from different origins that appear to show limited or non-existent competition.
>
> Kodiak Regional Aquaculture association asks the Board to review the previous emergency petitions, ACRs and proposals that have been summarily rejected by the Board of Fisheries since 2018. The pattern of the proposals for the 23-24 Board cycle is simply a continuance of the same and repeated efforts of a few individuals to assert their conviction that Alaska's hatchery programs lack sufficient oversight and need to be curtailed. The assertions and implications that somehow hatchery operations have been given a "pass" on issues of sustainability, scientific defensibility, or rigorous oversight are simply unfounded. The public record from all of the meetings in which hatchery proposals have come before the Board reaching back five or more years have repeatedly affirmed the regulatory scrutiny of Alaska's hatchery programs by ADF&G, the Board process, and the Regional Planning Teams as well as the Alaska Hatchery Research Program (AHRP).
>
> Hatchery programs seem to be an easy target when folks are disappointed with a fishery return or outcome. How and when and how many fish return to a specific river system or region have a host of variables, many of which are outside the control of any decision maker or human action. Efforts to blame hatcheries by way of correlation, supposition, and biased opinion have not succeeded in making a substantive, defensible case against

> Alaska's hatchery program. Moreover, proposed solutions are more about allocative outcomes than hatchery regulations within State guidelines."
>
> The RC concludes with: "It may be the case that with so many new Board members, it is difficult to recognize the redundancy of these proposals. However, we have seen similar efforts as ACR2 in 2018 and through a series of proposals at the previous LCI meeting in Seward, proposals in Southeast Alaska, and as Proposals 49-55 at the 2021 Prince William Sound Finfish and Shellfish meeting in Cordova. At that meeting, I simply re-submitted over 30 pages of written comment KRAA had submitted at previous meetings on the same topics and similar proposals. KRAA's comments represent just a fraction of the time and effort demanded of those who have been forced to respond to repetitive proposals and to defend the Alaska Hatchery Programs. I would again draw your attention to that record, but more importantly, I would ask the Board to recognize that, at each turn, the Board has rightly rejected this systematic effort to malign Alaska's hatchery programs and their underlying science, management, and oversight by ADF&G."

This RC misses the entire point of all hatchery egg reduction proposal objectives and ignores the massive volume of peer-reviewed science that indicates the negative impacts of salmon hatcheries on wild stocks. It shows lack of understanding of the complicated nature of the fisheries web that production hatcheries share with wild stocks. And it shows no concern for the growing crisis in Alaska salmon wild stocks all over the state, not just in the AYK. This RC reiterates the claim that PNP hatchery egg reduction proposals are "allocative" in nature, when in fact, these proposals have been repeatedly labeled "conservation." But obviously this RC was the basis of the Board's decision to remove Proposal #59 from the Kodiak proposal book.

The reality is that this RC is an echo throughout the hatchery world that proves a point: both PNP hatcheries and the Alaska Department of fish and Game and to a degree the Alaska Board of Fisheries seem committed to limiting any public scrutiny of PNP hatcheries.

## In Summary: Creating a comprehensive public dialogue

The following attached comments are in response to the Board of Fish stating that recent proposals from the Interior do not have sufficient information to support their position on PNP hatchery egg reduction. While this letter is lengthy, it is only a fraction of what could and should be reported; there is a very strong (and growing) correlation between massive hatchery production and negative impact on wild salmon stocks.

The following comments will also offer insight into the bigger picture of the salmon crisis in Alaska and hopefully illustrate the central point: The objections raised by the Department or hatchery managers do not negate what is needed the most: a real conversation instead of piecemeal (and competing) discussions without subsequent action. Perhaps the Board of Fisheries might consider a vastly expanded meeting of the Hatchery Committee of the Whole to structure how Alaska might be served to have such a critical dialogue.

Hatchery salmon are generally counted in total commercial salmon harvests together with wild stock. They are marketed as wild stock. These two actions confuse the general public but hatchery salmon are noted as separate in state laws and regulations.

The FAC fully understands that Asian hatchery stocks present in the Bering Sea are currently outside of the control of Alaska to mitigate. But Alaskan hatchery stocks exacerbate the competition at sea presented by these stocks and Alaskan hatchery stocks have the additional impacts of straying in Alaskan waters. Is it fair that Alaska PNP hatcheries must bear the burden of scrutiny? Probably not. But it is even less fair that the vast AYK, with thousands of people dependent on salmon, have absolutely no fishing opportunity and are faced with grave food security and cultural identity crises without confronting all the measures possible to mitigate the crisis.

All of this points to the need that Alaska is long overdue on a serious discussion about Alaska's PNP hatchery program.

- **Alaska really needs to organize a series of production hatchery forums** that bring in the best scientists from around the Pacific Northwest to debate the potential impacts of hatcheries on wild stocks from what is known far beyond the straying studies currently being conducted in limited areas of the Gulf of Alaska. Hatchery impacts are being studied everywhere and the body of evidence is growing that they play a significant role in salmon decline.

- Alaska needs an **environmental impact review of PNP hatcheries** that is independent of state and PNP related reviews and can assess multiple environmental costs associated with hatchery production. In the 50 years that PNP hatcheries have been operating in Alaska, there has never been an environmental impact statement.

- **Alaska's PNP hatchery program needs an independent cost-benefit analysis**. While PNP hatcheries are advertised to be "self-supporting", a true cost-benefit analysis might reveal this not to be true. Is the Alaska PNP model truly sustainable?

- **This discussion is strictly about production hatcheries (PNP) and is not a reference to mitigation or sports hatcheries.**

- Finally, **Alaska needs a deep discussion about what it means to protect our wild salmon stocks.** There is a very distinctive mindset associated with wild stock management versus hatchery production. Mitigation and non-anadromous hatcheries aside, PNP hatchery fish are managed as a commodity whereas wild stocks must be managed to protect the health of the species themselves. That difference in management comes up all the time – in public and private conversations, in Board meetings and legislative action. It is the central reason that the AYK is so alarmed at the rejection of hatchery proposal discussions; we are seeing too much evidence that fisheries managers are comfortable with substituting hatchery production for wild stock management.

  "Dialogues about hatcheries must be rooted in humility, where all participants must accept that the beliefs they hold, and perhaps hold to tightly, might be — at least in part — incorrect. But unless we collectively acknowledge that we might be wrong when it comes to Alaska hatcheries there will be no true dialogue, only continued division and deadlock."[11] (Dr. Peter Westley)

## SECTION III
## Why does this matter?

Wild salmon have sustained humanity since before recorded time. Salmon are an anadromous species that must navigate complex passages of up to thousands of miles. They have an incredible gauntlet of climate change/fluctuating environmental conditions, harvest / intercept, bycatch, hatchery competition, predators, disease and inadequate to poor multi-jurisdictional management to navigate. The fact that they have survived modern man at all is a testimony to their strength and resilience.

But now that resiliency is running out. The world has threatened that resiliency so much that the billions of salmon that have fed ecosystems around the world for millennia are now a trickle; the threat of losing whole runs is the reality rather than incidental. Even more, we have lost or are losing the genetic stock that produced massive sizes of salmon. *In less than one hundred years we have damaged our wild salmon stocks in such significant ways that we have likely permanently altered patterns and genetics.*

*We never thought we would be in the predicament that our wild salmon might not be sustainable.* We can no longer assume that the bounty of wild salmon that existed throughout millennia is going to survive into the future. The immense loss that is occurring in the AYK is a reflection of what has happened in other parts of the world and a harbinger of what will happen in the rest of Alaska. Our Yukon River Canadian counterparts have been standing down on most salmon harvest for over twenty years and clearly warning us – "*your time is coming."*[12]

***That time is now.***

**Alaska needs to decide if we want to save our wild salmon or not**

**Alaska is not charged with feeding the world; our biggest priority (Article 8, Alaska Constitution) is protecting wild salmon for the use of Alaskans based on *sustained yield*. Our management of commercial harvest and development of enhancement is increasingly in conflict with that mandate.**

**If we see salmon strictly as a commodity to be exploited for commercial gain, which is essentially what production hatcheries were created for, then we lose sight of our ability to see wild salmon as the keystone species of entire ecosystems. We thus lose sight of our incentive to protect wild salmon.**

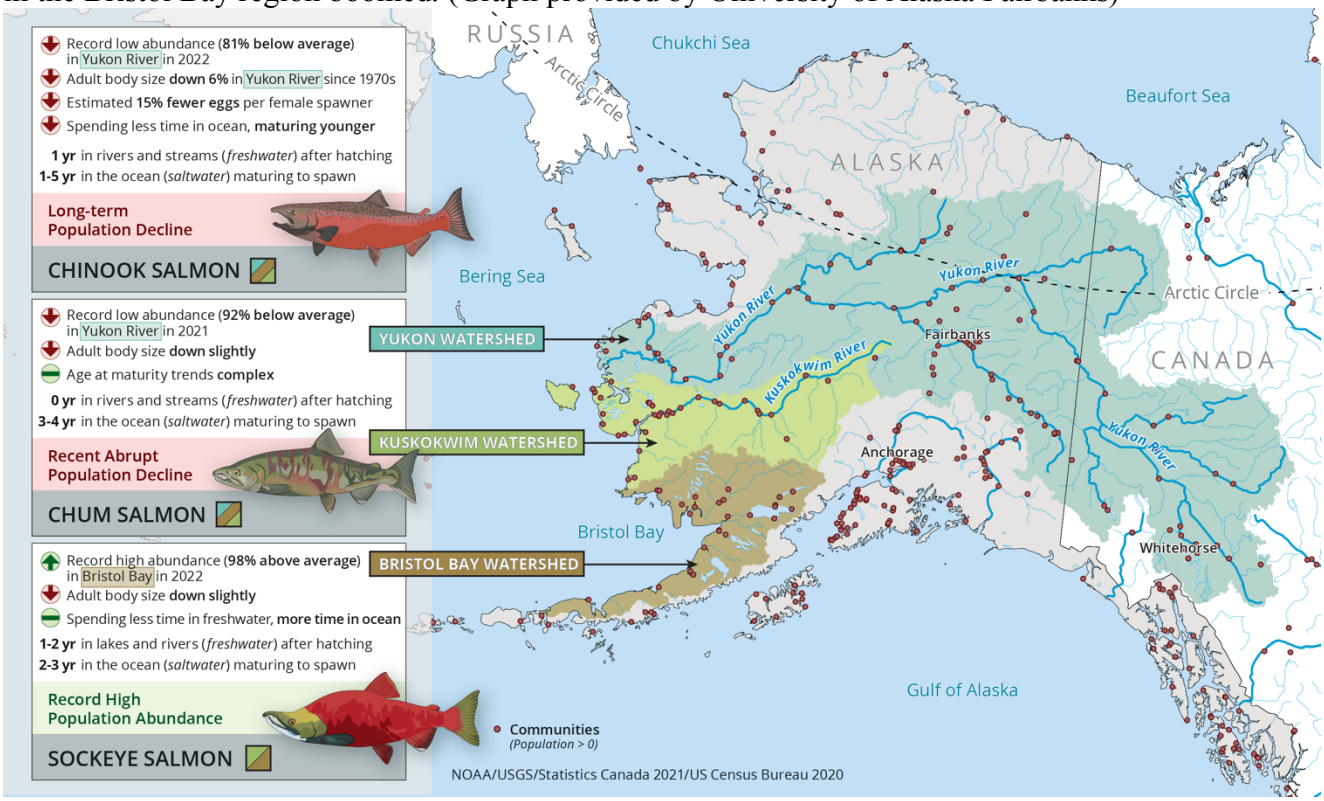
Hatchery salmon are fundamentally different from wild salmon in four distinct ways:

- Hatchery salmon do not feed ecosystems
- Hatchery salmon require a costly and complicated system to produce
- Hatchery salmon have genetic differences from wild salmon
- Hatchery salmon can threaten the survivability of wild salmon

Therefore, we cannot manage wild salmon in the same way we manage hatchery stocks. Very often, the two are diametrically opposed but we have a difficult time assessing how one management schematic affects the other.

## The AYK is a harbinger of rapid salmon decline

Salmon runs in the Yukon and Kuskokwim Rivers suffered crashes, which sockeye salmon runs in the Bristol Bay region boomed. (Graph provided by University of Alaska Fairbanks)




**Alaska salmon woes, extreme precipitation, tundra shrub growth part of Arctic transformation** NOAA's 2023 Arctic Report Card highlights challenges posed by rapid climate change in Alaska and elsewhere in the far North, along with some local responses

BY YARETH ROSEN - DECEMBER 13, 2023 *ALASKA BEACON*

## The growing Artic-Yukon-Kuskokwim (AYK) salmon crisis

The essential concern of the Fairbanks AC, and indeed all stakeholders in the Arctic-Yukon-Kuskokwim (AYK), is the sustained and extreme decline of Chinook, summer and fall chum and coho wild salmon in the AYK and for the decline in general of Chinook all over the state. This drives the need for mitigative answers.

Subsistence has a priority in times of low abundance but in recent years there has been little to no opportunity for any salmon fishing at all in the AYK. This has created an enormous burden on the thousands of subsistence-dependent residents as food security and cultural and traditional practices

> "I remember teeming fish camps and fishwheels dominating my view on the Yukon River fifty years ago. It was glorious and we thought it would last forever. Fish camps were once everywhere on the rivers and coasts of Alaska as people followed the rhythm of seasonal migrations. Fish camps were the learning centers for the young, where elders taught skills, history, culture, resource management. The family worked together and

reinforced inter-generational inter-dependency. They built nets or fishwheels in accordance with the geography and they took only what they needed for subsistence and trade. This scenario was repeated in whole coastal fishing communities as well, where families worked to fish multi-species, living a life that provided health, sustenance, education and work, *as well as protection of the species*. With the coming of bigger boats, commercialization and fishing quotas, family fish camps and fishing communities started disappearing until now they are a tiny fraction of what they once were. *The loss of fish camps is one of the greatest tragedies to befall Alaska culture, education and resource protection.*" [13]

The loss of salmon fishing opportunity in the AYK affects thousands of people and the entire ecosystems they rely on. The AYK covers the entire northern and western regions of Alaska, dominating the state in terms of geography.

**AYK Region** The Arctic-Yukon-Kuskokwim (AYK) Region includes all waters of Alaska that drain into the Bering Sea, Chukchi Sea, and Arctic Ocean north from Cape Newenham. For the purposes of salmon fishery management the region has been divided into four Management Areas which have been subsequently divided into districts and subdistricts. Area definitions and the designations of districts or subdistricts within each area of AYK in Alaska follow those defined in regulation (AS 5AAC.). The Yukon River in Canada has been defined as a fifth Management Area in AYK for purposes of archiving data in the AYKDBMS. For the Canadian portion of the Yukon River area names and definitions follow those used by the managing agency; Canada Department of Fisheries and Oceans (CDFO).

