March 12, 2022

To: Members of Board of Fish,

I am opposed to proposal 282. My name is James Brown and I live in Sand Point and have lived here since 1976. I began seining in 1977 and set netting in 1983. Back then we fished salmon every day and there was no escapement problem. In 1984, I was a crewmember and we fished on the SEDM five days a week in June and July. After that season, Chignik went to The Board of Fish and basically shut down the mainland to us. We had a few days here and there which became no days presently since the SEDM does not open until August. Meanwhile, the Chignik fishermen have come to the Board with proposals every meeting cycle to shut down fishing to us in Area M and have been successful. If this proposal is passed, it is going to devastate the people who live in Sand Point. The fishery has been restricted so much that it is hard to make ends meet.

I bought a boat and Area M setnet permit in 1989 and sold my fishing operation in 2003 and got a land job. In 2004 I purchased some apartments in Sand Point. My tenant's income depends on salmon fishing. People here are having a hard time making ends meet as it is and it's getting worse. People don't have money for rent, utilities and food. One of my tenants has a welding business and is struggling to make ends meet because a lot of boat owners are not having repairs done. Another tenant is a shipwright and does fiberglass work and cannot keep busy. Sand Point's economy depends on our salmon fishery. Things are pretty tough.

I am a firm believer that cutting more fishing time in Area M will do nothing for Chignik stocks. Restricting fishermen who are several hundred miles away doesn't seem to be helping. Perhaps in the name of conservation, Chignik Bay, sections 271-10, 272-20 should be permanently closed to allow more fish to escape. Maybe fishing right outside the lagoon is part of the problem. Another problem in Chignik comes from several things including Chignik's co-op which put their seiners in the lagoon catching fish that should have spawned. Another problem is Black Lake is filling in with silt. What can we do about this? Another problem is the salmon stray effect which is when salmon leave their lakes and head out to sea, they could have intermingled with other salmon from other area and become diverted. For example, salmon from Chignik may have run into a school from Kodiak, Cook Inlet or Area M and ran with them out to sea and lost their direction. The Chignik salmon may have gotten tangled up with a larger school of salmon and were drawn to them. Sometimes more fish show up in an area that shouldn't be there. I have included some information about salmon straying which is a real thing. I talked about this with ADFG at a Board meeting several years ago and they were receptive of it. The boundary between Area L and Area M is at Kupreanof Point. Who can say that salmon who spawn in Area M are not getting caught in Area L? There were never any studies.

If you keep blaming and restricting Area M for problems in Chignik and we aren't the problem, then you are ruining our lives and not helping save the problem of Chignik sockeye escapement. Please throw Proposal 282 out.

Thank you,

James Brown

Hakai Magazine

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Some scientists think salmon essentially vote on their preferred path when presented with a fork in the stream. Photo by Yva Momatiuk and John Eastcott/Minden Pictures

Do Salmon Make Decisions as a Group?

A series of studies suggests migrating salmon work together to find their way home—and get lost when there aren't enough of them to make a decision.

by Nancy Averett

August 9, 2019 | 1,000 words, about 5 minutes

This story is over 2 years old.

A baby salmon is, often, the product of its parents' final burst of life. The two adult fish, having fought their way upriver—skirting predators and navigating sometimes thousands of kilometers inland—end up hovering together, spewing eggs and sperm over the same rocky streambed where they were born. Likewise, their offspring will migrate out to sea, spending several years gobbling up plankton and fish before returning to that stream to start the cycle anew.

Except, occasionally, they don't. Sometimes, salmon stray on their way home, venturing into unknown waters. Each year, some percentage of migrating salmon always stray, but scientists don't know why that percentage can vary so much—some years there are many strays and other years there are only a few. Now, some researchers have an idea why, and their work has helped foster a new scientific discipline.

It all began in 2013 when Peter Westley, now a fisheries ecologist at the University of Alaska Fairbanks, discovered something counterintuitive. Westley was parked in front of a computer crunching salmon straying rates and noticed that in years when salmon are abundant, fewer stray than in years when they are scarce. To Westley, that didn't make sense. "If there's competition on the spawning grounds, you would think some fish would go elsewhere. Yet the numbers said the opposite."

