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Welcome to Chinook News

No fish is more linked to Alaska than the Chinook salmon. Chinook salmon are iconic to Alaska and its people and have been one of our most valuable resources for thousands of years. They feed our families and provide significant economic opportunities across our state

It's no secret that in many rivers and streams, fewer of these cherished fish have returned recently. I have heard from many of you and I share your concerns. Given the importance of these fish to Alaskans and the mandate of the Alaska Department of Fish and Game to manage for sustained yield, state fishery managers have developed and implemented a multi-faceted research program aimed at ferreting out the causes of recent declines so we can better predict future runs and better manage for sustained harvests.

It's also our mission to share what we know and what we hope to learn with you, the owners of this resource. The *Chinook News* is a publication prepared by department staff designed to provide a statewide perspective, introduce the major issues surrounding Chinook salmon in Alaska, and give the reader an overview of what we are doing to understand and

sustainably manage this important resource, and to rebuild stocks. Inside this and future issues you will find articles focused on research projects included in Governor Parnell's Chinook Salmon Research Initiative, public involvement and partnership opportunities, scientific findings, facts and myths, and more. We will be tackling more specific and detailed material in upcoming editions of *Chinook News*.

ADF&G remains committed to the long term health and sustainability of our fisheries resources for all Alaskans. I invite you to join us by sharing this newspaper and contributing to the conversation—and conservation—of the mighty king salmon. Feel free to stop by or contact any of our numerous area offices across the state, visit our web site, or send us an email. We welcome your thoughts.

Sincerely,

Commissioner Cora Campbell



Subsistence Chinook salmon fishing in Nushagak. © ADF&G. Photo by Sarah Hazell.



ADF&G college intern Kevin Greco holds a king salmon at Deception Creek near Willow, AK. This photo was taken during an egg take. © ADF&G. Photo by Ryan Ragan.

Chinook Salmon Research Initiative

Ed Jones, Fish and Game Coordinator, and Terry Thompson, Program Coordinator

Chinook salmon are Alaska icons. Alaskans and visitors alike have long taken to the state's waters in pursuit of big Chinook or "kings," as many locals call them. Today, Alaska's Chinook stocks are caught in a cycle of low productivity and low abundance. The resulting social and economic hardships are felt statewide, in both rural and urban communities.

To address and understand the downturn in productivity the Alaska Department of Fish and Game initiated a comprehensive planning effort with a goal of identifying statewide knowledge gaps in Chinook salmon life histories and stock assessments. This effort resulted in a draft gap analysis document that was provided to the public in early October 2012. Building on this analysis, the department hosted a Chinook salmon research symposium in late October 2012 to identify key knowledge gaps and assemble a list of research priorities to better understand the many factors affecting Chinook salmon abundance in Alaska. More than 450 stakeholders participated in the two-day symposium where speakers addressed recent downturns in Chinook salmon abundance, discussed statewide research and management needs, and provided perspectives on how best to address key gaps of information about Alaska's Chinook salmon stocks. Presentations, public comments in person, via the internet, and in writing, were used by state, federal, and academic biologists and scientists in part to develop the 2013 Chinook Salmon Stock Assessment and Research Plan. At a projected cost of \$30 million over five years, the plan is a stock-specific, life history based approach to research that focuses on twelve indicator stocks from the Arctic to Southeast Alaska representing diverse life histories and migratory characteristics over a broad geographic range.

In late 2012, Alaska Governor Sean Parnell announced his commitment to an initial investment of funds towards the \$30 million five-year Chinook Salmon Research Initiative. This funding will be used to complement the approximately \$14 million the department currently puts towards Chinook salmon research and management in its annual operating budget. In announcing his commitment to fund additional Chinook salmon research, the governor said, "Alaska's fishing industry is a vital economic engine in our state. Chinook salmon are a cornerstone of our culture and livelihood. I look forward to working with the Legislature in support of this research initiative."

During the 2013 and 2014 legislative sessions, the Alaska legislature supported the Governor's Initiative and provided \$7.5 million each year to the department for the Chinook Salmon Research Initiative. In 2014 the department will put 35 projects in the water as part of this initiative. These projects will first and foremost increase our confidence in estimates of adult spawning abundance. Studies to estimate the abundance of juvenile salmon will also take place. Together with stock-specific harvest estimates generated through detailed marine sampling programs, it will be possible to reconstruct total runs on a postseason and inseason basis. As a result, more timely and informed abundance-based management decisions will be made, allowing for sustained harvests and healthy levels of spawning abundance over time.



Map courtesy of Ryan Snow, ADF&G.

Where will this research occur?

Alaska is massive, with hundreds of Chinook salmon stocks spread across the state. The authors of the gap analysis recommended 12 stocks for additional work. Each of these indicator stocks represents a wide range of ecological and genetic characteristics which will allow department scientists to better understand regional differences in Chinook salmon productivity and abundance.

The research team identified the following Chinook salmon indicator stocks for intensive study:

- | | | |
|--------------------|------------------|-------------------|
| 1. Yukon River | 5. Karluk River | 9. Chilkat River |
| 2. Kuskokwim River | 6. Susitna River | 10. Taku River |
| 3. Nushagak River | 7. Kenai River | 11. Stikine River |
| 4. Chignik River | 8. Copper River | 12. Unuk River |

Understandably, the research team recognized that there are many other stocks of Chinook salmon that could have been included in this statewide list. Narrowing the focus to these twelve stocks was strategic as these systems produce a large proportion of the statewide Chinook salmon harvest and thus are vitally important to the cultural, subsistence, and economic sustainability of the rural and urban communities near these watersheds.

Stay Informed

The department is keenly aware that Chinook salmon are critical to our state's culture, economy, and lifestyle. Due to this intense interest, the department is committed to keeping all Alaskans informed about the status and findings of the Chinook Salmon Research Initiative. Please visit our Chinook Salmon Research Initiative website at www.adfg.alaska.gov/index.cfm?adfg=chinookinitiative_main to keep track of recent initiative activities and project updates. ↻

Chinook Salmon Abundance and Productivity Trends

Danielle F. Evenson and John K. Carlile, Fisheries Scientists



Spawning Chinook salmon in Portage Creek, Alaska.
© ADF&G.

The Columbia River in Washington state is expecting "a fall chinook run for the record books — 1.6 million salmon, the largest since counting began at Bonneville Dam," according to a report in The Columbian newspaper in February. Such a return would be 26 percent greater than the unexpected high of 1.26 million the river saw in 2013. And the Columbia River is not alone. Many Pacific Northwest systems have enjoyed larger than normal Chinook returns in recent years, even as Alaska stocks have struggled. So, what gives?

The truth is, Chinook salmon abundance and productivity generally vary over time and throughout the salmon's range along the Pacific coast from Alaska to central California. When Chinook abundance and productivity is high, it tends to stay high for five

or so years—the life cycle of an average Chinook salmon—and when it is low it tends to stay low for a few years. Interestingly, opposing trends of high or low productivity in northern and southern reaches of the salmon's range are not uncommon.