- The Yukon River is the largest river in Alaska and its drainage is the fifth largest in North America. The Yukon Management Area includes all of the Yukon River drainage in the United States except for the Tanana River drainage. The area as a whole is sparsely populated; only about 12,000 people live along the Yukon River and its tributaries (excluding the Tanana River). The communities within the area are invariably located near water, because of the importance of fish and/or marine mammals as a food source to native people historically and today.[14]
- The Kuskokwim River is the second largest drainage in the state of Alaska. The glacially turbid mainstem is approximately 900 miles long, originating from the interior headwaters of the Kuskokwim Mountains and the shadows of the Alaska Range. The Kuskokwim River flows in a southwest direction to the Bering Sea. The sparsely populated Kuskokwim drainage has population centers at Bethel, Aniak, and McGrath, in addition to numerous villages along its length. The Kuskokwim is a remote area of Alaska. People usually travel by aircraft to one of the three previously mentioned hubs. There are no roads, except within the cities and villages on the Kuskokwim.[15]
- The Northwestern Management Area includes all waters that drain west in Alaska that are north of the Yukon River and south of Point Hope. This includes all the drainages of Norton Sound, the Seward Peninsula, Kotzebue Sound and the Chukchi Sea to Point Hope. The total land area is about 68,000 square miles. Sport fisheries in the area target all species of pacific salmon, Dolly Varden, Sheefish, Arctic grayling, northern pike, lake trout, Arctic char, and to a small degree, burbot.[16]

The Yukon River, in particular, an area of over 833,000 square miles between Alaska and Canada[17]. has had no directed commercial fishery of Chinook salmon since 2008, and no allowable subsistence harvest of Chinook for many years. In 2022, there was no harvestable

surplus of any species and in 2023 only a limited window of fishing was allowed for summer chum, using very limited, often non-traditional, gear. Some discrete stocks, such as the Chena and Salcha Rivers, traditional heavy Chinook and summer chum producers, have been so low in recent years that a complete loss of those stocks is possible. Escapement goals have not been met for many years in most streams and treaty obligations with Canada for border crossing of Chinook and fall chum have not been met in years. In the Anvik River, in particular, summer chum failed to meet escapement in both 2021 and 2022, showing a decline of over 90% compared to the previous decadal average escapement. [18]

At the state level, Yukon River Chinook salmon have been a Stock of Concern (SOC) since 2000 and the Alaska Board of Fisheries reviewed that listing in 2022. There currently are efforts to make both Yukon River summer and fall chum, and even coho salmon, into SOCs because of sustained declines that are greatly impacting subsistence. In 2023:

- Chinook salmon passage was the second lowest ever recorded at the [Pilot Station sonar] project (2022 was the lowest) and about 33% of the average annual passage of 177,431 fish. The Eagle sonar operated from June 30 to October 6, with an estimated passage of 14,752 Chinook salmon, which is approximately 70% lower than the historical average and the second lowest season total estimate (2022 was the lowest).
- The Yukon River fall chum salmon run is the fifth lowest on record (1974–2022), while the coho salmon run is the second lowest (1995–2022). The fall chum salmon run size is approximately 290,000 fish compared to a historical run size of 948,000 fish. The coho salmon run size is approximately 65,000 fish compared to a historical run size of 222,000 fish.
- Yukon River summer chum returns in 2023 were not as bad as Yukon River Chinook, fall chum, and coho in 2023, however they were "well below the 10-year and 20-year averages." [19]

The Yukon River salmon decline is so critical that it is affecting people's physical health and mental well-being. The federal government provided disaster relief for the Yukon River in 1998, 2009, 2012, 2020, 2021 and 2022. "The salmon crisis in the Yukon and Kuskokwim rivers is harming more than local economies, food security and culture, according to people in the region. It is also harming human health. That was a message emphasized at a field hearing held by U.S. Sen. Lisa Murkowski, R-Alaska, in Bethel, the regional hub for the Yukon-Kuskokwim Delta."

The crisis is so severe that national and international news sources are conducting in-depth reporting. In a recent December 2023 article,[20] the *Washington Post* reported:

> EAGLE VILLAGE — When Jody Potts-Joseph was growing up, her family mushed sled dogs during the harsh Alaska winters to hunt and trap, feeding them salmon caught from the Yukon River by the thousands. But after rebuilding her sled dog team as an adult, Potts-Joseph, a member of the Han Gwich'in tribe, had to turn to store-bought dog food. The river that was once renowned for its salmon doesn't have enough to offer anymore. "We haven't been able to fish for a number of years," she said as her dogs yelped outside her home in Eagle Village, close to the Yukon near the border with Canada.
>
> "Flowing from British Columbia through Alaska to the Bering Sea, the nearly 2,000-mile-long Yukon River used to teem with chinook and chum salmon, sustaining a culture of harvesting fish to feed both Alaskans as well as sled dog teams vital for transportation

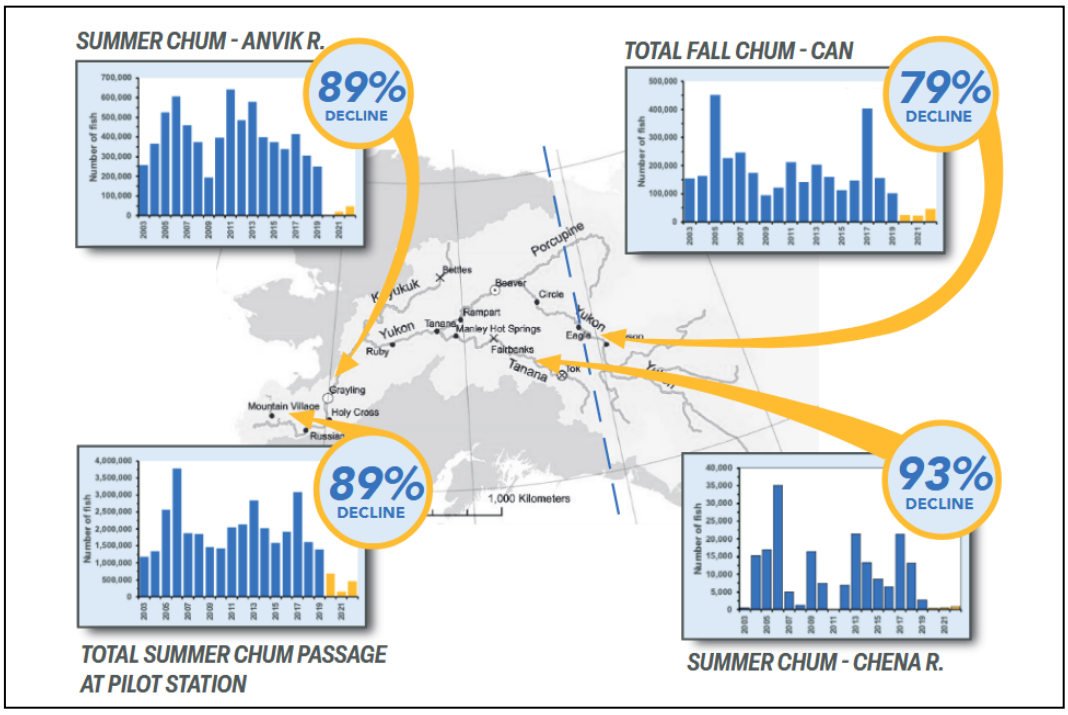
during the winter. Now those salmon runs have turned into a trickle, as climate change and other factors weigh against the fish. The result is a drastic cut to local food supplies in a region where store-bought food, shipped in from thousands of miles away, is expensive. "Alaska is a canary in the coal mine," said Andy Bassich, a homesteader and dog musher at Calico Bluff only a few miles from the Canadian border."

"The declines have forced regulators to issue a series of restrictions on subsistence, commercial and recreational fishing up and down the river, upending a way of life for Alaska Native people and severing a vital connection between land and sea."

"This is the most disconnection to the river I've had in all my life," said Holy Cross resident David Walker, who called into the weekly Yukon River salmon management teleconference hosted by the Yukon River Drainage Fisheries Association. Walker said that no one nearby is fishing, and described neglected fish camps overgrown with grass. "I don't want to get too negative, but I heard one Elder tell me, 'It's like cultural genocide,'" Walker said."

**<u>Evidence of severe decline of the Yukon River chum populations 2003-2022</u>**

Percent figures in the bar graphs indicated the percent decline in annual run sizes from the period 2003-2019 compared to the period 2020-22. Chum salmon are critical to food security in the region in times of low Chinook runs, including the past three years**.** *Source: Yukon River Joint Technical Committee 2022.*



## Alaska Salmon Research Task Force

As a result, Alaska's congressional delegation has been focused on many ways to address the decline other than just periodic disaster reliefs. One of the methods to address has been the development of an Alaska Salmon Research Task Force, conducting through NOAA. In a December 19, 2023 Opinion piece in the *Anchorage Daily News,*[21] Sen. Dan Sullivan wrote the following:

> "I want Alaskans to know that in Washington, D.C., we are very focused on this important issue and trying to get to the bottom of what is happening to salmon during their lifecycle and what is impacting salmon survival and healthy returns for spawning. That's why, working with Alaskans, I wrote and was able to pass the Alaska Salmon Research Task Force Act, which was signed into law last year. This legislation is bringing the best minds from across the state — Alaska Natives, scientists, state, federal and university officials, and fishermen who spend much of their lives at sea — to figure out exactly what is happening with our salmon returns. Nineteen members of the new Alaska Salmon Research Task Force have been appointed and are currently working hard to bring their expertise together into a report that I hope to bring to both Congress and the administration to leverage funding and support for the important work we need to be doing on salmon in Alaska.
>
> Critically, the Research Task Force has also formed a 29-member working group from the Yukon and Kuskokwim River regions of Western and Interior Alaska, specifically focused on king and chum salmon returns in their rivers.
>
> Why does this gap in knowledge about our salmon exist? Much of NOAA's fisheries research efforts are informed by the North Pacific Fisheries Management Council, which places a high priority on research for stocks they manage that have seen high levels of variability including crab and cod. In the meantime, gaps in our fisheries knowledge, particularly with regard to salmon research, are getting bigger.
>
> For years, much of the federal support for salmon has been funneled toward habitat restoration in Washington state and Endangered Species Act-listed stocks in the Pacific Northwest. I have emphasized repeatedly with senior Commerce Department and NOAA officials that while that work is important, supporting healthy salmon returns before they reach such a depleted, endangered status is critical and a much more cost-effective approach. Alaska has nearly pristine, healthy habitat and the challenges our salmon face out in the ocean are fundamentally different, although no less culturally important, than those in the Pacific Northwest."

This is a crisis that started decades ago but it is now a continual downward trajectory. There have been numerous historical fluctuations in AYK salmon runs over the last 130 years, many caused by over-fishing or changing environmental conditions. In 1994,[22] chum crashes on the Yukon River were the first shock wave of a more recent trend that has been up and down, but mostly down since that time. Bering Sea bycatch has long been a known cause but more recently Area M intercepts and production hatchery impacts are believed to be causes of equal consideration.

**For the AYK a Yukon River production hatchery is not the answer**

The Alaska Department of Fish and Game's response to mitigating this crisis is for the Yukon River, in particular, is to consider hatchery production.[23] This would only greatly exacerbate the impacts on wild stocks. Because the Yukon River is a linear mixed stock fishery, the following noted requirement would negate adding hatchery stocks as there would be no way to separate out the stocks for harvest. A March 10, 2014 memo (ADF&G) discussion paper notes:

> "Fishery management in Alaska has a wild stock priority. Hatchery produced fish are required to be released where the returns will be segregated from wild stocks. There is still potential to overharvest wild stocks when attempting to harvest hatchery produced fish, therefore it is important to be able to identify hatchery-produced fish through tagging when they are harvested in a mixed stock fishery. It may be necessary to forgo harvest opportunity on hatchery produced fish in order to protect a wild stock. Targeting of the hatchery produced fish could reduce the natural spawning population resulting in a decrease in natural production." [24]

A cost-benefit analysis and environmental review would quickly dispel a discussion of production hatcheries on the Yukon River. Aside from the immense costs, infrastructure needs and conflict with wild stock management, adding more fish into a system (the North Pacific) that is already over carrying-capacity would be fruitless. The returns to the *mitigation* hatchery near the headwaters of the Yukon River at Whitehorse proves the point:

> A mitigation hatchery does not generally produce a harvestable surplus. It is designed to replace salmon lost to dams or other obstacles in a specific watershed. The Whitehorse Rapids Hatchery provides Chinook mitigation for the Whitehorse River only, which is dammed. It is a very expensive operation that is mostly financed by Whitehorse Energy. The returns on Chinook salmon to this hatchery are less than 0.1 %, which means for 150,000 smolt released into the river, only 150 or less return.[25]

> "The Whitehorse Rapids Hatchery, owned and operated by Yukon Energy Corporation, has released Chinook salmon fry upstream of the dam since 1985. The current annual release target of 150,000 (2.0 gram) fry has been in place since 2002; releases since that time have ranged from 85,306 fry in 2008 to 176,648 fry in 2003. The recent 10-year average (2010–2019) is 138,104 fry clipped and released upstream of the dam (unpublished data on file with Trix Tanner, Restoration Coordinator, DFO, Whitehorse, YT)."[26] "In total, 27 female Chinook salmon (49.1% of the total 80 female Chinook salmon were returned to the Fishway), including 23 wild and 4 adipose-clipped (hatchery) salmon were removed for hatchery brood stock. Eggs were taken between August 20 and September 1, 2020 from 25 full (or nearly full) ripe females, and 2 partially spent or poor condition females. Fecundity estimates, excluding egg takes estimated to be partial, averaged 5,592 eggs, and ranged from 3,625 to 7,661 eggs." [27]

The billions of dollars spent on the Columba River salmon hatcheries are another case in point.

> "Most hatcheries are industrial affairs. Eggs and sperm first meet in white plastic buckets and are released after some months of growth. They crowd degraded streams, competing with wild fish for food and safe havens. Later in their lives, hatchery fish enter spawning grounds and interbreed with wild salmon, diminishing their genetic

> robustness. And, like boats, hatchery fish are money pits. The cost of salmon varies per hatchery, but 20 years ago, a researcher calculated that to keep hatchery salmon in swimming the Columbia and Snake River basins in Oregon, Washington, and Idaho, the price tag was US $400 per fish. [28]
>
> "An investigation by Oregon Public Broadcasting and ProPublica last year found that several federally-subsidized hatcheries on the Columbia River — responsible for 80% of all the salmon in the Columbia River — spent between $250 to $650 for every hatchery salmon that returned. There are about 200 salmon hatchery programs in the Columbia River Basin, and 80% of all salmon and steelhead that return to the Columbia River as adults started their lives in hatcheries, according to the National Oceanic and Atmospheric Administration fisheries division. The cost to taxpayers to maintain these hatcheries during the last 40 years has been about $9 billion when adjusted for inflation, according to Jaeger. This does not include any of the money spent by local governments or nonprofits and nongovernment agencies. "We found no evidence in the data that the restoration spending is associated with a net increase in wild fish abundance," Jaeger said. David Moskowitz, executive director of the nonprofit Conservation Angler which works to protect wild salmon and steelhead, said $9 billion dollars in the last four decades is probably a low figure." [29]

Many Yukon River stakeholders have repeatedly opposed production hatcheries[30] because of the threat posed to already severely threatened wild stocks. We have also illustrated that there is no feasible way to prosecute a PNP production hatchery on the Yukon, a sentiment the Department seems to be in agreement with. But the question is still out there and deserves a legitimate and very detailed conversation. Not just sound bites.

There is no other production methodology for anadromous hatchery release that is safe for the Yukon River. While there is a sports hatchery in Fairbanks, Ruth Burnett Hatchery, that is strictly for Interior non-anadromous sports stocking. The only other hatchery option is streamside enhancement, limited to educational permits and carrying the same mixed-stock conservation concerns of a production hatchery.

Yukon River stakeholders, on both sides of the border, want to protect, preserve and rebuild their wild stocks. Production hatcheries would hardly be compatible with that model.