Around the same time, Andrew Berdahl, now an ecologist at the University of Washington, was studying the movements of the golden shiner, a minnow that prefers darkness to light. Berdahl had placed groups of golden shiner in a tank, shone a light, and moved it randomly. He found that individual fish could not navigate to the dark areas on their own. But when they were in a big enough group, they could. When one fish found a dark patch, Berdahl says, it would slow down, prompting the whole group to turn toward it.

When Westley found Berdahl's write-up, he had an epiphany: maybe the straying salmon just didn't have enough colleagues around to make an informed decision about which way to go. "The pattern in [Berdahl's] data mirrored what I was seeing," Westley says. "I thought, maybe individual salmon are more likely to get lost if they're in smaller groups because there's not enough collective wisdom. It was an aha moment and [it] led me to reach out to Andrew."

The two began a partnership that, in the years since, has resulted in a new hypothesis on how groups of fish make decisions, and the development of a new field of science called collective movement ecology.

"We saw this disconnect between classic movement ecology, that looks at animal movement in time and space but that's largely done on an individual level, and social collective behavior, that looks at the finer-scale aspects of individual social interaction within fish schools, insect swarms, animal herds," says Westley.

In a series of papers, the two have laid out their case, arguing that salmon in an upriver run make decisions collectively.

The simplest piece of evidence is an expanded version of the discovery Westley had identified several years earlier: when there are more salmon, the number of strays decreases, and vice versa. But other evidence is more involved. Studies tracking salmon movements have shown that salmon gather at tributaries before turning into them, but could not explain why. Westley and Berdahl suggest the salmon may be sampling the conflicting odors where the water forks, then gathering on the side they guess to be the correct stream. Eventually, they come to a majority decision and head that way. "The idea is that they're essentially voting," says Berdahl.

In a paper, the two show how their hypothesis offers a better explanation for a well-known phenomenon. When salmon enter their native spawning grounds, they do so in pulses: one day 200 might enter, then none for several days, then 500, and so on. "Folk wisdom attributes these pulses to changes in water temperature, flow rates, tides, the moon, whatever," Berdahl says. But when scientists have tried to measure such influences, the results have been contradictory. Berdahl and Westley think the fish might be waiting for a social cue: as one fish feels ready to spawn, it moves forward. That triggers the next, resulting in a cascade of movement.

To test their idea, they created a simple computer model that allowed simulated fish to enter a creek either using social cues—following the fish in front of it—or by making independent choices. In the simulation, the social model produced outputs that nearly perfectly matched what was observed across 30 years of sockeye salmon data in Hansen Creek in Alaska's Bristol Bay region. "It produced the same pattern that was found in nature," Westley says. "Working on it reminded me how beautiful science can be in its simplicity and elegance."

Nolan Bett, who as a postdoctoral researcher at the University of British Columbia helped show how salmon follow a hierarchy of olfactory navigation cues when migrating upriver, says Westley and Berdahl's collective migration theory makes intuitive sense. "Anybody who's spent time standing at the side of a river looking at these salmon runs notices that they come up in these groups," he says. "And so it seems reasonable to think there could be some kind of interaction between them and that it benefits them to be in large groups when they're trying to do something that is very hard to achieve, which is migrating thousands of kilometers to a specific site," Bett says, adding: "The data that they have so far is, I would say, preliminary, but it certainly points in the right direction."

Westley uses the tragedy of the northern cod to illustrate the importance of understanding social movement. In 1992, east coast cod populations collapsed practically overnight. Fisheries managers were unaware of just how low cod numbers had become because they relied on catch rates as indicators of fish abundance. But cod travel in schools, and their declining numbers caused them to school more tightly than before. Fishermen were still catching plenty right up until the end. "It's a prime example of why we need to understand these collective movement dynamics, " Westley says.

Nancy Averett is an independent journalist who covers science and environmental issues from Cincinnati, Ohio. Her work has appeared in *Discover*, *Audubon*, *Sierra*, *Yale Environment 360*, TakePart, *Environmental Health Perspectives*, *Pacific Standard*, and many other outlets.