Trends in northern stocks vs. southern stocks, 1975–present

In general, Chinook salmon abundance in Alaska and north British Columbia peaked during the early 1980s (1979–1983), the mid-1990s (1992–1998), and in the early 2000s (2001–2006), as shown in Figure 1 for 11 Chinook salmon stocks where data were available back to 1975. In recent years,

(continued on page 3)

(continued from page 2)

productivity, abundance, and harvests have declined throughout Alaska and northern British Columbia.

In contrast, the southern stocks of Chinook salmon in Washington, Oregon, and California exhibit trends in abundance and productivity that are nearly opposite to their northern counterparts. As depicted in Figure 2, the southern, or Pacific Northwest index of Chinook salmon stocks peaked in the early to mid-1970s (while the northern stocks were in a period of low abundance), were in a trough for most of the 1990s (while northern stocks were having higher abundances), peaked again in 2002–2004, reverted to a trough in 2005–2009, and have been peaking from 2010 through the present (while northern stocks have shown persistent declines).

Chinook salmon show a wide diversity of life-history characteristics, including timing of adult spawning, variable ages of juvenile, or smolt migration out of their natal rivers, and different oceanic migration routes across their geographical range. These differing characteristics offer clues as to why there appears to be a nearly opposite relationship of abundance and productivity observed in northern and southern Chinook salmon stocks in most years.

What causes these trends in Chinook salmon abundance?

Abundance and productivity trends have been attributed to both natural and human-induced factors. Natural causes mainly involve climate driven conditions in freshwater and the ocean. Human-induced factors include, but are not limited to, habitat degradation, hatchery production, fishing practices, and achieved spawning escapements. Thus, productivity and abundance is affected at each stage of the Chinook salmon life cycle.

Of these factors, climate clearly plays an influential role. Climatic conditions such as precipitation and wind influence how nutrients mix and move through the water, influence primary production or phytoplankton levels, and ultimately affect growth and survival of fishes. While there has been extensive research on freshwater and estuarine factors limiting Chinook salmon production, limiting factors in the marine environment remain poorly understood. Because Chinook salmon spend anywhere from one to five years growing in the ocean before returning to spawn, more information on the marine environment is sorely needed.

Recent research suggests that salmon production is strongly linked to the mixing characteristics caused by wind and currents in the upper surface of the ocean, which affect the food chain salmon feed upon. When climate factors generate multiple winter storms in the North Pacific Ocean, nutrient-poor surface waters are mixed with nutrient-rich deeper waters, paving the way for increased primary production in the spring.

Ocean mixing is especially important in northern latitudes to bring nutrients up near the ocean surface where the phytoplankton can take advantage of the nutrients and penetrating sunlight that provides the energy to produce food through photosynthesis (Figure 3). Phytoplankton production fuels high productivity that cascades through the food chain. If phytoplankton production is high, zooplankton such as copepods and small fishes that feed on plankton are abundant, and food production for salmon is likely to be high. For juvenile salmon, fast growth resulting from good food access can make them less vulnerable to predation, leading to higher survival. When ocean mixing is low in Alaska, food sources are less abundant for Chinook salmon because they have somewhat specialized dietary requirements.

Current evidence links this ocean mixing in the

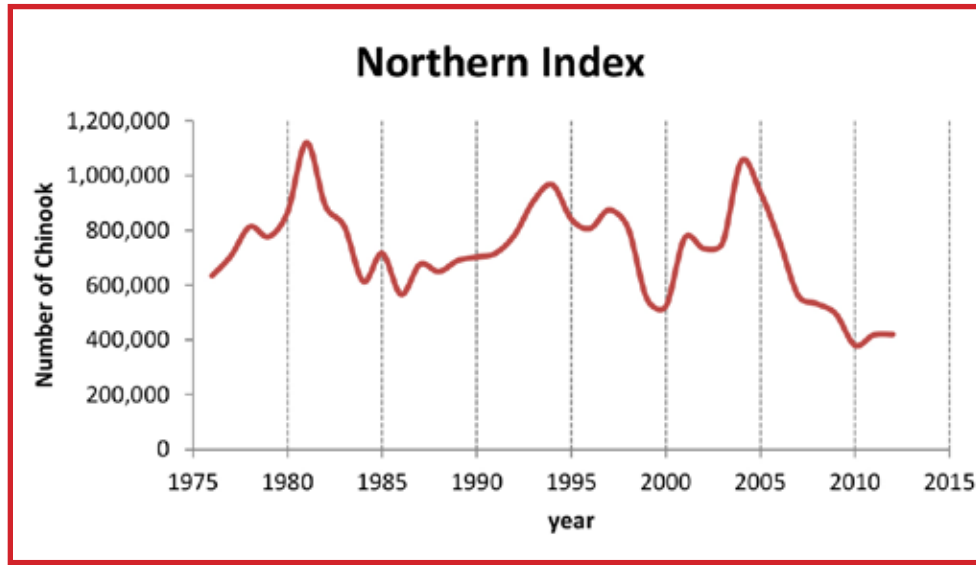


Figure 1.—Northern index of Chinook salmon abundance for 11 stocks in Alaska and northern British Columbia (BC). Stocks used for this index are those with harvest and escapement data back to 1976. These stocks include: Kuskokwim (Kuskokwim), Nushagak (Bristol Bay), Nelson (AK Peninsula), Ayakulik (Kodiak), Karluk (Kodiak), Anchor (Cook Inlet), Alek (Southeast), Taku (Southeast), Stikine (Southeast), Nass (Northern BC), and Skeena (Northern BC) Rivers.

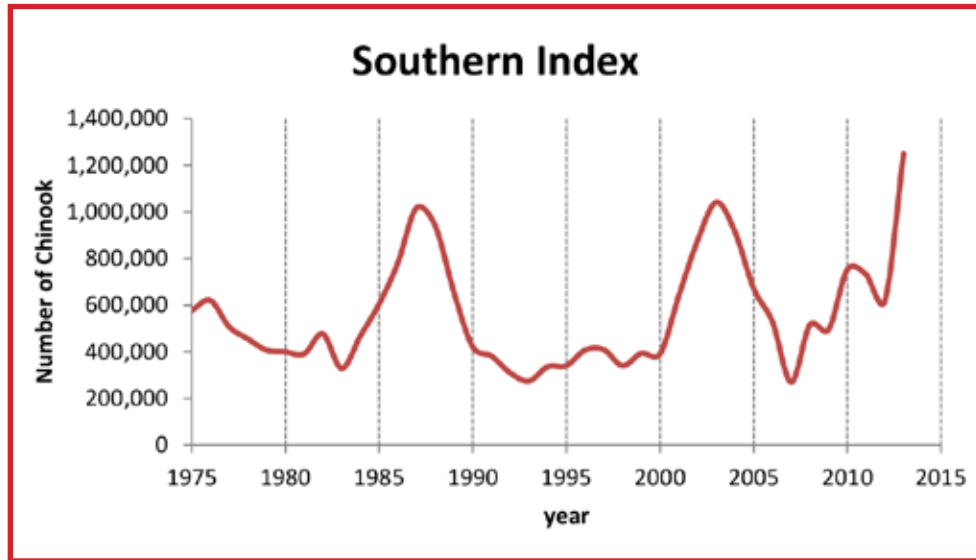


Figure 2.—Southern index of abundance for five stocks in Oregon and Washington. Stocks used for this index are those with harvest and escapement data back to 1975. These stocks include: Columbia spring, summer, and fall run (Columbia), Nehalem (Oregon), and Siuslaw (Oregon) Rivers.