> "Hatchery salmon are different from wild salmon in significant ways. Healthy wild fish populations are genetically diverse, shaped by natural selection to survive best in the changing watersheds their ancestors have returned to for centuries. Wild fish populations have adapted to the conditions in their watersheds, and they continue to evolve as those conditions change; this provides wild fish populations resiliency to climate change. Conversely, hatchery raised fish are shaped by artificial selection, are significantly less fit for survival in the wild, and generally have lower genetic diversity than wild fish. Hatchery fish are raised in an industrialized setting to maximize survival regardless of fitness. They are fed processed pellets by hand or by automated feed dispensers, provided with artificial shelters that are devoid of predators, and artificially spawned without regard to the importance and magic of mate selection or their fitness for successful spawning and survival in the wild. On the other hand, wild salmon must forage for food, find shelter, evade predators, and select mates. These natural selection pressures allow salmon to adapt to an ever-changing environment, creating more fit and resilient salmon

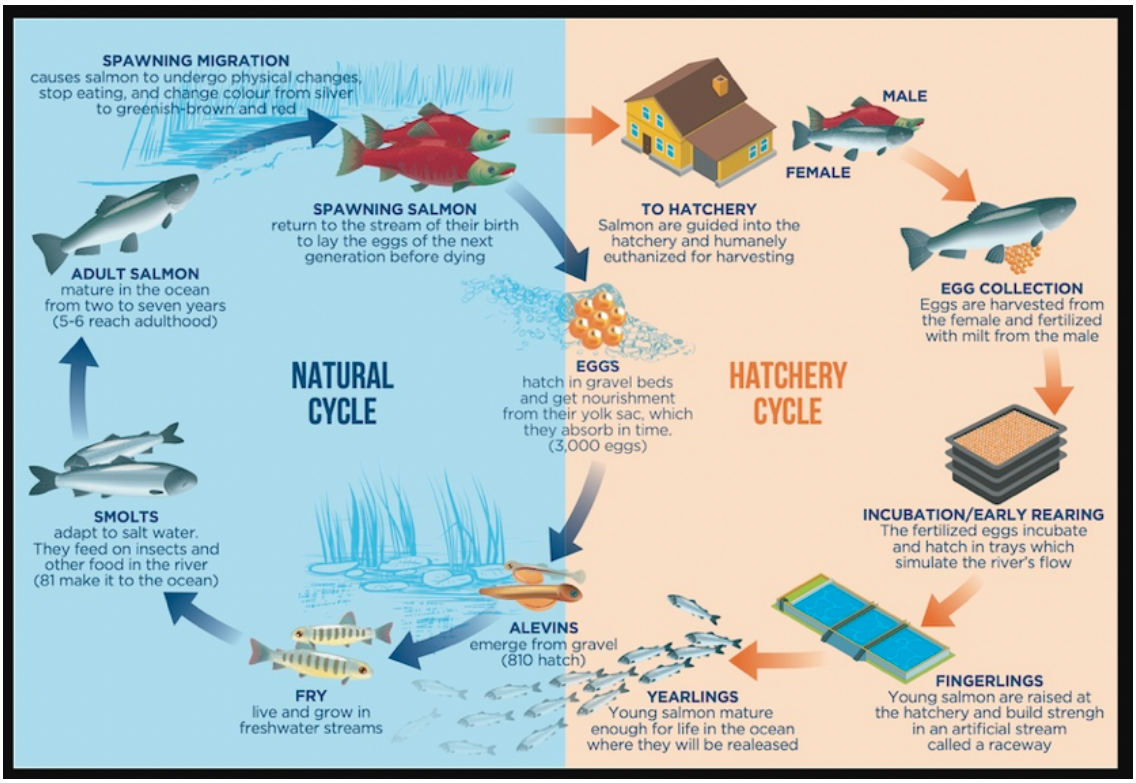
with traits that are well-adapted to local conditions to survive to pass on their genes, even in the face of climate change."[31]

The following might be a good explanation of the sentiment of many people in the AYK.

"The history of Pacific salmon hatcheries has little to show for its 120 years of effort and hundreds of millions of dollars in expenditures. Throughout that time, we have blindly depended upon hatcheries to compensate for overfishing and habitat destruction, even though science and historical trends indicate that hatcheries fail to meet this intended function. Despite widespread hatchery development, over 100 major Pacific salmon runs have gone extinct, and many of the remaining 200-plus runs are at risk of disappearing. Even though studies indicate that hatchery fish may accelerate the extinction of salmon runs, faith in hatcheries continues." [32]

"We've known for a long time that hatcheries are no solution to diminishing salmon runs. By the early 1930s, the science had already aligned against fish hatcheries. Why did we abandon the restoration and protection of salmon habitat and instead lean so heavily on hatcheries for fish? …. At first, it was mainly politics and blind faith in technology. Today, the reliance on hatcheries is a combination of politics, law, and desperation."[33]

Natural cycle compare to Hatchery cycle. Created by Dr. Joseph Spaeder, Bering Sea Fishermen's Association (BSFA)



## Dramatic declines in salmon abundance and size is not just an AYK problem

Chinook salmon, in particular, have shown severe declines in the AYK, Bristol Bay's Nushagak River, the fable runs of the Kenai River and Southeast Alaska. The Alaska Department of Fish and Game have noted the dramatic decreases since 2007.[34] "

> "With few exceptions, since 2007, Chinook salmon runs across the state have been well below the long term average. As a result, strict fishery management actions have been necessary to try and meet escapement objectives, and many fisheries have been curtailed to protect Chinook salmon. Even so, in some cases Chinook runs have been so poor that even with complete closures and no harvest at all not enough fish returned to make escapement objectives." One of the factors noted is a "decrease in marine survival, even in the face of some very good freshwater production in several systems, has been driving the downturn in overall adult production."

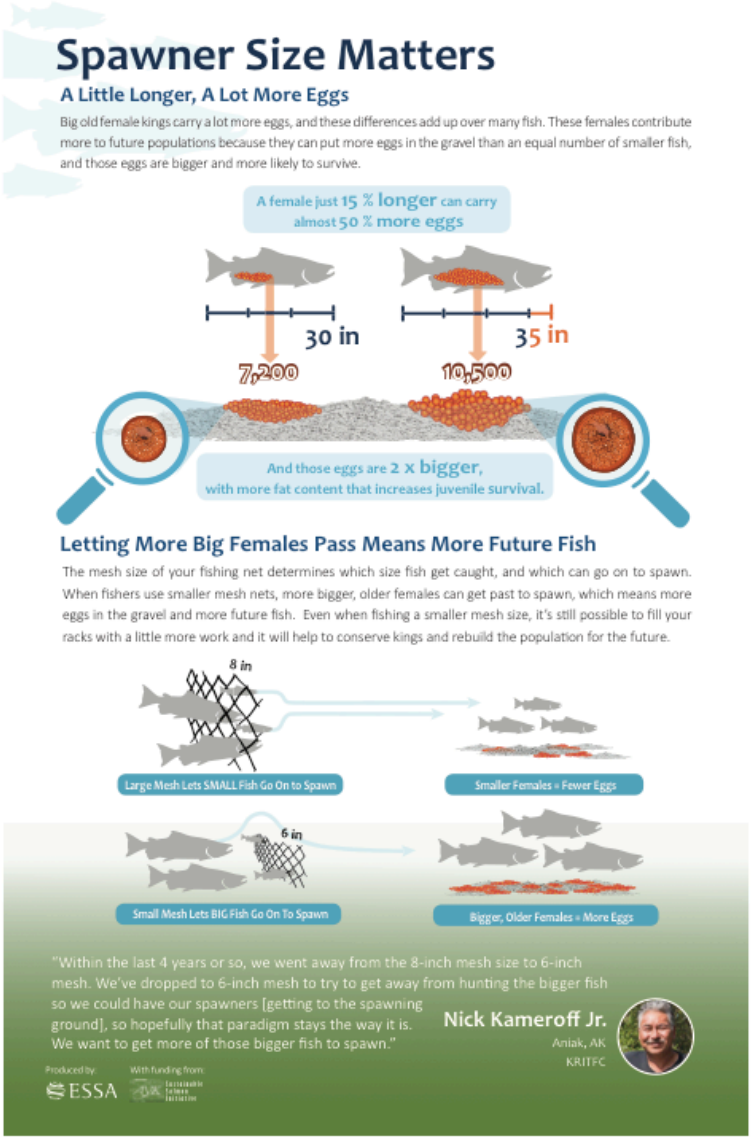
Chinook abundance is not only declining, but so is the average size. This is true of summer and fall chum, sockeye, and coho as well. Pink salmon are in high abundance, largely due to hatchery fish, but harder to get data on size changes. [35]

The August 2020 paper "Recent declines in salmon body size impact ecosystems and fisheries", a peer-reviewed paper published in *Nature Communications*[36], noted

> "Declines in animal body sizes are widely reported and likely impact ecological interactions and ecosystem services. For harvested species subject to multiple stressors, limited understanding of the causes and consequences of size declines impedes prediction, prevention, and mitigation. We highlight widespread declines in Pacific salmon size based on 60 years of measurements from 12.5 million fish across Alaska, the last largely pristine North American salmon-producing region. **Declines in salmon size, primarily resulting from shifting age structure, are associated with climate and competition at sea**. Compared to salmon maturing before 1990, the reduced size of adult salmon after 2010 has potentially resulted in substantial losses to ecosystems and people; for Chinook salmon we estimated average per-fish reductions in egg production (−16%), nutrient transport (−28%), fisheries value (−21%), and meals for rural people (−26%). Downsizing of organisms is a global concern, and current trends may pose substantial risks for nature and people."
>
> The paper further noted: "In all four salmon species, average body sizes were smaller after 2010 compared to before 1990 (the earliest baseline with sufficient data, Fig. 1). Comparing mean body length pre-1990 to mean body length post-2010, Chinook salmon exhibited the greatest magnitude decline, averaging an 8.0% decline in body length, compared to 3.3% in coho salmon, 2.4% in chum salmon, and 2.1% in sockeye salmon. Within species, the magnitude of declines varied among regions and populations (Fig. 1). For example, Chinook salmon populations in Westward Alaska and Arctic–Yukon–Kuskokwim declined by 10% on average, whereas conspecifics in Southeast Alaska declined by 4%." Ecosystems impacts included:

- **Nutrient delivery.** Salmon biomass provides critical nutrients to support freshwater and riparian productivity and biodiversity. Smaller salmon each transport less biomass, starving ecosystems of critical nutrients that support bears, insects, birds, trees, and juvenile salmon themselves.

- **Population productivity.** Larger female salmon produce more eggs, thereby bolstering population productivity. In a rapidly changing world, lost productivity caused by decreasing salmon size may reduce resilience to environmental variability.




## Too many salmon in the ocean?

Numerous recent articles have echoed a concern that there are too many salmon in the ocean vying for forage food. In a September 6, 2023 article "Warming Bonus", Alaska writer Craig Medred noted the following:

> "Six times in the last 11 years, the (Bristol Bay sockeye) harvest has topped 200 million, according to Fish and Game data. Prior to 2013, that had happened only four times. Prior to 1995, it had never happened at all. What followed '95 was another 200 million plus year in the 1990s, two such years again in the first decade of the new millennium, and

then a solid string of years in which every odd-numbered one – 2013, 2015, 2017, 2019, 2021 and 2023 – produced more than 200 million.

There was a reason the big catches came in odd years. Pink salmon, the smallest and shortest-lived of the Pacific species, have two distinct lineages: Odd-year fish and even-year fish with the former significantly more productive than the latter.

The prevailing but debated theory as to the differences in productivity between the odd and even years hinges on the idea that odd-year pinks chew such a big hole in the ocean's food supply that the even-year fish struggle to find enough to eat. The ripple effect on other salmon that compete with pinks for food is unclear, but returns of all salmon species in Alaska now seem to be yo-yoing significantly from odd to even years.

Some scientists contend that hatchery boosting of the already large number of Alaska's naturally spawned pinks has created so-called "trophic cascades" that drive down not only the numbers of other species of salmon but also some populations of marine birds. The situation is such that it actually had the North Pacific Anadromous Fish Commission (NPAFC) last year asking "Are There Too Many Salmon in the North Pacific Ocean?"

**How do hatcheries fit into the general salmon decline problem?**

Concern over the flood of hatchery fish into the North Pacific goes back decades. "Alaskan ocean ranching and hatchery operations release billions of farm-raised fish into natural eco-systems and wild salmon populations," said Aaron Hill, a biologist with the Watershed Watch Salmon Society. "There is increasing scientific concern about the effect that flooding the North Pacific with these fish is having on wild salmon populations." Alarm bells about the practice of ocean ranching began ringing as soon as the Alaskan fishery was certified more than 10 years ago. A 2001 report by the Environment and Natural Resources Institute at the University of Alaska Anchorage bluntly warned that the practice could jeopardize the state's own wild salmon populations."[37]

In a December 2023 article in the *Alaska Beacon*[38] noted the following commentary regarding a recent release of a synthesis of peer-reviewed papers:

> "A recent literature review that analyzed over 200 studies focusing on the release of hatchery salmonids, which include species such as salmon, trout, and char, revealed hatchery releases often adversely affect marine and freshwater wild salmonid populations. The research, "A global synthesis of peer-reviewed research on the effects of hatchery salmonids on wild salmonids," which appeared in Fisheries Management and Ecology, scoured over 50 years' worth of publications published between 1970 and 2021. Over half the publications studied fisheries in the United States, with other countries studied including Canada, France, Spain, and Norway. The research primarily focused on the effects releases have on 15 species, such as brown trout, steelhead trout, Chinook salmon, and Atlantic salmon.
>
> While the release of hatchery salmonids typically lead to an increase in stock abundance and overall aquaculture successes, those gains are often counterbalanced by genetic and ecological disruptions to wild populations. These disruptions are due to the fact that hatchery fish compete for the same resources and reproductive opportunities as wild

salmonids and can introduce exponentially harmful maladaptive behaviors in future generations.

"Wild and hatchery fish are not the same creatures. Wild salmonids embody unique genetic characteristics and incredible ecological strategies developed over long evolutionary histories, and hatchery fish can erode these adaptations and reduce the resiliency of wild populations," Helen Neville, one of the study co-author's and a senior scientist at Arlington, Virginia, U.S.A.-based nonprofit Trout Unlimited, said."[39]

The findings weigh into a sensitive topic with a big price tag. In the Northwest, hatcheries are supposed to be a solution to declining wild salmonid numbers, caused in large part by hydroelectric dams, overfishing, irrigation and climate change. In the Columbia River Basin alone, officials have spent billions of dollars on nearly 200 hatcheries as well as habitat restoration projects during the past 50 years to improve wild numbers, but research shows those programs are having an opposite effect.

The global studies, all undertaken between 1971 and 2021, were analyzed by scientists at the nonprofits Trout Unlimited, based in Virginia, and The Conservation Angler, out of Washington, along with the University of Washington, the University of Montana and the Université Laval, in Quebec, Canada. Their analysis was published in July in the journal Fisheries Management and Ecology.

Of the 206 studies the team analyzed, more than 80% revealed hatcheries programs had adverse effects on wild salmonids. Of the 3% of hatcheries globally that were found to benefit wild populations, the majority were stocked with wild fish who were bred and released in small numbers to boost severely depleted wild populations.

John McMillan, science director at The Conservation Angler who worked on the analysis, said the team wanted scientists all over the world who are studying the same fish species to see the impact of hatcheries programs beyond their regions of study. He said despite an overwhelming body of research showing most hatcheries programs hurt wild fish populations, it's often controversial to criticize such programs.

"It's frustrating from a scientific point of view, because you can see what the science suggests, but it's understandable why we've been reluctant to move our position on hatcheries, because of the social implications," he said. "This is one of those things, like climate change, where we have to sit back and think about our relationship with the animal, what it means to us and how much we want to give up so these animals can truly, potentially rebuild themselves."

## A Brief History of Hatcheries in Alaska[40]

Hatchery Development between 1936 and Statehood 1959: In the fifteen years between 1936 and 1951, little interest was shown in salmon propagation. The U.S. Bureau of Fisheries approached the problem of depleted salmon runs by imposing regulations on fishermen in order to decrease the commercial catch, not by encouraging artificial propagation of salmon. During this time a few experimental hatcheries were started. The federal government built Little Port Walter on Baranof Island in 1939. It's main focus at the beginning was pink salmon biology. By 1933, only two federally-operated hatcheries and one private hatchery were still producing fish. That year a new United States Commissioner of Fisheries, Frank T. Bell, made a tour of Alaska and ordered

the hatcheries to be closed. He took the view that these hatcheries were a waste of public money and further constituted an unjustified subsidy to a special industry. He said "The salmon will reproduce naturally, if a sufficient number are allowed to reach their spawning grounds. If any district is threatened with depletion, we will restrict the gear or the period and permit it to build up by natural propagation rather than try to do it artificially. [41]

Construction of the Kitoi Bay Research Station was completed in 1954. Their principal objective was to develop techniques for introduction of sockeye into lakes which were not utilized by anadromous fish. The hatchery provided sockeye fry for various experiments in stocking these lakes. There are presently several kokanee populations around Kodiak that resulted from these stocking experiments. In 1954, Deer Mountain Hatchery in Ketchikan became operational. Like the Kitoi Bay facility, it was originally designed to provide salmon fry for lake stocking programs. Most of the work was done with sockeye and coho salmon. When Alaska achieved statehood in 1959, the U.S. National Marine Fisheries Service was developing a fish culture research lab at Auke Bay near Juneau. All four of these facilities are still active today and involved with various research projects. The Kitoi Bay Research Station was destroyed by a tidal wave during the 1964 earthquake and was rebuilt as a production pink salmon hatchery, beginning in 1965. [42]

Alaska inherited hatcheries from the federal government after Statehood in 1959, with management by the FRED (Fisheries Rehabilitation, Enhancement and Development) Division of the newly formed Alaska Department of Fish and Game. In 1972, Alaska voters amended Article 8, Section 15 of Alaska's Constitution to provide tools for restoring and maintaining the state's fishing economy. The amendment provided an exemption to the "no exclusive right of fishery" clause in the state constitution, enabling limited entry to Alaska's state fisheries and allowing the development of aquaculture in the state. **Alaska's salmon hatchery program developed under this authority and was designed to supplement—not replace—sustainable natural production. Alaska's salmon fishery harvests were just 22 million fish in 1973 and 1974 (Figure 1).[43]**

In 1974, the Alaska Legislature expanded the hatchery program, authorizing private nonprofit (PNP) corporations to operate salmon hatcheries:

> "It is the intent of this Act to authorize the private ownership of salmon hatcheries by qualified nonprofit corporations for the purpose of contributing, by artificial means, to the rehabilitation of the state's depleted and depressed salmon fishery. The program shall be operated without adversely affecting natural stocks of fish in the state and under a policy of management which allows reasonable segregation of returning hatchery-reared salmon from naturally occurring stocks.[2] This means that PNP hatcheries have a fishery enhancement objective and hatchery permits are issued for production-scale hatcheries."[44]

"In the mid-1970s, commercial salmon harvests in Alaska reached near historic lows (20 to 25 million fish) compared with the very high salmon harvests of the 1930s (100 to 126 million fish).