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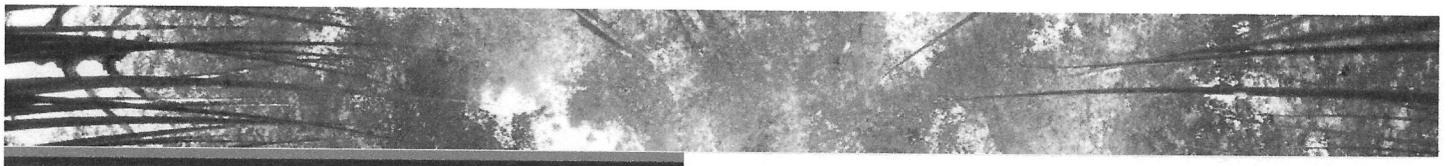

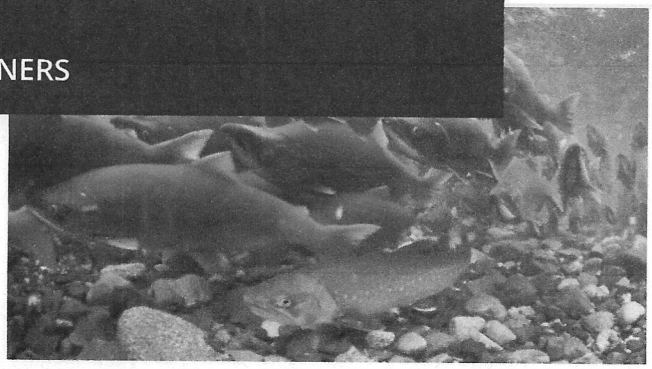

Environmental Science

Homeward Bound: Salmon Straying in the Pacific Northwest

April 12, 2018 Maddie Halloran 0 Comments British Columbia, Conservation, Ecology, environmental science, fisheries, Human dimensions, population ecology, salmon

SOURCE: Nolan N. Bett, Scott G. Hinch, Nicholas J. Burnett, Michael R. Donaldson & Sean M. Naman (2017) Causes and Consequences of Straying into Small Populations of Pacific Salmon, Fisheries, 42:4, 220-

230, DOI: 10.1080/03632415.2017.1276356

Introduction

All species of salmon spawn in freshwater and are "anadromous". This means that to complete their life cycle, juvenile salmon must migrate out to the ocean and return as adults to reproduce, or "spawn", in the river where they were born. The process of adult salmon finding their way back to their natal river after years at sea is called "homing". Homing back to the same spawning site allows salmon to pass down advantageous traits to their offspring.

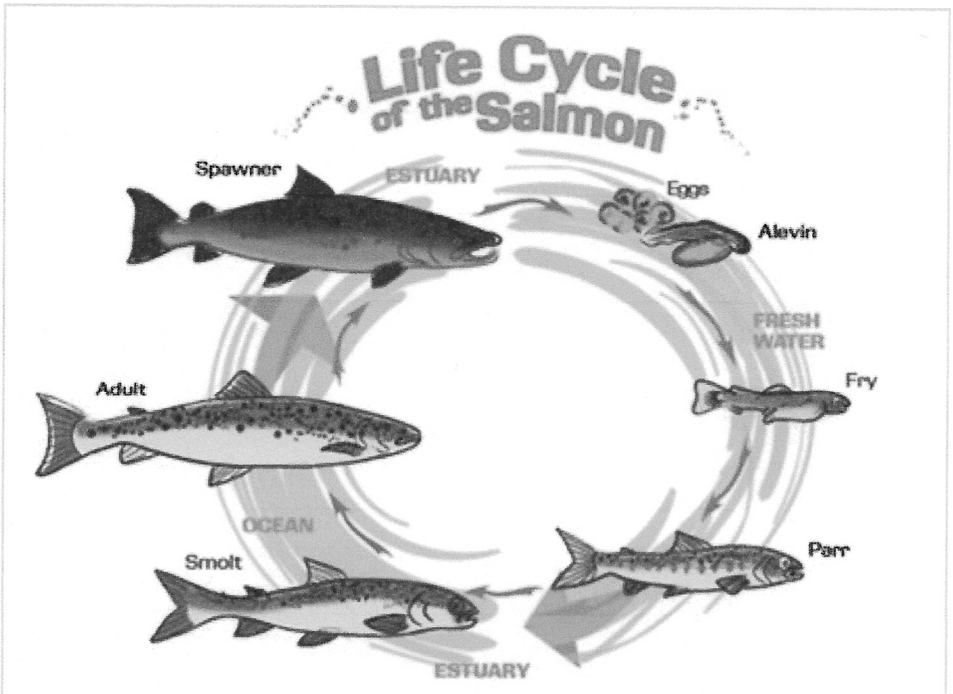

Figure 1. The salmon life cycle. The time spent in each life stage varies depending on the species. For more information on the salmon life cycle, check out: https://www.youtube.com/watch?v=5DqjsWsY8-g Image from https://salmonfactswork.weebly.com/salmon-life-cycle.htm