Figure 3. Ocean mixing.



North Pacific Ocean to a climate phenomenon akin to El Niño, referred to as the Pacific Decadal Oscillation or PDO index (Figure 4). To simplify, the Pacific Decadal Oscillation can be thought of as a surrogate for ocean conditions in the North Pacific Ocean. The Pacific Decadal Oscillation tends to flip flop between positive and negative regimes. Positive or warm ocean regimes (shown in red) are associated with generally high salmon productivity in Alaska and north British Columbia and generally low productivity along the western U.S. coast south of British Columbia. Negative or cold ocean conditions (shown in blue) tend to have the opposite effect. Figure 4 shows relationship between the northern Chinook index (black line) and the Pacific Decadal Oscillation. For the most part, when the oscillation was positive, northern stock abundances were high and when the oscillation was negative, abundances were low.

For the last several years, the Pacific Decadal Oscillation has been in a cool ocean phase, which did not bode well for Alaska and north British Columbia Chinook salmon abundances, but has favored southern stocks such as those returning to the Sac-

ramento, Columbia, and Oregon coastal rivers. It is important to note that these climatic influences on salmon in the southern areas may be overpowered by human-induced impacts. Alaska and North British Columbia stocks are primarily wild and spawn in pristine rivers, while many southern Chinook salmon stocks are composed mostly of hatchery-origin fish and originate from rivers that have been substantially altered by human activities.

What are the future trends in Chinook salmon abundance and productivity?

Although no one has a crystal ball, if history serves as a guide, we expect that Alaska Chinook salmon production will turn around as it has done several times in the not too distant past. In the meantime, the department's job is to ensure that adequate numbers of Chinook salmon reach the spawning grounds in rivers throughout the State of Alaska. Managing for sustained yield helps ensure that sufficient populations of Chinook salmon are available to take advantage of the more favorable conditions once they occur. ∞

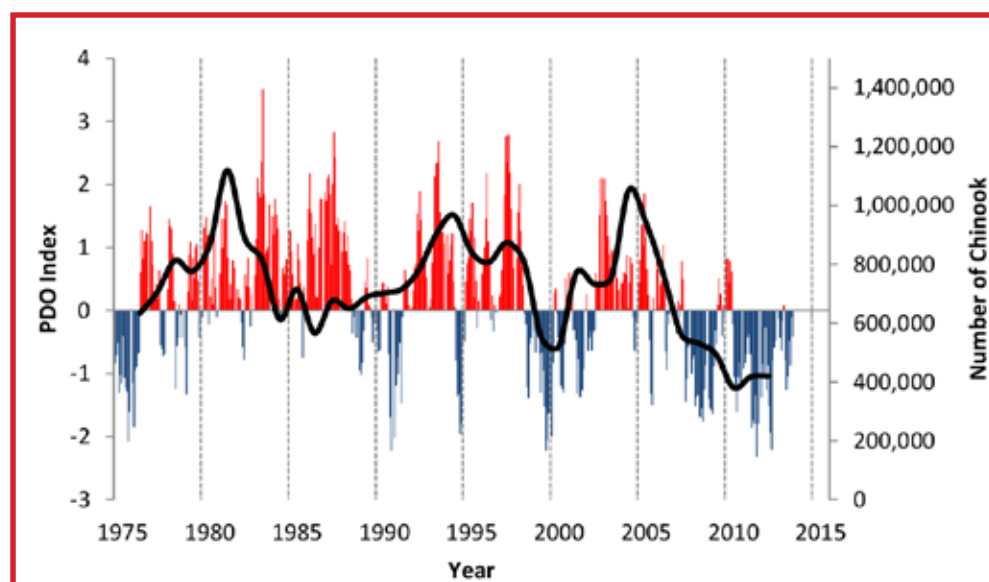


Figure 4.—Pacific Decadal Oscillation (PDO) climate data and the northern index of abundance for 11 Chinook salmon stocks in Alaska and northern British Columbia (BC).

The Role of Research in Understanding the Declines in Chinook Salmon Abundance in Alaska

Eric Volk and Bob Clark, Chief Fisheries Scientists



Fisheries geneticist Tyler Dann with survival and sampling gear for Chinook salmon on the Stuyahok River. © ADF&G.

If you live and work in Alaska, it would be near impossible to miss the news that Chinook salmon runs around our state are not doing so well and have been this way for a while. Weak Chinook runs resonate across the state impacting longstanding cultural patterns of food gathering, sport opportunities, and commercial economic activity.

What many, including scientists, do not know is why Chinook are returning in such low numbers and what can be done about it. Theories and suppositions abound around the fish camps, docks, water coolers, staff meetings, and halls of academia. Climate change, ocean acidification, predators, bycatch, food, competition with hatchery fish, and catch and release mortality are a few that have been suggested. But there are not a lot of facts, except that when runs are low, many will have to sit on the beach and wait and hope that things will get better. The simplest truth is that the basic facts of what has happened and is happening and where it happens have not yet been revealed for many runs of Chinook.

By basic facts we mean numbers. For example:

- How many are being caught in waters near and distant from home?
- How many Chinook are taken while fishing for something else?
- How many escape these fisheries to spawn?
- How many females and males?
- How old and large are they?

And we need these numbers by river system statewide. From these numbers we can tell how hard we are fishing, as well as how we are doing at providing for future runs through adequate numbers of fish, especially the larger and older females, on the spawning grounds. We have this information from the major river systems in Southeast Alaska because of federal funding received through the Pacific Salmon Treaty, but lack these complete numbers from the other major Chinook producing systems.

Efforts are underway to improve this situation with new research targeted to provide more complete numbers of Chinook returning to our rivers. Significant among these are new Chinook enumeration, or Chinook counting projects on the Susitna, Kenai, Nushagak, and Kuskokwim Rivers and plans to improve enumeration on the Copper and Yukon Rivers. We have also initiated efforts to sample all significant marine fisheries in the Gulf of Alaska to determine the river-of-origin of Chinook harvests. There are also ongoing efforts to determine region-of-origin of Chinook bycatch in groundfish fisheries in the Gulf of Alaska and Bering Sea.

Determining complete numbers of adult fish would be a start, but it is not enough. We also need to know how many juvenile Chinook salmon (the smolt that migrate down-river to the ocean and spend up to five years there) are being produced in our river systems each spring. This information is critical to understanding where the problem is occurring and to better understand if the low runs of Chinook will continue. Thanks to fund-

ing from the Governor's Chinook Salmon Research Initiative, we have begun to see if we can count juvenile Chinooks elsewhere in the state. The information gathered in Southeast Alaska indicates the poor Chinook salmon production is due to a substantial increase in marine mortality and subsequent decrease in marine survival. The Southeast information also shows that ample numbers of juveniles are actually migrating to sea and freshwater production has been about normal. However, for some reason these fish are dying at higher rates than normal in the ocean and truth be told—no one really knows why.