In 1973, the United Fisherman's Association (UFA)[45] was formed, organizing commercial - fishermen at the state level for the first time. Fishermen's groups such as UFA were a driving force behind Alaska's salmon hatchery programs. This group, along with others, believed it would take artificial propagation as well as some restrictive regulations to bring the commercial

harvest level back up from 23 million fish to 83 million fish. [46] To counter-act declining commercial salmon harvests, the state embarked on an ambitious salmon enhancement program. By 1988 the Alaska Department of Fish and Game (ADF&G) was operating 16 hatcheries throughout Alaska, which were annually producing more than 300 million juvenile salmon (Kelly et al. 1990.)"[47]

"The number of hatcheries increased to ten by 1974, with a combined egg take of 25 million eggs. At this time Crooked Creek was the only sockeye salmon facility and it incubated only 290,000 sockeye eggs; or roughly, 1% of the total eggs taken that year.

During the next six years the public and private hatchery programs expanded at a rapid pace and by 1980, there were twenty five hatcheries in operation, taking a total of 290 million eggs. Of that total, there were four sockeye salmon facilities; East Creek, Gulkana, Big Lake and Crooked Creek which combined took a total of 33 million sockeye salmon eggs. Crooked Creek is the only sockeye salmon facility in Alaska that does not use the "standard sockeye culture procedures" in its operations. It has never had an IHNV problem.

Most hatcheries, in 1980, were producing pink salmon. This was because pink salmon do not require fresh water rearing and they are the fastest maturing salmon with a life cycle of just two years. Therefore, pink salmon could be added to the commercial fishery quicker than any other species.

In 1976, Alaska legislation was passed creating Regional Aquaculture Associations that were responsible for the regional planning and coordination of salmon enhancement activities. The legislature felt that comprehensive planning on the regional level; primarily, careful hatchery site selection, would help mitigate potential problems such as intermingling of hatchery and wild stocks." [48]

In 1973, the legislature implemented limited entry in the commercial salmon fishery with the long-term goal of increasing economic returns to commercial fishermen. With the limited entry program in place, legislators felt more confident about expanding the hatchery program because the economic benefits of a rehabilitated fishery resource would not be dissipated among an ever-increasing number of fishermen. At this time, legislators also began to accept that nongovernmental hatcheries had much to recommend them from the perspective of public finance issues: the operation of private hatcheries could be funded from the harvest of returning fish and from tax assessments on the fishermen who had access to the hatchery production, thus shifting the cost of the facilities from the shoulders of the general public to the people who derived benefits directly from them. Thus, fisheries organizations and other' Private Non-Profit (PNP) groups were encouraged to build and operate PNP hatchery facilities. The 1974 Alaska State Legislature authorized the Commissioner of ADF&G to issue permits to PNP corporations for the construction and operation of salmon hatcheries. [49]

However, as the PNP hatchery program developed and hatchery technology progressed, it became evident that the cost of developing viable salmon hatcheries was far greater than was initially expected. In 1974 funds became available through the Renewable Resources Development Fund that was established that year. Additional state loans for construction of PNP hatcheries became available in 1975 when the commercial fisheries loan program was expanded to include hatcheries. The following year, a separate fisheries enhancement loan program was established. [50]

Today, there are now 30 hatcheries in Alaska; 28 are PNP hatcheries all operating within the Gulf of Alaska.

## A Brief History of the Board of Fish Hatchery Committee

In 1997 at the Board of Fisheries meeting in Ketchikan, the Board considered a proposal from Elfin Cove (#421/ 5 AAC 40.005) requesting limits on the production capacity of PNP hatcheries in Southeast Alaska–Yakutat area and Prince William Sound. The proposal was seeking relief:

> "PROBLEM: Excessive hatchery production of low cost pinks and chums are flooding processors with huge quantities of relatively poor quality fish (fish often harvested for the sake of high volume eggs alone). Hatcheries that emphasize pink and chum production have effectively become fish farms producing ever more quantities to cover their ever higher operating costs. Higher production rates also increase potential disease problems in hatchery and wild stocks. WHAT WILL HAPPEN IF NOTHING IS DONE? Salmon fishermen are being shut out of markets by cheaper cost recovery fish. Poor quality fish reduce consumer satisfaction with Alaska salmon and result in lower overall prices for wild natural stocks as well, multiplying the economic impact. Many fishermen will not be able to compete with hatcheries."

The Board tabled the proposal and instead, requested a review by the Department of Law and ADF&G to define (1) the Board's authority as embodied in legislative intent to regulate hatcheries and hatchery production, and (2) review the historical relationship between the Board and the (PNP) hatchery management planning process. The review was aimed at clarifying what the Board of Fisheries role is in the hatchery planning and regulation process. The Board was scheduled to review those reports at the 1997 Board of Fish work session.[51]

As a result of that meeting, on November 6, 1997, the Department of Law delivered a Memorandum on the "Authority of the Board of Fisheries Over Private Non-Profit Hatchery Production." Dubbed "The White Law" in deference to Board Chairman, Dr. John White, the memo defined the authority of the Board under several statutes.

Subsequently, in 1999, there was a proposal submitted by the Bering Sea Fishermen's Association (BSFA). Proposal #99-358, that enhanced many of the concerns of the Elfin Cove proposal, seeking caps on many hatcheries for chum salmon over growing concerns of ocean-carrying capacity, stating:

> "The dramatic growth in harvests of hatchery-origin chum salmon in Alaska. and its effects on ocean carrying capacity and exvessel and wholesale prices for chum salmon destined for the fresh and frozen domestic market. Prior to 1993 Alaska's total chum salmon harvest ranged usually between 7 and 10 million fish with the exception of the boom harvest of 15 million fish in 1998, a year of big runs and high prices. Beginning in 1993, harvests of hatchery-origin fish in both the common property and cost recovery fisheries took off and have not looked back. From 1994 through 1998 total harvests have consistently exceeded 15 million fish and topped 21 million in 1996 all fueled by hatchery fish. Despite this increase in production the exvessel value of Alaska's chum salmon harvest has remained flat at ranging between $30.6 million and $31.8 million from 1993 through 1998 with the exception of 1995 when the value reached $38.3 million. Ironically, in 1992 Alaska's harvest was only 10 million fish but the ex-vessel value was still $30.3 million (Source: McDowell Group/Salmon Market Information Service)."

While this proposal was also not passed, it help to prompt the creation of the Board of Fisheries Hatchery Committee in 1999. It was an ad hoc committee that did not meet until 2001 and then in 2002 the Board adopted a joint protocol policy between the ADF&G and the Board on salmon enhancement, reaffirming *annual* hatchery committee meetings. The Board stated its intent to institutionalize a public forum to bring a statewide perspective to issues associated with hatchery production of salmon. Accordingly, the department and board agreed to enter into this joint

protocol to coordinate department and board interaction on certain aspects of salmon hatchery policy and regulation.

And then, the Board abandon hatchery discussions for the next 16 years. In 2018, the Board re-established the Hatchery Committee of the Whole Board for annual non-regulatory meetings to present reports and findings to the public. Since 2018, it has met every year in a one-day meeting except in 2020 because of Covid restrictions. As far as can be found, NO egg reduction proposals have ever been approved by the Board.

## Hatchery production in releases and harvest returns: Alaskan and Asian

There are 30 salmon hatcheries in Alaska. Two are sports stocking hatcheries, heavily subsidized by the Dingell-Johnson Sport Fish Restoration Act (**16 U.S.C. 777** et seq.) that was passed in 1950. The other 28 are PNP (Private-Non-Profit) hatcheries. The PNP hatcheries produce all five species of Pacific salmon, in varying amounts depending on the location. In 2021, according to the 2021 Annual Enhancement Report from ADF&G (Table 1), the estimated total **hatchery salmon returns** attributed to Alaska PNP hatcheries (including common property harvest, cost-recovery harvest, broodstock, and other) as reported by operators, by area and species:

- Chinook 68,667 (the most expensive to produce)
- Sockeye 1, 490, 482
- Coho 799,630
- Pink 57,078,941
- Chum 9.437,312
- TOTAL 68,875,032

In 2022 hatchery returns were estimated to be about 25% of all common property harvests with pink salmon over 40% and chum salmon at 76%.

"**Alaska (salmon hatchery) releases** have grown to 1.89 billion as of 2022, a 28 percent increase rather than a 25 per decrease from 2000, according to the Alaska Salmon Fisheries Enhancement Annual Report 2022 for the state Department of Fish and Game. More than a billion of the little salmon released last year were pinks, according to the report. Releases of pinks – the smallest and least valuable of Pacific salmon but the cheapest and easiest to ranch on the ocean pastures – are now close to the 1.1 billion hatchery fish of all species that would have been released if the year 2000 promise had been kept."[52]

In total (Alaskan and Asian stocks) "About 5 billion hatchery salmon, primarily chum (*O. keta*) and pink salmon, are released into the North Pacific Ocean each year (Ruggerone & Irvine, 2018). Hatchery fish account for roughly I In 40% of the total salmon biomass in the North Pacific Ocean (Ruggerone & Irvine, 2018). Supplementation from hatcheries can affect wild populations in multiple and complex ways. Hatchery programs were developed primarily to mitigate declines in wild populations; however, concerns over adverse genetic or competitive effects of hatcheries on wild salmon have been raised repeatedly (Araki et al., 2007; Hilborn, 1992; Jasper et al., 2013; Naish & Hard, 2008; Waples, 1991). Although the majority of hatchery reared pink salmon returning as adults are harvested in ocean fisheries, several million fish that spawn in regional streams may interbreed with wild-origin fish (Knudsen et al., 2021). Some hatchery programs might replace rather than augment wild production due to increased competition for resources, as has previously been suggested for pink salmon in Alaska (Hilborn & Eggers, 2000; but see

Wertheimer et al., 2001). The potential for negative impacts of increasing abundances of hatchery reared salmon in the ocean has led to calls for an open dialogue on the number of hatchery fish being released each year (Connors et al., 2020; Holt et al., 2008)."[53]

- A significant share of the salmon caught by North American commercial fishermen are released from hatcheries. In recent years, hatchery fish have accounted for about 38 percent of total Alaska "wild" salmon catches, including about 40 percent of Alaska pink salmon catches and 69 percent of Alaska chum salmon catches. Most Alaska hatchery production is concentrated in Southeast Alaska and Prince William Sound. The importance is highlighted by ADF&G: "The ocean ranching program provides hundreds of Alaskans with seasonal jobs. It is now considered the largest agricultural industry in Alaska" (Farrington 2004 p. 2)[54].

Alaska enhancement was originally encouraged by processors to help off-set the odd-even year differential that naturally occurs in wild pinks. However, pink and chum hatchery production have put stress on ocean carrying capacity and thus have affected all salmon, both hatchery and wild.

> "Questions concerning the carrying capacity of the North Pacific Ocean in regard to salmon emerged in the early 1990s with increasing overall numbers of fish. Differences in diets, growth, condition, distribution, and catch of three competing species—pink salmon, sockeye salmon, and chum salmon—in even years compared with odd years suggested that pink salmon were placing a disproportionately high demand on pelagic production. It was further suggested that biennial oscillations in standing stocks of phytoplankton and zooplankton in the central SNPO/BS, apparent by 1990 and out of phase with each other, represented a trophic cascade initiated in odd years by prey demand of pink salmon—during odd years, relaxed grazing pressure by depressed numbers of macro-zooplankton, among the primary prey of pink salmon, led to an elevated standing stock of phytoplankton in summer."[55]

Recent history of pink salmon harvest (reflects even/odd years of wild salmon production) both wild and hatchery combined:

- 2023 "A total of 230.2 million salmon were harvested in 2023, a 43% increase from the 2022 total harvest of 160.7 million fish. The 2023 commercial salmon fishery all species harvest was valued at approximately $398.6 million, a significant decrease from 2022's value of $720.4 million. International market conditions significantly impacted pricing of salmon statewide, thus value of the harvest. Sockeye salmon accounted for approximately 45% of the total value at $181.1 million and 23% of the harvest at 51.8 million fish. Pink salmon comprised approximately 29% of the value at $113.7 million, and 66% of the harvest with 152.4 million fish.
- 2022 Pink salmon comprised 14% of the value at $102.2 million, and 43% of the harvest with 69.1 million fish[56]
- 2021 Pink salmon accounted for approximately 28% of the value at $178.8 million, and 69% of the harvest with under 161.0 million fish.[57]
- 2020 Pink salmon accounted for approximately 21% of the value at $61.8 million, and 51% of the harvest at 59.4 million fish.[58]
- 2019 Pink salmon were the second most valuable species representing 20% of the total ex-vessel value at $128.6 million, and 62% of the harvest at 129.1 million fish[59]

- 2018 Pink salmon represent approximately 12 percent of total value at $69.2 million, and 36 percent of total harvest at 40.7 million fish.[60]
- 2017 Pink salmon accounted for 25% of the value at $169.0 million, and 63% of the harvest at 141.6 million fish.[61]

"The hatchery harvests alone in both 2013 and 2015 were greater than the entire statewide commercial salmon harvest in every year prior to statehood except for seven years – 1918, 1926, 1934, 1936, 1937, 1938 and 1941," Mark Stopha, who oversees the state's private, non-profit hatcheries for Fish and Game, raved in the state's May 2016 issue of Alaska Fish & Wildlife News."[62]

What does not get reported in annual summaries (except possibly by digging through the Alaska Salmon Fisheries Enhancement Annual reports both statewide and individual hatchery):

- The percentages of hatchery stock harvest to wild stock harvest in both the common property and total harvest
    - In the 2022 report[63], Appendix II notes a high of 52% total harvest of hatchery produced harvest to wild stock 2010 and averages over last 20 years of about 30%, most of which are pink salmon and most produced by Prince William Sound Aquaculture Association [64]
- What sector harvests the most hatchery fish?
    - Who actually gets the most benefit of pink harvests?
    - What percentage of those beneficiaries are Alaskans?
- Which hatcheries have the highest return?
- What are the limitations are for each hatchery in terms of facilities and costs and how does that relate to permitting?

However, sometimes a reporter will do the digging. In March of 2022, Laine Welch reported in National Fisherman rankings by returns and by numbers for 2021:

- Prince William Sound had the highest number of hatchery returns in 2021 at 48.2 million salmon. Nearly 40 million were caught in the commercial fisheries, worth almost $68 million to fishermen, or 62 percent of the dockside value. Pink salmon contributed the most at $49 million.
- Kodiak ranked second for hatchery salmon returns at 11.6 million fish. That produced a catch of more than 8 million fish worth $10 million to fishermen. Pink salmon contributed most to the value at over $8 million, followed by sockeyes at $1.5 million.
- Southeast Alaska had a total return of 8.2 million hatchery salmon. Nearly 5 million of those were caught, valued at $32 million to fishermen, or 27 percent of the region's dockside value.
- Cook Inlet ranked fourth for hatchery returns at 827,000 salmon. The fish contributed about 134,000 salmon to the inlet's commercial fishery, valued at $946,000, or 5 percent of the value to fishermen. Sockeye salmon paid out the most by far at $908,000, followed by pink salmon at $38,000.
- Since 1995, annual releases by Alaska's combined hatcheries have ranged from 1.4 billion to 1.8 billion juvenile salmon.
- About 1.7 billion fish were released in 2021, mostly from eggs collected in 2020. They included 870 million pink salmon and 750 million chums.
- Alaska hatchery operators expect a total return of just over 44 million salmon in 2022.