Like many people, I love eating salmon, and I was surprised to learn that many populations of several different salmon species are listed as threatened, endangered, or even extinct from their native ranges. This is mostly due to overfishing during the 19th and 20th century, as well as the continued human impact on the environment, including pollution, warming temperatures, and dams that block key spawning habitat. Because of their strategy of "homing", salmon could be listed as threatened or endangered as specific populations under the Endangered Species Act. Additionally, scientists can track populations of salmon that always return to the same stream and try to figure out why that particular population is struggling.

Due to their high value as a commercial and cultural resource throughout their range, salmon have been intensively studied along both coasts of the United States for years. It is difficult to track a species like salmon in the ocean, so researchers primarily study them in freshwater streams, both after they are born and when they return as adults. As they have tracked more and more of these fish, scientists are discovering that some adult salmon do not always return to their home stream. If an adult salmon does not successfully find their way back to spawn, they are referred to as a "stray". Strays are of high interest to fisheries biologists because we are beginning to realize the impacts they can have on vulnerable populations of salmon.

Up the Creek: A Case Study

This study involved a relatively small population of wild Sockeye Salmon (approximately 26,000 fish) in in the Seton River of British Columbia. Researchers collected tissue samples from 152 fish caught at the Seton Dam fishway (Figure 2) and analyzed their DNA. They determined that 55 of the 152 fish

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were strays, and likely would have attempted to spawn outside of their own spawning area.

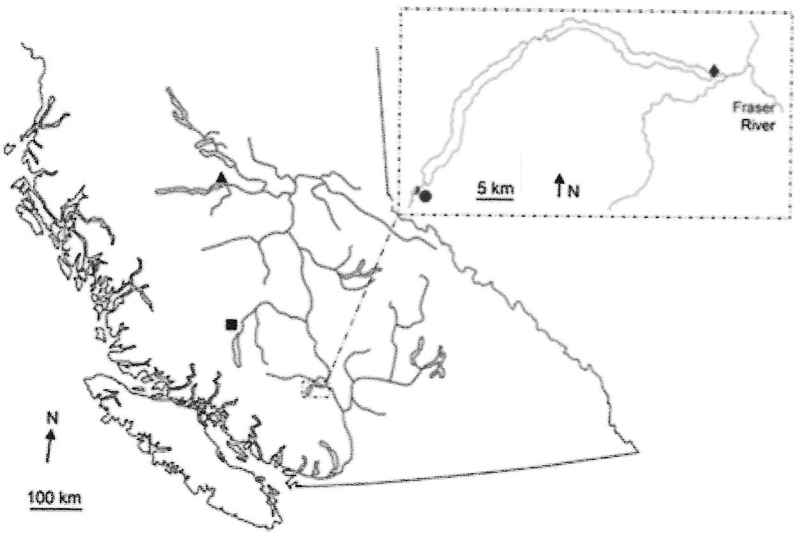

Figure 2. Map of British Columbia's Fraser River system. Sockeye Salmon from Stellako River (triangle), Chilko River (square), and Gates Creek (circle) areas were captured at the Seton Dam fishway (diamond).

Why is this important?

There are several consequences of salmon straying into small populations. For example, imagine that you are throwing a party on a small island. You've carefully decided on a small guest list and given your friends important information like the weather forecast and the lack of fresh water sources, so they can arrive ready to party. Now imagine that a huge boat shows up full of people who did not have that information and are not prepared to stay on the island, but they join anyways. These newcomers disrupt your evening with their complaints and make it harder for your original guests to enjoy the party, even though they came prepared.

In a similar way, populations that receive strays may suffer by

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losing traits that have allowed them to adapt to their environment by mating with the newcomers, which could reduce overall survival. However, straying may also provide the benefit of a "rescue effect" and save declining populations from extinction by adding diversity and higher numbers of fish. As we struggle to manage dwindling salmon populations throughout the West Coast by battling centuries of negative human impacts like overfishing, it is important to continue to learn all we can about the life cycle patterns of these fish.

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