Beginning in 2014, we will be implementing new juvenile Chinook enumeration projects in the Copper, Karluk, Nushagak, and Yukon Rivers. We also have plans to begin enumeration projects in the Susitna and Kenai Rivers in the near future.



Tissue collection of an axillary fin from a Chinook salmon for genetic stock identification. This is a nonlethal method of collecting tissue samples. © ADF&G.

Our hope is that all of this new information will provide the basic facts needed to answer the questions of what is happening and where so that we can better predict runs of Chinook salmon in the future and better manage fisheries to sustain harvests even during years of low runs. ♪



Brian Elliot holding a tagged Chinook salmon on the Chilkat River, during the adult mark-recapture project in June 2002. ©ADF&G.

Chinook Salmon: Diversity of Life History Traits

James Savereide, Fishery Biologist

Chinook salmon (*Oncorhynchus tshawytscha*) like all Pacific salmon species are anadromous, which simply means a fish that is born in fresh water, spends the majority of its life at sea, and returns to fresh water to spawn. Chinook salmon are also considered semelparous, which is another fancy word for fish that spawn only once and subsequently die.

The Chinook's life cycle includes egg to alevin to fry to parr to smolt to adult, as described at a glance below.

- **Egg:** Eggs are typically deposited in late summer under gravel structures created by adults called redds.
- **Alevin:** The eggs hatch as alevin in early spring but remain in the gravel feeding off their yolk sacs for several weeks.
- **Fry:** They emerge from the gravel as fry and begin feeding on small aquatic organisms called zooplankton.
- **Parr:** As parr salmon, they develop vertical stripes on their sides and begin to feed on aquatic insects and larvae.
- **Smolt:** As they migrate to sea as smolts they lose the parr marks and enter into coastal estuaries to feed on small fish, insects, and crustaceans.
- **Adult:** Once at sea, they spend the rest of their adult lives feeding mainly on squid, herring, krill, and crustaceans before returning to spawn.

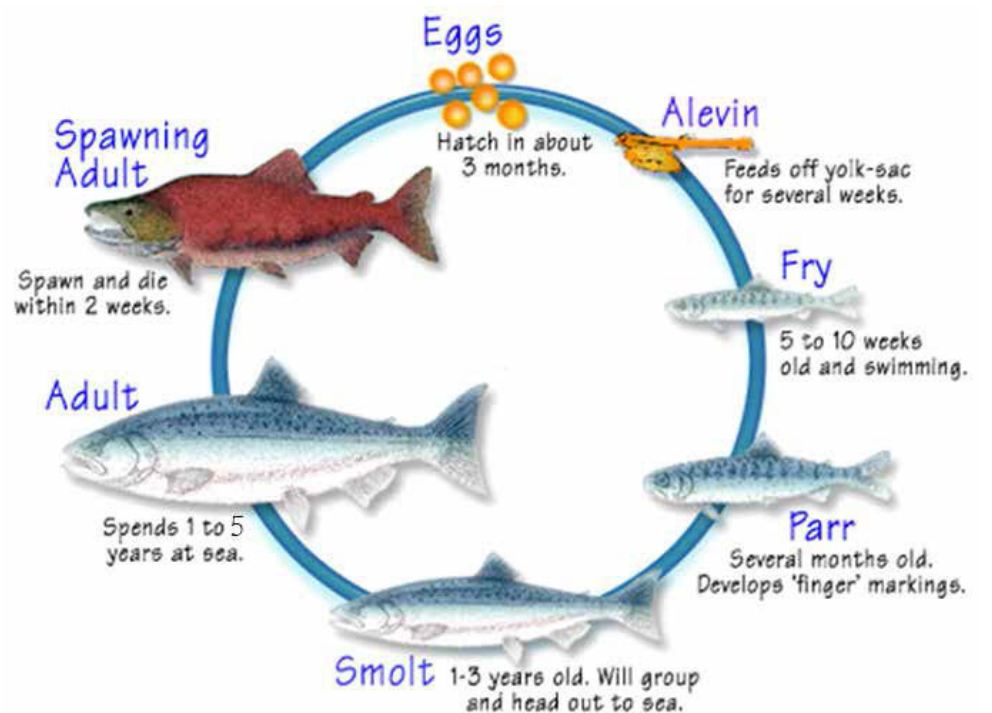
The whole life cycle typically is three to eight years depending mostly upon the amount of time the fish spend at sea, which ranges from one to five years. Within this basic life history strategy, Chinook salmon have evolved numerous juvenile and adult behaviors or tactics that minimize risks of mortality over their lifespan.

Two types of Chinook

Researchers have classified Chinook salmon into two basic types:

1. Ocean-type fish migrate to sea within a few months of being born
2. Stream-type fish spend at least one additional year in freshwater.

Stream-type fish are the norm for all of Alaska with the exception of a few systems in Southeast Alaska where both types are found in significant numbers. Variation in these two types of Chinook can also be observed within each



type. For example, ocean-type Chinook salmon migrate to coastal waters immediately after emergence as fry or up to a few months later as parr; stream-type Chinook salmon stay in fresh water for one or two years. So, not only does each type of Chinook salmon exhibit differences, the individuals within each type also possess different tactics.

The fact that Chinook salmon possess such a diverse set of life history traits suggests that they have evolved these traits to adapt to the constantly changing freshwater and saltwater environments they encounter. The two types of Chinook salmon are characterized by life history differences including the amount of time spent in freshwater, their distribution in the ocean, and even the timing of their spawning migrations. Researchers believe this diversity diffuses the causes of mortality across years and habitats, which in turn minimizes the risk of any particular age group from substantial fisheries, habitat modification, and ecosystem changes. ~

How Salmon Find Their Way in the Deep Blue Maze of the Ocean

Birch Foster, Fishery Biologist

On a remote Southwest cape of Kodiak Island in 2013, the skipper of a commercial tender buying salmon from fishermen near the mouth of the Ayakulik River noticed something out of the ordinary. On one of the thousands of fish he sees in a season, a single fish, otherwise robust and healthy looking, had unusually large pupils. Curious, he set the salmon aside and sent it to a fishery biologist in Kodiak who forwarded it to the state's fish pathology lab in Anchorage for disease testing. Interestingly enough, it was determined that there was nothing wrong with the fish except that it was simply born with extremely poor vision in both eyes. This salmon had been in the ocean for two years migrating with other fish. How did this salmon survive the vast expanse of the North Pacific Ocean and return to Kodiak Island as a mature adult without good eyesight? The answer is technology—fish technology! Salmon have developed an incredibly complex mechanism for navigating not only the freshwater but the marine environment as well, and a large portion has little to do with the eyes.