In 2009, the Research Group in Corvalis, Oregon prepared a study for the Wild Salmon Center in Portland, Oregon, the *North Pacific Salmon Fisheries Economic Measurement Estimates*,[65] which included the proportional share of the effects from salmon origin – both wild and hatchery. They noted:

> Enhancement of salmonid species natural production using artificial propagation takes place in all regions of the North Pacific. In some areas, such as the Columbia River, public hatcheries are part of mitigation agreements for dam construction and habitat alterations. In other areas such as Alaska, hatcheries are a public/private partnership designed to increase natural production. In the Russian Far East, both private and public hatcheries have been developed to increase overall harvests. Based on the limited amount of information available, in many cases the revenues that may be received from these harvests are not adequate to cover the costs of producing fry/smolts. Fishery enhancement hatcheries are often the political response to societal demands for increasing salmon and steelhead harvests or replacing production lost to other manmade water developments; and, economic analysis rarely plays a role in decision making for that response.
>
> Study area salmonid abundance by origin estimates show that hatcheries contribute significantly to North Pacific capture fisheries using the assumption that ocean harvests are not appreciably selective. Hatchery production varies considerably by region and species. Less than 10 percent of total salmon production in Russia originated from hatcheries, but hatchery production has been increasing in recent years. Hatchery salmon represented more than 70 percent of both total pink salmon and total chum salmon in Prince William Sound, and more than 55 percent of chum salmon in southeast Alaska. Nearly all of Japan's production is from hatchery origin chum salmon. Using a 1990-2005 annual average, hatchery-origin adult salmon abundance averaged 78 million chum, 54 million pink, and 3.2 million sockeye salmon per year, or approximately 62 percent, 13 percent, and four percent, respectively, of the combined total of wild and hatchery salmon abundance.

Those percentages have increased over time. The numbers for percentages of hatchery to wild harvest as of 2022 were reported in the Annual Enhancement Plan[66] as follows:

> Chinook - 19% of statewide commercial harvest was hatchery
> Sockeye – 2%
> Coho – 35%
> **Pink – 40%**
> **Chum – 76%**
> Total of all species – 25%

It is easy to see why hatchery production is so integral to the commercial industry. The investment that the commercial sector has made in hatchery production over the years is significant. This is what makes it so hard to have a truly informed dialogue. The natural inclination is to shut down the conversation.

But in 2024, with the immense uncertainty about processing capabilities and buyers, the reprocessing of Alaska salmon in China coming under greater scrutiny, the dramatic plunge in ex-vessel pricing and the increased costs of operations, the increasing shortfalls in egg collection,

the decreasing market value of both roe and flesh, are all contributing to a very unstable situation that will affect the entire industry, including the ability of hatcheries to utilize cost recovery to pay their operational costs and rely on enhancement taxes to pay loan debt service.

There are many hidden costs. For instances, most common property fishermen likely do not know that they will have to pay for the debt service of the hatchery region they fish in through enhancement taxes, whether or not the hatchery is open or must close.

Nor do we ever get into a realistic discussion of the cost of hatcheries and the role the Department plays in those costs. Those disclosures are hard to get. Despite PNP hatcheries being depicted as "self-supporting" there is an entire role that several State agencies play in permitting and loan operations. Many people outside the PNP hatchery system wonder if state costs to support hatcheries takes away funding and personnel for wild stock monitoring.

It's time we asked some of the harder questions.

In a December 2023 opinion piece in the *Anchorage Daily News,* Dr. Peter Westley, University of Alaska, wrote:

> "Hatcheries in Alaska have not completely replaced wild salmon. But they have also not yielded as much benefit to Alaskans as we have been led to believe — hatcheries have detrimentally affected wild salmon productivity and are reshaping ecosystems in unpredictable ways. I believe hatcheries are not dichotomous; they are not good or bad, right or wrong, but are tools that have beneficial purposes for specific objectives. But like any tool there are inherent risks in its use.
>
> In a world where it feels that so many of the challenges facing salmon and salmon-dependent people are beyond our control, hatcheries are one of the few levers we can actually pull. We have control over when, where, and how many salmon are released from hatcheries. Given the scientific evidence, it is reasonable for fishery groups or policy makers to consider reducing numbers of hatchery releases. It is equally reasonable to consider what might be lost or gained — and by whom — in any scenario of reduced hatchery production."

## The particular impact of pink salmon production

**There is a greater issue here. Chinook salmon have been declining in size and abundance since 2006 and declining body size of other salmon species in recent years[67] are all indicators of ocean carrying capacity problems. Which is exactly where too much hatchery production fits in, especially pink salmon.**

A peer reviewed study published by *Nature Ecology and Evolution* in 2019 suggests humans are gambling with tens of thousands of years of evolution that allowed sockeye to adapt into various age classes to survive environmental catastrophes.

> "The positive effects of climate change for earlier migration to the ocean, which may increase population productivity, are largely dampened by longer ocean residence," the scientists concluded. "The evidence for overcrowding of salmon in the ocean and increased competition for resources has been gaining strength. Hatchery production has

increased substantially since 1970, and there is high spatial and trophic overlap between sockeye, pink and chum salmon in the North Pacific.

"Growth and survival in North American salmon stocks have been shown to be negatively affected by hatchery-produced pink salmon." Warming waters in the lakes of Bristol Bay have boosted plankton productivity and caused young salmon to grow faster than in the past, according to a team of scientists led by Timothy Cline of the University of Michigan. As a result, more young-sockeye are going to sea as one-year-old fish instead of spending two years in freshwater. Once at sea, however, the young sockeye face increased competition from pink salmon – many of them hatchery fish – for food.

Human intervention at multiple levels – commercial harvests, hatcheries, and climate change – have combined to alter the shape of a salmon population historically comprised of fish that spend two years in freshwater and two years in the ocean – so-called 2.2s, and a mix of 1.2s, 1.3s, and 2.3s. "These (human-driven) stressors combine to reduce the size-at-age of fish vulnerable to commercial fisheries and have increasingly favored a single-age class, potentially affecting the age class complexity that stabilizes this highly reliable resource," the researchers said."[68]

Alaska hatchery production is the second highest in the North Pacific, according to the North Pacific Anadromous Fish Commission (NPAFC) September 2018 newsletter on North Pacific hatchery production.[69] At this point, there is not much we can do about Asian hatchery production but we can do something about Alaskan production.

Salmon fisheries researcher Daniel Schindler of the University of Washington's School of Aquatic and Fishery Science has studied Alaska's salmon fisheries for over two decades. "Pink salmon are dumped into the ocean with the assumption that they don't negatively impact with anything," he said. "We have known for at least 10, probably 20 years, that pink salmon compete with other species in the ecosystem." As numbers of hatchery salmon have ramped up, "we have seen negative impact on other fish and the effect of pinks on the growth of wild fish," he stated, adding that with the last big heat wave productivity of salmon declined. **"Most of the north Pacific salmon did not do well and pinks are taking a bigger piece of a smaller pie," he said**.[70]

"Increasing production of hatchery salmon over the past four decades has led to concerns about possible density-dependent effects on wild Pacific salmon populations in the North Pacific Ocean. The concern arises because salmon from distant regions overlap in the ocean, and wild salmon populations having low productivity may compete for food with abundant hatchery populations. We tested the hypothesis that adult length-at-age, age-at-maturation, productivity, and abundance of a Norton Sound, Alaska, chum salmon population were influenced by Asian hatchery chum salmon, which have become exceptionally abundant and surpassed the abundance of wild chum salmon in the North Pacific beginning in the early 1980s. We found that smaller adult length- at-age, delayed age-at-maturation, and reduced productivity and abundance of the Norton Sound salmon population were associated with greater production of Asian hatchery chum salmon since 1965. Modeling of the density-dependent relationship, while controlling for other influential variables, indicated that an increase in adult hatchery chum salmon abundance from 10 million to 80 million adult fish led to a 72% reduction in the abundance of the wild chum salmon population. These findings indicate that competition with hatchery

chum salmon contributed to the low productivity and abundance of Norton Sound chum salmon, which includes several stocks that are classified as Stocks of Concern by the State of Alaska. This study provides new evidence indicating that large-scale hatchery production may influence body size, age-at- maturation, productivity and abundance of a distant wild salmon population."[71]

"Hatcheries programs in the Northwest and globally that release hundreds of thousands of fish each year had the worst effect on wild salmonid populations, according to the analysis. "When you see really large releases of fish, they tend to swamp out the wild population," McMillan said.

"An example is pink salmon released from hatcheries in Alaska. Unlike most salmon species, pink salmon spend two years rather than one in the ocean feeding before returning to their spawning grounds in rivers. They enter the ocean almost immediately after being released, and feed on vast amounts of microscopic plankton, which are the food for larger plankton that other fish species such as Chinook, coho, steelhead and sockeye eat. When hundreds of thousands of pink salmon are released from hatcheries each year, they upset the balance of food available in the ocean for all those other species.

"It's not leaving enough food for other salmon in the ocean," McMillan said. It's even negatively impacting orca populations, who feed on those other salmon species. You consume so much at the bottom of the food chain that it cascades to lower production at the top."[72]

We know that pink salmon are dominating in warming waters, a trend expected to increase. In a June 19, 2022 article "Should Alaska Hatcheries Continue Raising Pink Salmon?"[73], Alaska writer, Miranda Weiss, wrote:

"It's a heyday for pink salmon in the North Pacific. Across the region, there are three times more pink salmon in the ocean than there were about 50 years ago. Nearly three out of every four salmon in the North Pacific are pinks. Hatcheries are piling onto that bounty."

Since the 1970s, industrial production of pink salmon has exploded, and today, hatcheries in the United States, Canada, Russia, and Japan pump about 1.3 billion pink salmon fry into the Pacific each year, leading to the production of roughly 82 million adults. About 15 percent of all pinks in the ocean originate from hatcheries, topping off a population that is already at a record level of abundance. This means there are about as many hatchery pink salmon as there are wild sockeye and more hatchery pinks than each of wild chum, chinook, and coho. The bulk of this production comes from Alaska.

Despite being the smallest of the Pacific salmon at less than two and a half kilos, pinks are the darlings of the hatchery industry in part because of their rapid life cycle. These fish are voracious feeders and fast growers, quickly bulking up to market size by increasing their weight 500 percent at sea over four months. And unlike other salmon species that spend a variable number of years in salt water—up to five years for chinook—pinks return for harvest predictably after about 18 months at sea.

> This short life cycle is one reason why wild pink salmon are thriving in today's changing ocean conditions. As waters warm, their ability to reproduce at breakneck speed enables pinks to quickly colonize new areas and recover from population drops, prospering like rats where other species might fail. Warming conditions are also altering the food chain in ways that appear to favor wild and hatchery pinks alike."

This is coming at a time when ex-vessel pricing has fallen to the sixth lowest historic lows on record[74] [75] [76] and even availability of a buyer is in question because of massive changes in the processing sector. This will put more pressure on hatcheries to increase pink production rather than decrease in order to meet cost recovery goals. At the same time, unless prices improve dramatically and buyers are available, fishermen may not be able to afford to fish pink salmon.[77]

Pink salmon have a high commercial value in volume, primarily because of their roe, [78] but their ex-vessel price is generally the lowest. Pink salmon are almost exclusively harvested by seiners except in some subsistence harvests. Cost recovery is conducted entirely by contract seiners. Pink salmon pay the hatchery bills.

> "Pink salmon will return two years after eggs are collected. Other species have longer production cycles. Thus, it comes down to water, expense, and value of the return. These are the economic factors that PNP Hatchery Board of Directors and their constituents weigh in operating their hatcheries. Although king, sockeye, and coho salmon garner higher prices per pound at harvest, chum and pink salmon cost less to rear and generally provide a higher economic return on production costs, requiring less "cost recovery" harvest to pay for hatchery operations and leaving more fish for the commercial and sport fisheries to harvest."[79]

Miranda Weiss goes on to note the impacts of pink salmon in the ocean:

> "Researchers have long known that salmon in lakes and streams compete with each other for food. But understanding what is happening in the open ocean is a different story. All natural systems are difficult to study, but marine habitats—which are largely out of sight, are often frustratingly remote, and extend over vast distances—may be some of the trickiest. Salmon scientist Greg Ruggerone thinks he's found a workaround.
>
> "The fingerprint has appeared on salmon runs across the Pacific. Chinook from British Columbia fare poorly when pink numbers are high. Coho in southeast Alaska are smaller when pinks abound. Chum from Puget Sound to Russia's Kuril Islands eat less when crowded by pinks. Steelhead in the central North Pacific go hungry in pink boom years, and on the Fraser River in British Columbia, fewer young chum survive in years crowded with juvenile pinks."
>
> "These are disturbing trends, but when Ruggerone and biological oceanographer Sonia Batten from the North Pacific Marine Science Organization compared 15 years of plankton data with pink salmon abundances, a more alarming pattern emerged. For more than two decades, Batten and her team have been gathering data about the North Pacific's smallest creatures using a meter-long torpedo-shaped sampling device called a continuous plankton recorder that is towed behind tankers and cargo ships. During odd years, when there could be as many as 40 times more pink salmon as during even years in the waters she was studying, large zooplankton such as copepods declined, while levels of phytoplankton— food for copepods and other kinds of zooplankton—went up. Pink

salmon, it appeared, were wiping out the highest value food, large zooplankton, essentially eating the steaks and leaving only celery."

"It was a really clear effect of the top of the food chain affecting the bottom," Batten says. She had never before seen a single predator species controlling the abundance of plankton. Pinks, Batten and Ruggerone concluded, were triggering a trophic cascade, where hungry fish were completely altering the food chain." [80]

"This food chain effect might be why researchers have seen the impacts of pink salmon on mackerel and herring, which feed on zooplankton and are the targets of lucrative commercial harvests. The well-being of seabirds that prey on small fish that, in turn, gorge on the same zooplankton targeted by pinks also hinges on the seesawing abundance of these fish. Ocean researcher Alan Springer has seen how seabirds produce fewer chicks in years with abundant pinks, and he is confident that pink salmon booms are linked to a succession of seabird wrecks that have alarmed coastal communities and puzzled scientists in recent years. "They're intimately connected," he says.

"The pink fingerprint is showing up elsewhere, as well. Within a minute of looking at a graph, shared by a colleague, that showed the mortality of endangered killer whales off British Columbia and Washington, Ruggerone recognized the pink effect. "It's still mind-boggling for a lot of people," he says. These killer whales rarely eat pink salmon, and the decline of chinook salmon, the preferred prey for these marine mammals, cannot explain why there's a biennial pattern in whale deaths. Researchers believe that the sheer number of pink salmon—which, in this southerly part of the fish's range, can be 45 times more numerous in odd years—could be disrupting killer whales as they hunt for dwindling chinook.

But what, specifically, is the ecological fallout of the billions of pink salmon released into the North Pacific by hatcheries? Brendan Connors, a fisheries scientist at Fisheries and Oceans Canada, wanted to tease out the effects of industrially produced pinks from wild ones. Connors put himself through university as a fishing guide on Haida Gwaii, taking clients out with single-action reels for coho and chinook. He dove into researching salmon interactions at sea after the Fraser River sockeye run collapsed catastrophically in 2009."

Connors and his team zeroed in on the question of how hatchery pinks affect sockeye runs. They reviewed data from 47 sockeye populations that enter the ocean from waterways in British Columbia to the Bering Sea, which represent nearly all of the North American sockeye runs. In the northern part of the sockeye's range—such as in Bristol Bay—warming temperatures have boosted wild sockeye populations, so much so that negative effects from competition with pinks are offset. But in the southern part of their range, hatchery pinks alone have reduced sockeye survival by about 15 percent. If the gushing tap of pink salmon hatchery production were shut off, Connors explains, sockeye runs on the Fraser—some of which are at risk of extinction—would have a better shot at recovery." [81]

> "We often think of the ocean as this big place, as limitless," Connor says. "This work really challenges those simple assumptions." Ruggerone and others are concerned that, at least in parts of the North Pacific during high pink years, the ocean may have met its production limit, and any new fish added only take away other parts of the biological pie." [82]

In concluding the article, Weiss discovers the biggest stumbling block of having a dialogue about hatchery impacts in Alaska:

> "Ruggerone, Connors, Hillstrand, and others say that it's time to talk about the big picture. But especially here in Alaska, going up against hatcheries can mean swimming against a raging tide. Leon Shaul, a retired state biologist, knows this. During nearly four decades of research on coho salmon in southeast Alaska, Shaul discovered that competition with pinks was leaving coho—the target of valuable sport and commercial fisheries—smaller. But his concerns gained no traction among managers. "Almost nobody is willing to look at the policy level," he says. Hatchery culture is infused into state decision-making at the highest levels, including Alaska's recently appointed director of commercial fishing, Sam Rabung, who has spent the bulk of his career in the hatchery industry working his way up from technician to numerous leadership positions. And hatcheries are backed by deep-pocketed seafood processors, such as Peter Pan Seafood Company and Trident Seafoods, which rely on hatcheries for one-third of the value they get from pinks. These hatchery fish are processed into canned salmon and roe, as well as frozen headed-and-gutted fish that is exported to China and elsewhere and sold back to US markets as vacuum-sealed fillets, burgers, and other products. The politically powerful processing sector has openly urged for a boost in hatchery production. Questioning the industrial production of salmon fry in Alaska, Shaul says, is like disparaging corn in Iowa."[83]

**<u>What is the appropriate venue for a discussion on hatchery impacts and oversight?</u>**

If we do not have conversations about egg intake at the Board of Fisheries than what other options do we have? The Board of Fisheries is the only venue Alaskans have to present proposals for hatchery egg production and this is the singular oversight the Board has on hatcheries.[84]

Consistent with the Joint Protocol on Salmon Enhancement (#2002-FB-215)[85]:

- In actions taken in January 2001 and June 2002, the Alaska Board of Fisheries stated its intent to institutionalize a public forum to bring a statewide perspective to issues associated with hatchery production of salmon. Accordingly, the department and board agreed to enter into this joint protocol to coordinate department and board interaction on certain aspects of salmon hatchery policy and regulation."

For years, the FAC has sought a substantive dialogue on hatchery production because of the impacts on wild salmon stocks. The FAC has been very active in encouraging the reactivation of the long-dormant Board of Fisheries Hatchery Committee as a way to begin that dialogue.

Between the creation of the Alaska Hatchery Act in 1974 and 1999, there was no BOF oversight on hatchery permits. The first BOF hatchery committee was created in 1999 as a standing committee and met in 2001 and 2002 when the BOF created joint protocols (#2002-FB-215) with the Department and to establish annual hatchery reviews. This was abandoned in 2003 and the BOF did not address hatcheries again until 2018. Beginning in 2018, and except for 2021 because of Covid, the Board of Fisheries Hatchery Committee of the Whole has met as a non-regulatory meeting to provide reports and information to the general public. As informative as these meetings are, they have allowed very little interactive dialogue with or testimony from the general public.

However, both the Department and the Board of Fisheries have a history of dismissing hatchery proposals and discouraging hatchery discussions.

- At the 2023 Lower Cook Inlet meeting, the Board Chair noted that "My feelings are quite well known where these sorts of proposals come up at each and every meeting. In Cordova (December 2021) I was quite vocal on what I thought of that for those who weren't on the board at that time.[1] I am willing to take it off the agenda unless someone tells me not to."

- At the December 2021 Prince William Sound Finfish meeting, the Department considered two proposals submitted by an FAC member to reduce egg production as allocative and therefore were neutral. The Department cited the Regional Plan Team (RPT) as the appropriate venue for egg production discussion.[86] The Board subsequently defeated one of the proposals and did not deliberate on the second one.[87] Eight other hatchery amendment proposals were rejected at this same meeting.

*All* the hatchery egg reduction proposals that the Fairbanks Fish and Game Advisory Committee and others have submitted in the last several years are directly related to growing concern over the impacts of hatchery fish on wild stocks, particularly pink salmon.[88] However, many of these proposals have been dismissed on the basis of lack of analysis to support the premise of the proposal.

While the percentages of reduction requested in many of these proposals do not have analyses, the requests represent the need to reduce hatchery production period. We have no pathway of getting to that central discussion except through the Alaska Board of Fish and/or the Alaska Legislature.

This is immensely frustrating to all of us who are watching the increasing ratio of hatchery to wild stock harvest as an indicator that hatchery stocks are taking over wild stock production.

**<u>Change starts with the acknowledgement that there is a problem</u>.**

It has taken 40-50 years for fisheries managers in the Pacific Northwest to come to the realization that hatcheries may be more of a problem than a benefit. In his classic 1999 book, *Salmon Without Borders,* and the sequel, *Salmon, People and Place; a Biologist's Search for*

[1] Review audio from the December 2021 Prince William Sound Finfish BOF meeting. https://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.meetinginfo&date=11-30-2021&meeting=cordova

*Salmon Recovery,* world renowned fisheries biologist, Jim Lichatowich, notes that decades of spending billions on salmon hatcheries in the Pacific Northwest have only resulted in a *net loss* of 40% of wild salmon range.[89] Lichatowich indicts salmon hatcheries for being the center of a flawed conceptual foundation for salmon management, which has sacrificed salmon habitat for what he calls a "simplified industrial production system."' That system has traded away habitat for hatcheries, countenanced widespread overharvesting, largely ignored adverse effects on wild salmon, and lost sight of the salmon's essential attachment to place."

## Alaska Department of Fish and Game role in informing the Board of Fish

The Alaska Department of Fish and Game is the primary manager salmon in Alaska. The Department is also the sole permitter of any enhancement. However, because the Department is involved in hatchery production and oversight at many levels, it had for years a separate division (not integrated with Commercial Fisheries) that was just for hatchery management and promotion. One of the goals of that division was to create Comprehensive Salmon Plans (CSPs) in 12 regions of the state as a vehicle for creating Regional Aquaculture Associations (RAAs) for PNP hatchery development. Not all regions accepted this premise. Except for a brief time when Norton Sound considered and then discarded a PNP hatchery model, Western Alaska has rejected the PNP hatchery model.

The Department is the major informer of science to the Board of Fish. But the Department also fully believes in the benefits of hatcheries. They continually cite the economic benefit of the hatchery program and the reliance of the fishing industry on what is essentially a mixed-stock fishery of hatchery and wild fish. Department comments on hatchery proposals often reference how difficult it would be to reduce egg production at hatcheries because of the economic harm it would bring to both hatchery management and common property fishermen.

> "State regulators say they have no evidence that the ocean has reached its carrying capacity for hatchery fish, which rewarded Alaska commercial fishermen with sales averaging $120 million for 2012 through 2017. They are loath to seek a reduction in hatchery output because of the economic, societal and cultural value of the fish. "The program has been successful and continues to provide benefit to Alaskans," said Bill Templin, chief fisheries scientist for the Alaska Department of Fish and Game." [90]

This is reinforced by reports such as the McDowell economic reports. The message is clear; economics counts, cost to wild stock is secondary. However, our State's Constitutional mandate is to protect our wild salmon stocks.

In addition, the Department's position on causes of AYK salmon decline has been to point to ocean regime shifts. While ocean changes are definitely impacting salmon, they are not the only decline factor. Those changing conditions should increase precautionary measures rather than dismissing them.

## Stalling for more research: We could wait forever for there to be "sufficient evidence"

Alaska has a Sustainable Salmon Policy (5 AAC 39.222) requiring "precautionary measures" in all our salmon management and regulatory decision making.

However, the Department has continually claimed there is not sufficient evidence of negative hatchery impacts and are "waiting the results of more studies." Those straying studies are not expected to be completed until 2026 and they are limited in scope. There are so many more impacts the Department is not currently investigating.

But others have and these include research by the top scientists in Alaska, Western Canada and the Pacific Northwest. The John R. McMillan, et.al. synthesis of peer-reviewed hatchery science [91] was exhaustive and global in synthesizing public databases, resulting in the discovery of 206 publications, 83% of which report adverse impacts on wild salmon. Only 3% of the publications reported beneficial effects, nearly all from recovery programs.

> "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."

The Alaska Department of Fish and Game initiated a research program for assessing hatchery and wild stock interaction[92] because of increased public pressure to evaluate hatchery impacts on wild stock.

> For the protection of wild salmon stocks, hatchery programs are required to use local stocks as the brood source and locate hatcheries away from important wild stocks. Requiring the use of only local salmon stocks means that straying hatchery fish are less likely to reduce fitness of local populations.[93]
>
> Because of the value of hatchery production to industry's harvest, and the mandate that hatchery production be compatible with sustainable productivity of wild stocks, ADF&G and private hatchery operators have recognized the need for a research program addressing concerns about escapement assessment, and genetic and ecological interactions between hatchery and wild stocks.
>
> ADF&G organized a science panel composed of current and retired scientists from ADF&G, University of Alaska, aquaculture associations, and National Marine Fisheries Service. Panel members have broad experience in salmon enhancement, management, and wild and hatchery interactions.

The panel raised three priority questions:

- What is the genetic stock structure of pink and chum salmon in each region?

- What is the extent and annual variability in straying of hatchery pink salmon in Prince William Sound (PWS) and chum salmon in PWS and Southeast Alaska (SEAK)?
- What is the impact on fitness (productivity) of wild pink and chum salmon stocks due to straying of hatchery pink and chum salmon?
- How significant are the differences in which hatchery fish are marked and which aren't?
    - Numbers of hatchery salmon on the spawning grounds are typically not reported because hatchery fish cannot be identified without a mark for identification (which some hatcheries fail to do) and because spawning salmon, especially pink and chum salmon, are typically enumerated using techniques such as aerial flights that prohibit identification of hatchery versus wild-origin salmon. The degree to which hatchery salmon contributed to regional natural spawning populations in our dataset reflects the ability of harvesters to remove most hatchery salmon in the region (e.g., terminal hatchery harvest area), the ratio of hatchery to wild salmon abundance, distance of the stream from the hatchery, species of salmon and associated degree of straying, and characteristics of the hatchery to attract homing hatchery salmon. As a result of these factors, our dataset overestimates wild salmon abundance and underestimates hatchery salmon production in some regions such as Prince William Sound and Southeast Alaska where hatchery production of pink and chum salmon is high. In these regions, the Alaska Department of Fish and Game (ADFG) has begun investigations to determine numbers of hatchery salmon on the spawning grounds (R. Brenner, S. Moffitt, ADFG, pers. comm.). The influence of hatchery strays on wild salmon counts was greater after about 1980 when hatchery production was relatively high.[94]

These studies are long overdue but they are also very limited in time, space and scope and will only give us a small regional understanding of localized impacts on a few streams. These studies do not address the greater issues of impacts on wild stocks to other regions because of competition for forage food nor do they address the potentially growing wider scope of straying to other regions.

The studies that are conducted on hatchery pink and chum salmon within the marine environment have overwhelming indicated that hatcheries have significant and multiple impacts on wild stock.

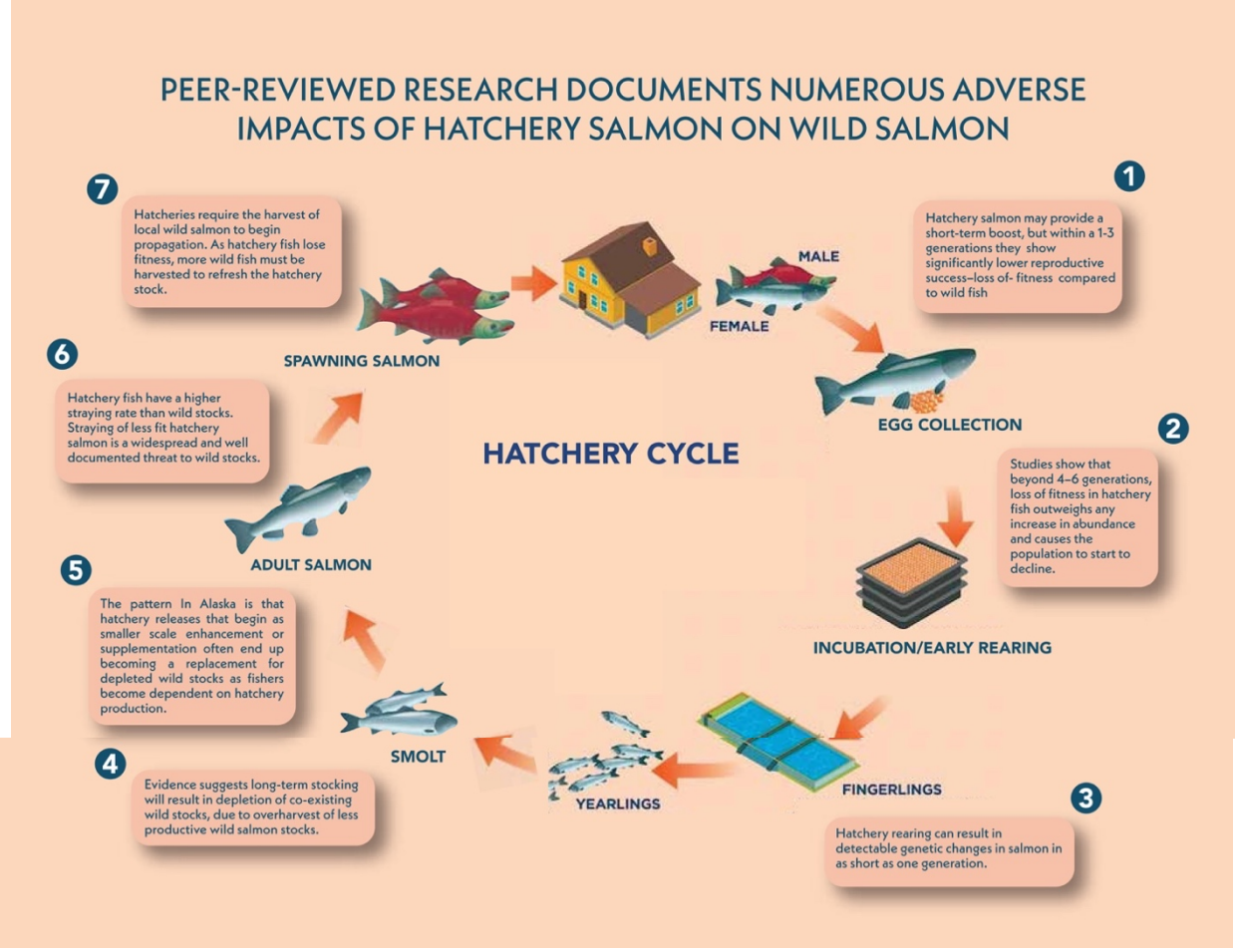
> The cooperative work of scientists from Trout Unlimited, U.S. and Canadian universities, and other organizations, the new study entitled "A global synthesis of peer-reviewed research on the effects of hatchery salmonids on wild salmonids," evaluated over 50 years of scientific studies from around the world which investigated the impacts of fish hatcheries on wild salmonid populations. The study's results were resounding, revealing that 83 percent of all published research determined that hatcheries had an adverse impact on wild fish populations. Perhaps even more alarming was the study's discovery that a mere *3 percent* of research during the last half century demonstrated a beneficial hatchery impact on wild fish populations.[95]

**How does climate change fit into the conversation?**

Hatchery impacts are certainly not the only factor in salmon decline. There are multiple drivers of salmon decline - bycatch, intercept, hatchery impacts, disease, management practices and

climate change, just to name a few. Climate change is often at the top of the list. There is little we can do about climate change except monitor and adapt. **However, like hatchery impacts, climate change is only one decline factor and should never be a default excuse to ignore and address those factors we can mitigate. Climate change, if anything, makes precautionary management measures all that more critical.**

**Humans are left with only a few options to mitigate salmon decline. Limiting hatchery production is one of those options.** Those of us outside of the hatchery bubble are deeply affected by and concerned about the impact of hatchery fish on wild stock, particularly the current massive production of pink salmon in both Alaska and Asia (mostly Russia.) Hatcheries rank right up there with intercept and bycatch on high-impacts. After reading reams of peer-reviewed materials, it is easy to see that hatchery production could eventually extirpate wild salmon stocks.




**Hatchery Salmon do not feed river ecosystems**

RC004 Bering Sea Fishermen's Association, Alaska Board of Fisheries Hatchery meeting October 14, 2023

## Wild Salmon are the biological foundation of river ecosystems

Lessons from the Pacific Northwest

"Few animals have been as central to the Pacific human experience as salmon. Their annual migrations are a miracle of nature. They feed us and their presence tells us that our rivers are still healthy. From grizzly bears to orca whales, at least 137 different species depend on the marine-rich nutrients that wild salmon provide(see our interactive illustration to explore just a few). The last intact salmon watersheds around the North Pacific are composed of free-flowing rivers and dense forests, which provide clean drinking water and absorb carbon to slow climate change.