Throughout all stages of their development and movement through freshwater lakes and rivers, Chinook salmon, like all salmon, imprint on (that is learn and remember) smells and/or the chemical nature of their surroundings. Not only do they imprint on the smells of their freshwater environment, they also imprint on the smells of their ocean environment in the vicinity of their natal (home) stream. Due in part to this, salmon are able to migrate thousands of miles, taking advantage of the abundant food resources of the North Pacific Ocean and subsequently returning as a mature fish to the



Central Alaska anglers. Note the Chinook salmon's lateral line. © Mark Emery.

exact location they were spawned. This incredible homing instinct (ability to return to their original location) is inherited by all salmon. Even a salmon's run timing (internal time mechanism that determines what time of the year they will return to the river) is inherited through their genetic makeup.

What's not inherited by salmon is a set migration pattern. As salmon get farther away from their home stream, the smells they have imprinted on are simply too diluted to detect, especially considering the dynamic nature of the currents in the ocean. Recently, it has been discovered that salmon also imprint on the earth's magnetic field that exists where they first enter the sea. While humans can't sense the magnetic field that directs a compass, a salmon can detect minute variations in the field. In fact, other marine creatures that migrate long distances have demonstrated a unique ability for this, like sea turtles and blue fin tuna.

While the exact mechanism of geomagnetic homing by salmon is a mystery, it is thought the salmon's lateral line (a sensory organ that runs down the side of the fish from the gill plate to the tail fin) has the ultra sensitive ability to not only detect magnetic variation but other things like vibrations and electrical current in the water. As salmon migrate and feed in the dark blue ocean, they sense minute variations in the magnetic field to determine their location. As if salmon weren't fascinating enough, recent studies have shown slight natural movement (drift) of the earth's magnetic field causes slight shifts in migration route of returning salmon! This evidence of variable migration routes by salmon originating from the same streams suggests that the salmon essentially have their own internal global positioning system (GPS) via the magnetic field. Not only do they know where they are, they know when they have to start back in order to return to spawn on time. While other cues to migration are likely incorporated by the salmon's sophisticated navigation system, like temperature, tides, and the solar/lunar cycle, vision plays a small role compared to their other amazing senses.

The truth is, the presence of a salmon having limited eyesight but still being able to migrate normally is probably not that unique, especially considering the abundance of salmon in Alaska. This one example demonstrates why the salmon is not only reliable and steadfast to its place of origin, but also adaptable to the constantly changing conditions of the climate, making it one of Alaska's most sustainable and impressive resources. ~

The Chinook Tradition: Feeding Alaskans, the Economy, and a Hungry World

Ken Marsh, Information Officer

For a great many Alaskans, the ice- and snow-free months begin and end on the water, in the sun, wind, and rain, where wild Pacific salmon are plucked with nets from the tides, or pulled leaping and thrashing with rod and reel from our rivers and creeks. Of the five Pacific salmon species that appear here en masse each summer, roiling estuaries near and far as they journey up natal streams, none have gained a higher standing — as a traditional food source, cultural icon, sport fish, and economic sparkplug — than the Chinook.

Commonly called “king salmon” or simply “kings” by Alaskans, Chinook are the largest of Alaska’s salmon and, even in the best of times, the least abundant. The heaviest on record, caught in 1949 in a Petersburg commercial fish trap, weighed an astonishing 126 pounds. The world sport fishing record, a scale-straining lunker of 97 pounds 4 ounces, was hauled from the Kenai River in 1985.



A 55-pound king salmon from Central Alaska. © Mark Emery.

For perspective’s sake, the proportion of Chinook to other salmon species may be roughly illustrated by looking at Alaska’s overall annual commercial salmon harvests. While the annual commercial take of all salmon species averaged around 172 million fish from 1990 to 2006, the total annual catch of Chinook averaged only 630,000 (1970 to 2006). In other words, Chinook have traditionally represented only around 0.4 percent of Alaska’s annual commercial salmon catch.

Coveted by subsistence, sport, and commercial fishers alike, the Chinook’s appeal has long transcended its succulence as table fare, its power against rod and reel, and its marketable size. Alaska’s state fish, a fitting symbol of a place as broad, wild, and enigmatic as the big salmon itself, the Chinook remains a prominent thread in the fabric of this place, its people and its history.

Subsistence

For Alaska Natives along the Yukon River, king salmon have forever been — and remain today — staples of the traditional subsistence diet. The Yukon River kings are valued for their particularly

rich fat reserves (an adaptation that provides fasting fish the energy required to travel upriver nearly 2,000 miles through Alaska and into Canada) and are favored by many as the region’s best salmon for human consumption.

These first salmon of spring arrive shortly after the Yukon is free of ice and were historically taken by people such as the Anvik-Shageluk Ingalik, the Deg Hit’an and others with traps, dip nets, and even harpoons. Early subsistence fishing methods were recorded by James W. VanStone in *Ingalik Contact Ecology: An Ethnohistory of the Lower-Middle Yukon, 1790-1935*:

“(King salmon) were taken most effectively in large basket traps. ... Traps were more effective than gill nets since these fish do not travel as close to shore as do other species of salmon. Another common means of taking them was by means of a dip net. The fisherman, in his river canoe, drifted down river with the current while holding the net in the water. When an ascending salmon was caught, it was lifted out, killed, and placed in the canoe; then the operation was repeated.”

Similar methods were employed by all Alaska Natives throughout the king salmon’s Alaska range; nets and basket traps were constructed with available wood, roots, animal hide, and sinew while harpoons, as described by VanStone in another paper about the Deg Hit’an, consisted of a “spruce wood shaft, approximately 1.5 cm in diameter, and a fixed antler fore shaft, which is inserted into a slit at the distal end of the shaft and lashed with spruce root. The harpoon heads have closed sockets, single spurs, and round line holes from which extend rawhide lines.”

In the late 1800s, fish wheels began to appear in some Alaska rivers. A new technology brought north with the Klondike Gold Rush from the Pacific Northwest, the concept was as effective as it was simple. Baskets affixed to struts (or spokes) radiating out from an axle were set on a floating platform that was placed in the current and anchored to the river bottom. The paddle-like baskets constantly rotated with the current so that salmon traveling upstream were scooped up and funneled into a bin placed on the fish wheel platform. Originally used to catch salmon to feed miners and settlers, fish wheels were soon adopted by Alaska Natives. Some subsistence fishers today still use fish wheels

to catch salmon, including Chinook, on the upper Copper, Yukon, and Kuskokwim Rivers.

Subsistence fishing for king salmon in Alaska today is governed under “subsistence uses,” a term defined by state regulation as the

“noncommercial, customary and traditional uses of wild, renewable resources by a resident of the state for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption...”

When harvest restrictions are necessary to conserve Chinook, subsistence fisheries by law have preference over other fisheries.

Chinook salmon harvests by subsistence fishers in Alaska averaged 167,000 fish annually from 1994 to 2005. More recently, subsistence harvests have ranged from an estimated statewide total of 157,813 fish in 2007, to 141,563 in 2009, and 128,662 in 2011. King salmon in each of these three years accounted for 15 to 16 percent of the total statewide subsistence harvest of all salmon species.