Salmon and freshwater ecosystems are inextricably linked by feedbacks between salmon runs, food webs, and riparian forests. Salmon runs function as enormous pumps that push vast amounts of marine nutrients from the ocean to the headwaters of otherwise low productivity rivers. For example, sockeye salmon runs in southwest Alaska contribute up to 170 tons of phosphorous per year to Lake Illiamna. These nutrients are incorporated into food webs in rivers and surrounding landscapes by a host of over 50 species of mammals, birds, and fish that forage on salmon eggs, juveniles, and adults in freshwater. Predators, such as brown bears, disperse these marine nutrients into surrounding forests, enhancing the growth of stream-side trees that shade and protect stream banks from excessive erosion. In southeastern Alaska, spawning salmon contribute up to 25% of the nitrogen in the foliage of trees, resulting in tree growth rates nearly three-times higher than in areas without salmon spawning. As they grow and age, these trees eventually return the favor for salmon by falling into salmon streams and forming log jams that provide shelter for juvenile salmon and protect the gravels that adults use for spawning. Abundant salmon returns feed the rivers and shape the habitats that support the next generation of wild fish. Generally, the more pristine, diverse, and productive the watershed, the healthier the salmon stocks."[96]

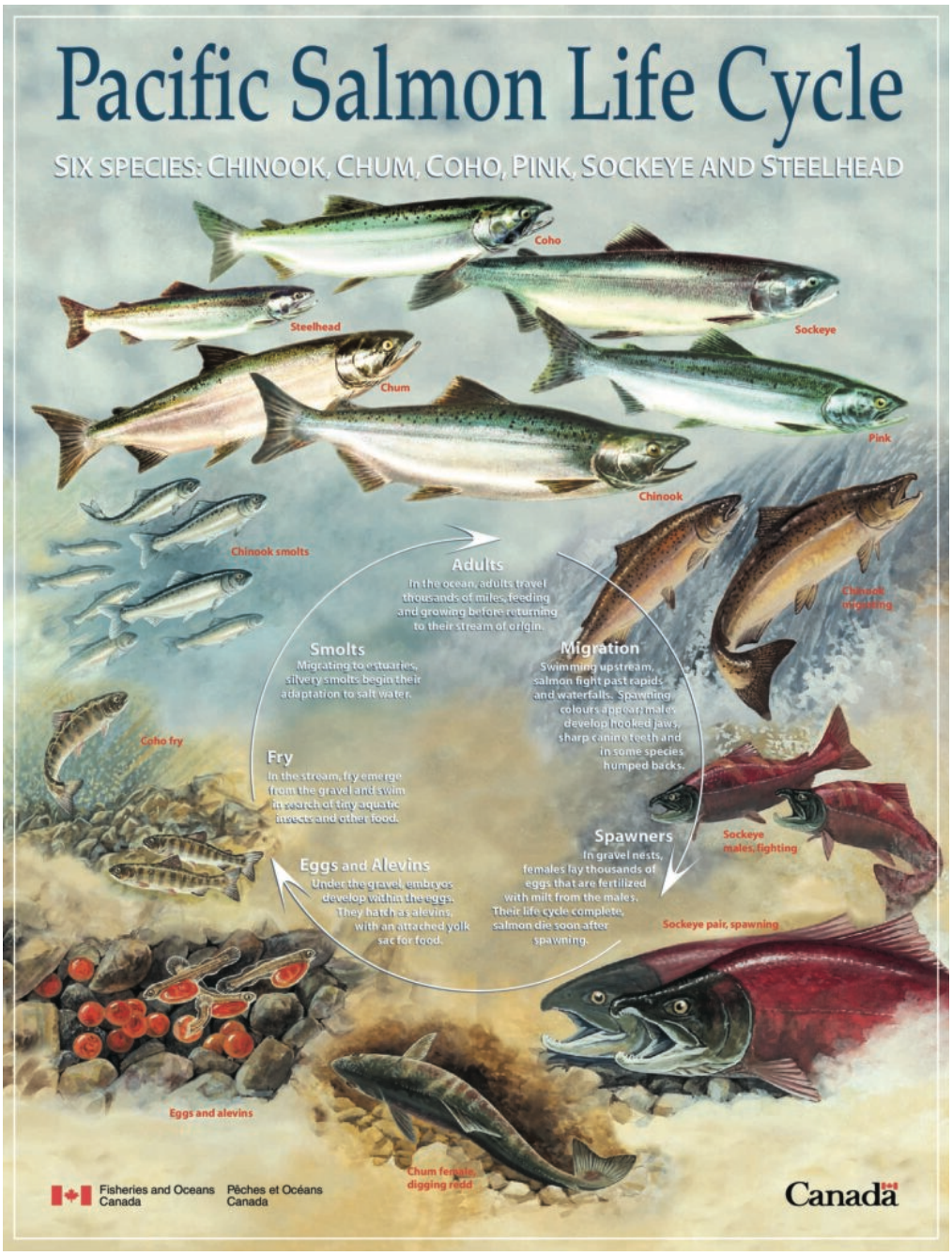
"Billions of taxpayer dollars have been spent on salmon restoration efforts in the United States and Canada but few success stories have emerged. Some may yet succeed; it is still too early – only a few salmon generations' worth of time – to discount them. But most salmon restoration efforts have failed so far because they were implemented only after salmon stocks reached low levels of abundance. The Endangered Species Act, for example, only halted coho harvest in Oregon after the salmon were at less than 3% of historic abundance. By the time stocks had been pushed to the threshold of extinction, the factors causing their declines were entrenched. To restore salmon rivers at that point may mean removing mainstem dams, de-watering irrigated crops, eliminating popular salmon hatchery programs and reclaiming habitat that is now home for thousands of people. That is a huge lift for society, even for a charismatic fish.

The second mistake we made was damaging and/or replacing the native, locally-adapted genetic stocks with hatchery-bred salmon. The native stocks have adapted to the challenges of each river, and are the building blocks of salmon restoration. We have weakened these native stocks by planting non-native salmon and steelhead stocks for over 100 years, and allowing them to interbreed with wild fish.

The third mistake is that most of the money dedicated to salmon recovery was and is spent treating symptoms, instead of causes, of salmon decline. For example, fish management budgets are dominated by hatchery programs, which simply replace wild fish with hatchery fish and further weaken the native stocks that hold the promise of long-term recovery. Moreover, much of

the resources going towards habitat protections has been spent on temporary fixes, ones that may be helpful in the short term but don't offer real long-term solutions." [97]

"If our salmon are not healthy, then our watersheds are not healthy-and if our watersheds our not healthy, then we have truly squandered our heritage and mortgaged our future."
John Kitzhaber



[1] The Fairbanks area Fish & Game Advisory Committee (AC) is one of 88 active committees in Alaska created by the legislature and the Joint Board of Fisheries and Board of Game to provide the Boards with recommendations regarding fish and game issues. We are a group of citizens elected by our peers at a yearly meeting which is open to the public. Our meetings occur each 2nd Wednesday of the month and are publicly noticed on the State of Alaska website.

[2] Kitoi Bay Hatchery is located on the west side of Izhut Bay roughly 30 miles north of Kodiak. It was originally built in 1954 by U.S. Fish and Wildlife Service as a sockeye salmon research facility and, following the 1964 earthquake, was rebuilt by the Alaska Department of Fish and Game. By 1976, hatchery production priorities had switched to pink salmon fisheries enhancement. Bunkhouses and a number of other buildings were erected in the 1980s. The site is state-owned and is operated by the nonprofit Kodiak Regional Aquaculture Association.

KBH now houses eight permanent staff, and as many as 15 seasonal staff during egg-take periods. It is the third biggest hatchery production site in Alaska. According to KRAA's website, the goal of the facility is to "provide enhanced common property salmon fishing opportunities for Kodiak Management Area fishermen by increasing returns of pink, chum, coho, and sockeye salmon through broodstock development, egg takes, incubation, hatching, rearing, and releasing juvenile salmon, primarily to the Kitoi Bay area." Secondary user groups of hatchery-reared salmon include subsistence and recreational fishermen. KBH is currently permitted to take 215 million pink salmon eggs, 36 million chum eggs, 2.3 million coho eggs, and 850,000 sockeye eggs, for raising and releasing. ("Inside the hatchery operation that's a safety net for Kodiak fishermen — and the center of a political battle" By Alistair Gardiner, Kodiak Daily Mirror Updated: October 8, 2018 Published: October 7, 2018 https://www.adn.com/alaska-news/wildlife/2018/10/07/inside-the-hatchery-operation-thats-a-safety-net-for-kodiak-fishermen-and-the-center-of-a-political-battle/)

[3] How much notice is required to meet the "reasonable" public notice provision of the Open Meetings Act? How much notice is required depends on the complexity of the issue and the potential effect it will have. Proper public notice must be provided in advance of the proposed action and local ordinances should state the minimum number of days that notice is required. This number should be adjusted up if the situation warrants additional notice. Special and emergency meetings require only 24 hours notice or less. If less notice is given, absent members must waive the notice requirement. Notice requirements for work sessions and committee meetings should follow the same guidelines as those established in local ordinance for regular meetings. There are minimum mandatory notice requirements for certain actions, such as notice of a public hearing on a proposed ordinance, or election notice. There is, however, no specific number of days spelled out in statute that defines "reasonable." The general tone of case law on the subject has essentially found that reasonable notice provides enough notice **that a concerned party will have notice of a proposed action within enough time to be involved in the** deliberations. This could vary anywhere from three months to three days. The notice also has to provide enough information to let the public know what subjects will be covered in the meeting. If a complete agenda isn't available at the time of posting, a summary will work until the complete agenda is available.
https://www.commerce.alaska.gov/web/dcra/LocalGovernmentResourceDesk/LocalGovernmentElectedOfficials/OpenMeetingsAct.aspx?TSPD_101_R0=0890181cafab2000fd24d37ab9c37bdc048256469e54bda7caecc57faf394e2f622edf0683dbca3d08f1500f2714300054084b7df9942c519c69131e5ebcaf9ecaa6602afe7e422eb68274f0332e4aedb0c901ef741872166bf9b8349c0b4777

[4] https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/findings/ff02215x.pdf

[5] Advisory Committee members are unpaid. They do not get stipends and budgets are severely limited to compensate a member to travel to board meetings.

[6] ***5 AAC 40.820 - Basic management plans***

(a) A hatchery operator shall manage the hatchery and its salmon returns in accordance with a basic management plan approved by the commissioner. Before the public hearing held under 5 AAC 40.210 on the proposed hatchery, department staff, in conjunction with the applicant, shall develop a draft basic management plan that includes a facility development schedule of no more than five years. Department staff and the applicant shall present the draft basic management plan and facility development schedule at the public hearing and shall make copies available for public review and comment at the hearing.

(b) If, following the public hearing, the commissioner decides to issue a permit for the proposed hatchery, department staff shall finalize the basic management plan and facility development schedule after all comments have been considered. The final basic management plan, which includes a facility development schedule, describes the conditions under which the permit will be implemented, and is an addendum to the permit.

[7] 5 AAC 40.820. Basic management plans (a) A hatchery operator shall manage the hatchery and its salmon returns in accordance with a basic management plan approved by the commissioner. Before the public hearing held under 5 AAC 40.210 on the proposed hatchery, department staff, in conjunction with the applicant, shall develop a draft basic management plan that includes a facility development schedule of no more than five years. Department staff and the applicant shall present the draft basic management plan and facility development schedule at the public hearing and shall make copies available for public review and comment at the hearing. (b) If, following the public hearing, the commissioner decides to issue a permit for the proposed hatchery, department staff shall finalize the basic management plan and facility development schedule after all comments have been considered. The final basic management plan, which includes a facility development schedule, describes the conditions under which the permit will be implemented, and is an addendum to the permit

[8] Listen to Board deliberations for the Lower Cook Inlet meeting audio, 4:11 and 4:19pm, https://www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.meetinginfo&date=11-28-2023&meeting=homer

[9] A particular paper, "A Global Synthesis of Peer-Reviewed Research on the Effects of Hatchery salmonids on wild salmonids", John R. McMillan, et,al., *Fisheries Management and Ecology* July 2023

[10] Salmon Fishery Enhancement Plans, Alaska Department of Fish and Game https://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesPlanning.enhance

[11] *OPINION: It's time for a difficult discussion about Alaska's salmon hatcheries By Peter WestleyUpdated: December 11, 2023 Published: December 11, 2023 https://www.adn.com/opinions/2023/12/11/opinion-its-time-for-a-difficult-discussion-about-alaskas-salmon-hatcheries/*

[12] Wild Salmon Survival is a Shared Responsibility", Gale K. Vick, Yukon River Drainage Fisheries Association (YRDFA) January 2024 (pending)

[13]"Wild Salmon Survival is a Shared Responsibility", Gale K. Vick, Yukon River Drainage Fisheries Association (YRDFA) January 2024 (pending)

[14] https://www.adfg.alaska.gov/index.cfm?adfg=ByAreaInteriorYukonDrainage.main

[15] https://www.adfg.alaska.gov/index.cfm?adfg=ByAreaInteriorKuskokwim.main

[16] https://www.adfg.alaska.gov/index.cfm?adfg=ByAreaInteriornorthwest.main

[17] https://en.wikipedia.org/wiki/Yukon_River

[18] Dr. Daniel Schindler, Alaska Board of Fisheries, February 6, 2023 https://aws.state.ak.us/OnlinePublicNotices/Notices/Attachment.aspx?id=139578

[19] 2023 Yukon River Salmon Summer Fishery Announcement #26 2023 Yukon River Preliminary Summer Season Summary, ADF&G, November 7, 2023

[20] *There's a crisis in the Yukon River Alaska communities have seen a vital food source disappear as fewer salmon make it up the Yukon River.By Marlena Sloss and Dino Grandoni, The Washington Post Updated: December 4, 2023 Published: December 3, 2023*

[21] ***OPINION: We're working to find the causes of Yukon salmon declines By Dan Sullivan*** **Anchorage Daily News,** ***Updated: December 19, 2023 Published: December 19, 2023***
***https://www.adn.com/opinions/2023/12/19/opinion-were-working-to-find-the-causes-of-yukon-salmon-declines/?utm_campaign=newsletter&utm_medium=december16&emci=d0bbe344-29ac-ee11-bea1-0022482237da&emdi=97564237-b9ac-ee11-bea1-0022482237da&ceid=184535***

[22] "The closure of the Yukon affected about 50 villages along the 1,200-mile stretch of the river that is in the United States. It came at a time when families were erecting fish wheels, staking nets, and gearing up for the last major opportunity to put away their winter supply of food. In recent years the average total subsistence catch of fall chum on the Yukon River has been about 130,000 fish; the run is a resource Indians and biologists always expect.``We were expecting 734,000 chum salmon adults to be returning to the Yukon," says Russ Holder, a management biologist for the Upper Yukon Area. ``It was very surprising when we counted only 220,000 fall chum. We need a minimum escapement of 400,000 to ensure future returns." The Battle for Fish and Survival Along the Yukon The failure of chum salmon to run in Alaskan waters last fall pitted Indian subsistence fishermen against the government By Story and photos Bert Gildart Special to The Christian Science Monitor, May 24, 1994| BEAVER, ALASKA

[23] Alaska Board of Fisheries Hatchery Committee October 2023
https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2023-2024/hatchery/yukon-river-chinook-enhancement-info.pdf

[24] Alaska Board of Fisheries Hatchery Committee October 2023 REPRINT of March 10, 2014 memo
https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2023-2024/hatchery/yukon-river-chinook-enhancement-info.pdf

[25] *OP-ED: The Biological and Practical Reasons Why the Yukon River Cannot Support and Anadromous Salmon Hatchery" G.K. Vick, Tanana Chiefs Conference* August 21, 2023

[26] YUKON RIVER SALMON 2020 SEASON SUMMARY AND 2021 SEASON OUTLOOK, United States and Canada Joint Techinical Committee (JTC), March 2021
https://www.adfg.alaska.gov/FedAidPDFs/RIR.3A.2021.01.pdf