The importance of Chinook for subsistence users varies by region. In 2011, the estimated subsistence king salmon harvest for the **Kuskokwim Area** was 65,852 fish (51 percent of the statewide subsistence harvest), followed by the **Yukon Area** with 41,069 king salmon (32 percent of the total subsistence harvest), the **Bristol Bay Area** with 14,106 kings (11 percent), the **Glennallen Area** with 3,649 (3 percent), and the **Northwest Area** with 1,701 (1 percent).

Sport Fishing

Early on the morning of May 17, 1985, a 68-year-old Soldotna automobile dealer was soaking salmon eggs in the lower Kenai River when, for just a moment, the entire world seemed to lurch to a stop. That’s when Les Anderson realized, struggling as his rod jolted and wrenched in his hands, that he’d hooked a big fish. The moment’s true significance, however, didn’t immediately occur to him.

Anderson pumped and reeled the thrashing king to his boat three times before he and his fishing

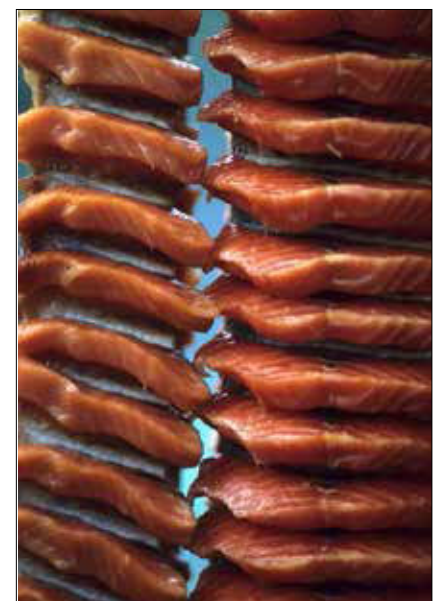
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Smoking Chinook salmon in Central Alaska. © Mark Emery 2008.



Subsistence king salmon fishery, Middle Yukon River area, Solomon family fish camp BBQ. © ADF&G. Photo by John Hyde.



Chinook salmon drying in the mid-Yukon River area. This technique of cutting fish into strips is one of the most efficient ways to dry or smoke Chinook salmon. © ADF&G. Photo by John Hyde.



Spruce poles being bent and dried to be used in constructing fish wheel baskets in the community of Tanana, Yukon Area. © ADF&G. Photo by Bonnie Borba.



Spruce poles drying to construct a fish wheel at a fish camp on the Tanana River, Yukon Area. © ADF&G. Photo by Bonnie Borba.



Looking up through spruce poles drying to construct a fish wheel at a fish camp on the Tanana River, Yukon Area. © ADF&G. Photo by Bonnie Borba.

(continued from page 6)

buddy realized it was far too heavy to haul over the side. In the end, they beached the boat and dragged ashore, flopping and flaying, a king salmon that would forever change Anderson's life and bestow upon the Kenai a legendary reputation as a river known for enormous Chinook.

Placed on a scale, Anderson's 97-pound 4-ounce king salmon turned out to be a world record. For trophy anglers, the catch set a high bar. It also led some to speculate that the distinctive glacial-green Kenai might be natal waters to even larger Chinook. Since Anderson's catch, many Kenai River king salmon anglers have wondered if their next cast might hook the holy grail of salmon: a 100-pound king.

The big catch drew the attention of a fascinated world to what was already a popular, though relatively new, sport fishery. It was not until around 1973 that "relatively large numbers of anglers discovered that (Kenai River) Chinook salmon were susceptible to harvest by bouncing terminal gear along the bottom from a drifting boat," according to Alaska Department of Fish and Game Biologist Stephen Hammarstrom in the 1978 report *Evaluation of Chinook Salmon Fisheries of the Kenai Peninsula*. Once discovered, the fishery grew rapidly. From 1974 to 1977, Hammarstrom reported that the estimated angler effort for Kenai River king salmon "expanded by 252 percent."

The popularity of the Kenai River king salmon sport fishery grew even more after news of Anderson's record catch and continued to rise well into the 21st century. Indeed, interest in sport fishing for Chinook has grown statewide. A 2006 Alaska Department of Fish and Game paper, *The Commercial Salmon Fishery in Alaska*, notes, "Currently, average (sport) harvest levels in the 2000s show increases over harvest levels in the 1980s of about 90 percent for Chinook."

Growth in Alaska's Chinook salmon sport harvests has been steep and steady. Division of Sport Fish statistics indicate the estimated annual statewide sport harvest of king salmon rose from 43,060 fish in 1977 to a total of 116,402 a decade later. By the year 2000, the yearly statewide Chinook sport harvest swelled to 177,928 fish and peaked in 2005 when 204,468 king salmon were caught with rod and reel.

Between 2000 and 2010, the Division of Sport Fish reports that sport anglers harvested a yearly average of 180,000 king salmon. Of that harvest, 53 percent was taken in the Southcentral region, location of the state's population and travel hub. The region's highways provide access to many waters, and fishing opportunities are plentiful, inexpensive, and generally easy to reach.

Memorial Day weekend has long marked the traditional — and unofficial — opening of the Southcentral salmon fishing season as this is roughly when the first significant numbers of Chinook begin

to return to the Kenai, Anchor, and Susitna River systems, among others. Runs build in June, peaking in the Kenai River and upper Susitna drainages in early to mid-July.

Kings also provide sport off Southcentral Alaska's coasts. In fact, for some saltwater anglers in Resurrection Bay out of Seward, and in lower Cook

Inlet and Kachemak Bay near Homer, king salmon fishing is a year-round event. Even during the short days of December, a small and particularly hardy fleet of hardcore salts brave dark waters and freezing spray to specialize in catching "winter" or

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First Copper River Chinook Salmon Arrives in Seattle

SEATTLE—It's (a) big business and big fun as the first Copper River salmon of the season arrived in Seattle. An Alaska Airlines Boeing 737-400 Combi freighter rolled to a stop on the ramp at Sea-Tac shortly after 6:00 a.m., and the captain and first officer brought out a big king salmon.

The kings and sockeyes of the Copper River command extra value, and not just because they're the first fresh fish of the season. The Copper is a big, brawling river, and fish have to be big and strong to survive it. The way they've evolved to meet its demands, and the foods they eat, give them a very high oil content, and therefore, superior color and flavor.

Frank Ragusa, of Ocean Beauty Seafoods said, "They're simply the best fish in the world." They're also loaded with Omega-3 fatty acids—held to be good for heart health.

Competition by restaurants and retailers for the fish

is intense. The Los Angeles Times is reporting that initial prices for the kings could range as high as \$50 a pound, though that will come down as the fish begin to arrive.

The harvest this year is expected to be 22,000 kings, though that's just an estimate, and could change as the fish actually come in. Fisheries inspectors closely monitor the catch, and could cut it down if the numbers of the fish returning to the river fall off sharply.

Chef John Howie, of SeaStar restaurants in Seattle and Bellevue, told KIRO 7 that the Copper River salmon generate so much excitement that this arrival will actually put more customers into the restaurants.

The run of Copper River kings and sockeyes together is expected to last well into June.

— KIRO 7 TV News



The first Copper River Chinook salmon of 2014 arriving in Seattle. Photo courtesy of Alaska Airlines.