[27] YUKON RIVER SALMON 2020 SEASON SUMMARY AND 2021 SEASON OUTLOOK, United States and Canada Joint Techinical Committee (JTC), March 2021
https://www.adfg.alaska.gov/FedAidPDFs/RIR.3A.2021.01.pdf

[28] EARTH FIRST Salmon Hatcheries | Lifeline For Struggling Rivers or an Ecological Burden? By Jude Isabella PublishedMar 17 2023 UpdatedApr 04 2023

[29]

| "Billions spent on hatcheries, habitat fails to help native Columbia River salmon, study finds" |
|---|
| **By Alex Baumhardt** (Oregon Capital Chronicle) Aug. 5, 2023 5 a.m. |

[30] YRDFA – Yukon River Drainage Fisheries Association – Resolution 2018-07
[31] *Hatchery life changes fish genetics, Oregon study finds,* The Oregonian, Published: Feb. 17, 2016

[32]

[33] EARTH FIRST Salmon Hatcheries | Lifeline For Struggling Rivers or an Ecological Burden? By Jude Isabella Published Mar 17 2023 Updated Apr 04 2023

[34] ADF&G https://www.adfg.alaska.gov/index.cfm?adfg=hottopics.lowchinookruns_info

[35] "The Declining Size and Age of Salmon", SASAP (State of Alaska's Salmon and People" https://alaskasalmonandpeople.org/topics/the-declining-size-and-age-of-salmon/

[36] https://www.nature.com/articles/s41467-020-17726-z

[37] Alaskan 'ocean ranching' damages wild salmon fishery, B.C. conservation groups say", by Randy Shore Randy Shore Vancouver Sun Published Jan 17, 2012 https://vancouversun.com/news/staff-blogs/alaskan-ocean-ranching-damages-wild-salmon-fishery-b-c-conservation-groups-say

[38] ***Analysis of Northwest, other salmon hatcheries finds nearly all hurt wild salmon populations***
*More than 200 studies across 40 years revealed large-scale salmon hatchery programs weaken wild salmon diversity and lead to wild population declines BY:* ***ALEX BAUMHARDT*** *- DECEMBER 26, 2023 5:00 PM*

[39] *Hatchery fish releases adversely affect wild salmonid populations, research* finds Seafood Source By

Emma Desrochers January 9, 2024 https://www.seafoodsource.com/news/premium/environment-sustainability/literature-review-finds-that-hatchery-fish-releases-adversely-affect-wild-salmonid-populations?utm_source=marketo&utm_medium=email&utm_campaign=newsletter&utm_content=newsletter

[40] Evaluating Alaska's Ocean-Ranching Salmon Hatcheries; Biologic and Management Issues", Environment and Natural Resources Institute, University of Alaska -Anchorage, October 2001
[41] "Evaluating Alaska's Ocean-Ranching Salmon Hatcheries; Biologic and Management Issues", Environment and Natural Resources Institute, University of Alaska -Anchorage, October 2001
[42] "Evaluating Alaska's Ocean-Ranching Salmon Hatcheries; Biologic and Management Issues", Environment and Natural Resources Institute, University of Alaska -Anchorage, October 2001

[43] Regional Information Report No. 5J22-02 Alaska Salmon Fisheries Enhancement Annual Report 2021 Lorna Wilson

[44] Regional Information Report No. 5J22-02 Alaska Salmon Fisheries Enhancement Annual Report 2021 Lorna Wilson

[45] This was incorrectly noted in the article. Should be United Fishermen of Alaska.

[46] Development of Public and Private Hatcheries in Alaska By Terry Ellison
Alaska Department of Fish and Game, FRED Division Presented at the 9th annual meeting of the Aquaculture Association of Canada Vancouver, British Columbia June 1-3, 1992

[47] "Evaluating Alaska's Ocean-Ranching Salmon Hatcheries; Biologic and Management Issues", Environment and Natural Resources Institute, University of Alaska -Anchorage, October 2001

[48] Development of Public and Private Hatcheries in Alaska By Terry Ellison
Alaska Department of Fish and Game, FRED Division Presented at the 9th annual meeting of the Aquaculture Association of Canada Vancouver, British Columbia June 1-3, 1992

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[50] Development of Public and Private Hatcheries in Alaska By Terry Ellison
Alaska Department of Fish and Game, FRED Division Presented at the 9th annual meeting of the Aquaculture Association of Canada Vancouver, British Columbia June 1-3, 1992

[51] Summary of Actions, Board of Fisheries, February 16-28, 1997, Ketchikan Alaska

[52] *Wild fish aid* By Craig Medred, September 30, 2023
HTTPS://CRAIGMEDRED.NEWS/2023/09/30/WILD-FISH-AID/
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[54] "The Role of Hatcheries In North American Wild Salmon Production", ISER, *The Great Salmon Run: Competition Between Wild and Farmed Salmon,* Gunnar Knapp January 2007
https://www.traffic.org/site/assets/files/3637/great-salmon-run.pdf
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[58] https://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr&release=2020_11_09_2
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[62] "Alaska Hatchery Pink Salmon Imperil Wild Stocks", Craig Medred, June 3, 2019, Seawest News
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[63] https://www.adfg.alaska.gov/FedAidPDFs/RIR.5J.2023.04.pdf

[64] Economic Impacts of Alaska's Salmon Hatcheries, McDowell Group, October 2018
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[67] Recent declines in salmon body size impact ecosystems and fisheries, Oke, et.al, NATURE COMMUNICATIONS | https://doi.org/10.1038/s41467-020-17726-z

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[70] *Fisheries Board Takes Up Proposal to Lower Salmon Production at Alaska Hatcheries*
November 29, 2023 Fishermen's News https://fishermensnews.com/fisheries-board-takes-up-proposal-to-lower-salmon-production-at-alaska-hatcheries/

[71] Environ Biol Fish (2012) 94:149–163 DOI 10.1007/s10641-011-9856-5 Evidence for competition at sea between Norton Sound chum salmon and Asian hatchery chum salmon Gregory T. Ruggerone & Beverly A. Agler & Jennifer L. Nielsen

[72] *Analysis of Northwest, other salmon hatcheries finds nearly all hurt wild salmon populations* More than 200 studies across 40 years reveals impacts of large-scale hatchery programsBy Alex Baumhardt, Alaska Beacon
Wednesday, December 27, 2023 7:32am

[73] Should Alaska Hatcheries Continue Raising Pink Salmon? *Alaska Magazine* June 19, 2022, Miranda Weiss
**https://alaskamagazine.com/authentic-alaska/should-alaska-hatcheries-continue-raising-pink-salmon/**

[74] "When compared to the long-term time-series (1985–2022), the 2023 all-species commercial salmon harvest of approximately 230.2 million fish and 919.7 million pounds was the fourth highest on record for total fish harvested, and the seventh highest on record for total pounds harvested. Adjusted for inflation (CPI, 2023 prices), the 2023

exvessel value estimate of $398.6 million was the sixth lowest exvessel value reported since 1975." https://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr&release=2023_10_30

[75] *Nearly 50 percent price drop from 2022 shocked fleet,* Market Report: Alaska Salmon, Charlie Ess, October 26, 2023 "As the fishing calendar in Alaska rolled over to August, the statewide harvest for all five species in all areas and all districts stood at 99.3 million fish. Overall, ex-vessel prices dropped to almost half of what brick-and-mortar processors had been willing to pay in 2022."

[76] https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch_statewide

[77] *Plagued by challenging market, Alaska pink salmon harvest unlikely to meet full potential as fishermen, processors throw in the towel* IntraFish, August 23, 2023 Ken Jones, a third-generation, Alaska-born fisherman, told IntraFish that taking into account all of his operating costs associated with fishing, his cost of producing a million pounds of pink salmon amounts to approximately 22 cents per pound.He noted while he has caught a little over that amount to date this season, he is "still barely breaking even with operating costs."

[78] ADF&G https://www.adfg.alaska.gov/index.cfm?adfg=pinksalmon.uses Commercial Fishing
Pink salmon continue to be one of the most important of the Pacific salmon for commercial fisherman in Alaska. While pink salmon have less commercial value than other salmon because of their lower oil content, commercially caught pink salmon today are canned, filleted and flash frozen, made into nuggets, and prepared into complete pre-packaged meals sold all over the world. Pink salmon are the most numerous of the salmon species caught in Alaska by commercial fisherman, usually by purse seine. The average annual Alaska harvest between 1959 and 1992 was 45.1 million pink salmon. Annual statewide commercial harvests have been around 100 million pink salmon since about 1990.

[79] *Alaska Fish & Wildlife NewsMay 2016*
*https://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=775*

[80] Too Many Pinks in the Pacific Evidence is mounting that pink salmon, pumped by the billions into the North Pacific from fish hatcheries, are upending marine ecosystems. The Paradox of Salmon Hatcheries. Hakai Magazine June 1, 2022

[81] Too Many Pinks in the Pacific Evidence is mounting that pink salmon, pumped by the billions into the North Pacific from fish hatcheries, are upending marine ecosystems. The Paradox of Salmon Hatcheries. Hakai Magazine June 1, 2022

[82] Too Many Pinks in the Pacific Evidence is mounting that pink salmon, pumped by the billions into the North Pacific from fish hatcheries, are upending marine ecosystems. The Paradox of Salmon Hatcheries. Hakai Magazine June 1, 2022

[83] Should Alaska Hatcheries Continue Raising Pink Salmon? *Alaska Magazine* June 19, 2022, Miranda Weiss
**https://alaskamagazine.com/authentic-alaska/should-alaska-hatcheries-continue-raising-pink-salmon/**

[84] AS 16.10.440. Regulations Relating to Released Fish**.**

> **(a)** Fish released into the natural waters of the state by a hatchery operated under AS 16.10.400 - 16.10.470 are available to the people for common use and are subject to regulation under applicable law in the same way as fish occurring in their natural state until they return to the specific location designated by the department for harvest by the hatchery operator.
> **(b)** The Board of Fisheries may, after the issuance of a permit by the commissioner, amend by regulation adopted in accordance with AS 44.62 (Administrative Procedure Act), the terms of the permit relating to the source and number of salmon eggs, the harvest of fish by hatchery operators, and the specific locations designated by the department for harvest. The Board of Fisheries may not adopt any regulations or take any action regarding the issuance or denial of any permits required in AS 16.10.400 - 16.10.470.

In a November 6, 1997[84] letter from the Alaska Department of Law to Alaska Board of Fisheries Chair, Dr. John White, the State reiterated the authority of the Board of Fisheries over Alaska Private Non-Profit Hatchery Production:

- Board Authority under AS 16.05.730: In 1992, the legislature enacted AS 16.05.730[4], which requires the department and Board to manage all fish stocks consistent with the sustained yield of wild fish stocks and authorizes, but does not require, management consistent with the sustained yield of enhanced stocks. AS 16.05.730(a). In addition, the statute mandates Board consideration of the need of enhancement projects to obtain brood stock when allocating enhanced fish stocks, and authorizes the Board to direct the department's management to achieve an adequate return for brood stock. AS 16.05.730(b). The Board may also consider the need for enhancement projects to harvest and sell fish to obtain funds for project operation, may direct the department to provide a reasonable harvest of fish to the hatchery for those purposes, and may adopt management plans to provide fish to a hatchery to obtain funds for the purposes allowed under AS 16.10.450 or AS 16.10.480(d). AS 16.05.730(c). Significantly, while the statute requires Board consideration of hatchery brood stock needs, it does not mandate any particular level of hatchery harvest of enhanced fish stocks. Consideration of harvest and sale of fish for project funding is authorized, but not required.
- Although the legislature placed primary administrative authority over the permitting and day-to-day operation of hatcheries within the department, it also vested considerable general and specific authority in the Board of Fisheries. The Board's regulatory authority over private, nonprofit hatcheries is governed primarily by AS 16.05.251, 16.10.440 and 16.10.730.
- The Board may exercise indirect authority over hatchery production by regulating the harvest of hatchery-released fish in the common use fishery, hatchery brood stock and cost-recovery harvests, and by amending those portions of hatchery permits relating to the source and number of salmon eggs, hatchery harvests, and the designation of special harvest areas by the adoption of appropriate regulations. However, Board action that effectively revokes, or prevents the issuance of, a hatchery permit is probably not authorized.

[85] https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/findings/ff02215x.pdf

[86] RC2, p.192-196, Proposals #54 and #55

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| Amend the Prince William Sound Management and Salmon Enhancement Allocation Plan to specify hatchery chum salmon production. | *Meeting 12-04-21: 04:45:06PM* |

[88] Magnitude and Trends in Abundance of Hatchery and Wild Pink Salmon, Chum Salmon, and Sockeye Salmon in the North Pacific Ocean GREGORY T. RUGGERONE* Natural Resources Consultants, Inc., 4039 21st Avenue West, Suite 404, Seattle, Washington 98199, USA RANDALL M. PETERMAN AND BRIGITTE DORNER School of Resource and Environmental Management, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada KATHERINE W. MYERS School of Aquatic and Fishery Sciences, University of Washington, Box 355020, Seattle, Washington 98195, USA. Abstract.——Abundance estimates of wild and hatchery Pacific salmon Oncorhynchus spp. are important for evaluation of stock status and density-dependent interactions at sea. We assembled available salmon catch and spawning abundance data for both Asia and North America and reconstructed total abundances of pink salmon O. gorbuscha, chum salmon O. keta, and sockeye salmon O. nerka during 1952–2005. Abundance trends were evaluated with respect to species, regional stock groups, and climatic regimes. Wild adult pink salmon were the most numerous salmon species (average 268x10 fish/year, or 70% of the total abundance of the three species), followed by sockeye salmon (63 x10 fish/year, or 17%) and chum salmon (48 x10 fish/year, or 13%). After the 1976–1977 ocean regime shift, abundances of wild pink salmon and sockeye salmon increased by more than 65% on average, whereas abundance of wild chum salmon was lower in recent decades. Although wild salmon abundances in most regions of North America increased in the late 1970s, abundances in Asia typically did not increase until the 1990s. Annual releases of juvenile salmon from hatcheries increased rapidly during the 1970s and 1980s and reached approximately 4.5 x10 juveniles/year during the 1990s and early 2000s. During 1990–2005, annual production of hatchery-origin adult salmon averaged 78 x10 chum salmon, 54 x10 pink salmon, and 3.2 x10 sockeye salmon, or approximately 62, 13, and 4%, respectively, of the combined total wild and hatchery salmon abundance. The combined abundance of adult wild and hatchery salmon during 1990–2005 averaged 634 x10

salmon/year (498 x10 wild salmon/year), or approximately twice as many as during 1952–1975. The large and increasing abundances of hatchery salmon have important management implications in terms of density-dependent processes and conservation of wild salmon populations; management agencies should improve estimates of hatchery salmon abundance in harvests and on the spawning grounds.

[89] "Salmon Hatcheries as Fish Factories: Forgetting the Lessons of Leopold, Michael Blumm, Lewis and Clark Law School, 2014 https://lawcommons.lclark.edu/cgi/viewcontent.cgi?article=1399&context=faculty_articles

[90] "Pink salmon numbers may threaten other North Pacific species", Dan Joling, Anchorage Daily News, November 2021, https://apnews.com/article/e589a757f4fd48869af6e17845c5c857

[91] "A Global Synthesis of Peer-Reviewed Research on the Effects of Hatchery salmonids on wild salmonids", John R. McMillan, et,al., *Fisheries Management and Ecology* July 2023

[92] https://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.current_research

[93] https://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.main

[94] SAFS-UW-1001 July 2010 **Abundance of Adult Hatchery and Wild Salmon by Region of the North Pacific**
Gregory T. Ruggerone Natural Resources Consultants, Inc., Seattle, Washington
Randall M. Peterman and Brigitte Dorner Simon Fraser University, Burnaby, British Columbia, Canada
Katherine W. Myers and Nathan J. Mantua School of Aquatic and Fishery Sciences, University of Washington
Prepared for the Gordon and Betty Moore Foundation

[95] 50 years of research overwhelmingly shows hatcheries are harmful to trout, salmon, char and more(/articles/50-years-research-overwhelmingly-shows-hatcheries-are/7715778) The science is clear, fish hatcheries do more harm than good *by Hatch Magazine - Wednesday, Sep 6th, 2023*

[96] Wild Salmon Center, https://wildsalmoncenter.org/why-protect-salmon/
[97] Wild Salmon Center, https://wildsalmoncenter.org/why-protect-salmon/