(continued from page 7)

“feeder” kings — fish drawn to area kelp beds and shoals by rich baitfish stocks.

The Southcentral region’s annual Chinook sport harvest is historically followed by Southeast, which between 2000 and 2010 accounted for 42 percent of the statewide sport harvest. Most king salmon in this productive region are taken by saltwater anglers among the straits and island-sheltered channels of the Inside Passage. An additional four percent of the statewide sport harvest of Chinook during this period was taken in the waters of the remote and sparsely populated Arctic, Yukon, and Kuskokwim areas.

Commercial Fisheries

Each spring, around mid-May, one of Alaska’s most renowned commercial salmon fisheries is hailed in a media event broadcast throughout the Pacific Northwest and beyond. At the spotlight’s center is a fresh-caught Copper River king salmon, dime-bright, pulled from a tub of ice and hoisted high by an Alaska Airlines pilot standing outside a cargo jet. The headlines typically read something like “First Copper River Salmon Arrives in Seattle.”

The Copper River commercial salmon season’s first catches include sockeye and Chinook, but it’s the big kings that often steal the show. Legendary for their exceptional reserves of healthy Omega-3 oils and fats and savored by gourmands for their “bright red flesh,” “firm texture,” and “rich, nutty flavor,” these early kings are marketed as the first, best salmon of the region’s annual fishing season. The fish net high prices for Copper River delta bowpickers — an average of \$5.46 per pound was paid in 2013 — and for retailers whose prices for fresh fillets last spring in the markets of Anchorage, Seattle’s Pike Place, and elsewhere ranged from \$27.99 to \$38.95 per pound.

Vaunted as those first Copper River kings are, though, they represent only a small fraction of a statewide commercial Chinook catch valued in 2013 at more than \$19 million. In fact, in the scheme of Alaska’s commercial salmon fisheries, Chinook have always played a minority role to more abundant species such as sockeye and pink salmon. Out of the total 2013 catch of more than 282.9 million salmon, only 323,394 — or about 0.1 percent — were Chinook. Even in better years, before the present cycle of low productivity beset the fishery and with typical commercial hauls averaging 630,000 per year statewide, Chinook harvests have represented a relatively small part of Alaska’s salmon catch. Even so, the big fish have long provided a significant source of income for many commercial fishers statewide.

Regionally speaking, the vast majority of Alaska’s commercially harvested Chinook are taken in Southeast Alaska. Catch methods include trolling, drift gillnetting, seining, and set gillnetting. Of the more than 241,000 Chinook commercially harvested in Southeast last year, the lion’s share — 149,559 fish — were taken with trolling gear. Framed by a spring season running from May into June, summer season running from July 1 through September 20, and a winter season from October 11 through April 30, this productive traditional fishery serves consumers fresh Chinook virtually year round.

Drift gillnetters ranked a distant second place in last year’s Southeast catch claiming 35,525 Chinook, while seiners took 24,519. Set gillnets in the region took an additional 1,401 of these valuable salmon. Southeast Alaska kings — especially fresh, troll-caught fish — draw premium prices which last year averaged \$6.70 per pound.

The remaining Chinook commercially caught in Alaska are taken mostly in gillnets from fisheries out of **Kodiak** (where the total catch for 2013 was 34,000), **Bristol Bay** (19,000), the **Yukon-Kuskok-**

wim Delta (a much lower-than-average number of 3,000), **Copper River/Prince William Sound** (10,853), the **Alaska Peninsula** (7,000), the **Upper Cook Inlet** (5,398), and **Lower Cook Inlet** (391). Many of these figures represent below-average catches due to recent low Chinook returns and measures taken to conserve and build stocks.

The average price per pound received by commercial fishers outside of Southeast and the Copper River (Prince William Sound) is significantly lower, with Cook Inlet-caught fish last year generating \$2.89 per pound, Kuskokwim fish netting \$1 per pound, and Bristol Bay fish bringing \$0.77 per pound. ∞

Commercial Fish Traps: A History of Excess

Commercial king salmon catches in Alaska date back to the late 1800s with harvests of 5,000 and 6,000 fish reported in 1890 and 1891 respectively. A couple of years later, in 1893, Chinook harvests leaped to 89,000. Records indicate a catch of 98,000 in 1899, and numbers continued to climb from there, ballooning to 201,000 by 1903. The impetus behind this initial surge (which extended to other salmon species as well) was simple: gold.

“The Klondike gold rush caused a dramatic increase in the non-Native population [in Alaska]: from 1,738 in 1890 to 8,707 in 1900,” writes Steve Colt, author of the paper, *Salmon Fish Traps in Alaska: An Economic History Perspective*. In terms of harvest, though, these numbers were just the beginning. A new industry was headed North and with it a wickedly efficient salmon-catching technique that would eventually lead to near devastation of the resource.

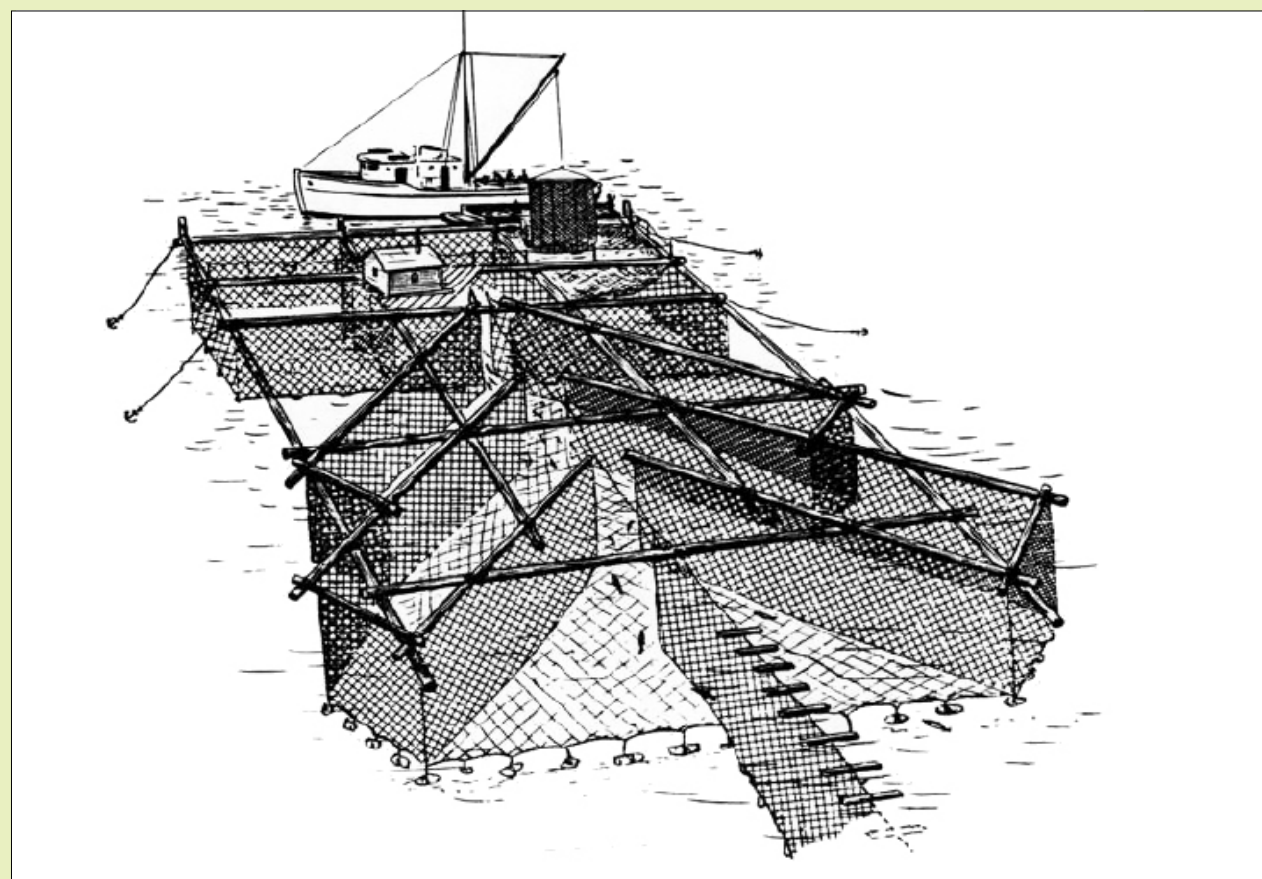
Alaska’s first salmon canneries were built in 1878 in Sitka and Klawock. By 1920, more than 100 canneries were “operating mostly in the protected waterways of the Southeast region, but several operations had been set up all along the coast,” spreading west to Bristol Bay, according to Colt. Millions of salmon were taken in fish traps owned and operated by these largely Outside-based canneries. The traps were highly effective in catching all salmon species and led annual Chinook harvests to spike in excess of one million fish in 1924 and again in 1937 — incredible numbers never achieved before or since.

Under the fish trap system, salmon harvests began a long-term decline after 1939. Despite outcry from territorial Alaskans, the federal government (which then managed Alaska’s salmon fisheries) refused to ban fish traps. Subsequently, the devices and the devastation they wreaked became a central rallying point in the push for statehood.

By the time Alaska became the 49th state in 1959, its salmon stocks were in dismal shape. In January of 1960, in a speech to the First Alaska State Legislature, Governor William A. Egan remarked, “On January 1 of this year, Alaska’s Department of Fish and Game was handed the depleted remnants of what was once a rich and prolific fishery. From a peak of three-quarters of a billion pounds in 1936, production dropped in 1959 to its lowest in 60 years. On these ruins of a once great resource, the department must rebuild.”

And rebuild it did. With care, determination, and hard work over the next 45 years, the young state’s efforts to rebuild its salmon stocks ultimately succeeded, with great success.

The fencing off of entire streams was banned in 1889. By 1906 no fixed gear was allowed in rivers or narrow bays. Thus the commercial fish trap evolved to take advantage of the Salmon’s tendency to migrate along the main ocean shore and to congregate at the mouths of bays. An early enthusiast writing in 1909 described the trap operations thus: “It is most simple in its construction, and consists of a long arm of piling and netting reaching out at an angle into the sea. The fish are stopped by the net, which is fastened to the piles and extends to the very bottom of the water. Continuing their way up against the trend of the water they pass through a narrow funnel which opens into the trap proper. The trap is completely covered on the bottom with a great net and the fish, crowding through the opening, find themselves in a trap from which there is no escape... This immense net is lifted from the inside of the trap at stated periods and the catch is dumped unceremoniously into waiting scows. The capacity of the scows used in Alaska is about twenty thousand fish, and it is not uncommon to see two of these coming from one trap completely filled with flapping, gasping salmon.” Kirkwood, Dean, 1909, p. 35. *The Salmon Industry in Alaska*. Portland Oregon: C. C. Chapman.



A Century of Salmon

Alaska Department of Fish and Game staff



Matanuska Valley colonists fishing, Cook Inlet, Alaska, 1936. Almer J. Peterson, papers and photographs, UAA-HMC-0413, Archives and Special Collections, Consortium Library, University of Alaska Anchorage.

The Early Days

Salmon have long played an essential role in Alaska's identity. Salmon are the basis for one of Alaska's most important industries and since the late 1880s, commercial fishing has been a critical part of Alaska economy and culture. In the Far North, Alaska salmon sustained the first humans long before the territory was purchased from Russia. Drawn by economic potential, early settlers arrived and began building fish camps and canneries.



Three people on shoreline holding fish, Cooper Landing, Alaska 1940. Alaska State Library, Doyle C. Tripp photograph collection.

Decades later, when the United States entered World War II and began rationing limited available protein for troops overseas and citizens at home, the nation turned to the Territory of Alaska's abundant fisheries resources. In the fisheries boom that followed, salmon were harvested in vast numbers, sent off to the canneries, packed and then shipped to the Lower 48. It was a prosperous time for Alaska's salmon industry, but harvests were too high for too long. Salmon runs began to decline.

One of the main contributors to salmon overharvest was fish traps. Fish traps were a primary supplier of salmon to canneries each year. Highly efficient, the traps caught so many fish that by the late

1940s, many territorial salmon runs were decimated. And by the time fish traps were outlawed in the late 1950s, the damage was done (see "Commercial Fish Traps: A History of Excess" on page 8).

Statehood

The plan to restore Alaska's salmon runs was simple. The first step was to fill river systems with spawning salmon and the best way to accomplish this was to stop fishing.

Prior to statehood in 1959, Alaska's fishing regulations and management plans were made largely in closed-door meetings between federal regulators and the salmon packers. Alaskans had little, if any, say in what was decided. To provide for an open public process and to give direction to the Fisheries Division, in 1949 the Territorial Legislature created the Alaska Territorial Fishery Service.

In 1959 the first state legislature renamed the Fishery Service to the Alaska Department of Fish and Game and the federal government withheld regulatory authority until 1960, allowing the state to develop laws and agencies to manage Alaska's fisheries resources. In the first draft of the proposed law that defined the department's authority and duties was a provision for a Board of Fish and Game that had regulatory authority but no administrative powers. At the same time, extraordinary power was granted to the commissioner to control fishing and hunting, as needed, and this authority could be delegated to managers to create a flexible and real-time regulatory system. In spring 1975, the legislature split the Board of Fish and Game into separate boards, the Board of Fisheries and the Board of Game, a model that continues today.

The importance of maximum salmon spawning capability was highly emphasized through the 1960s and fisheries were severely restricted. However, the plan worked; by maxi-

mizing the numbers of spawning salmon, salmon runs gradually recovered. Even so, there was still work to do.

One reason excessive harvests were allowed to continue for so long was because of inaccurate fish counts by federal fisheries managers. Before statehood, the U.S. Bureau of Fisheries allowed fishermen to harvest half of the salmon runs and let the other half escape to the spawning grounds. However, no official means existed to estimate run or spawning numbers, data that was gathered was not standardized, and enforcement of the rules and regulations was not structured.

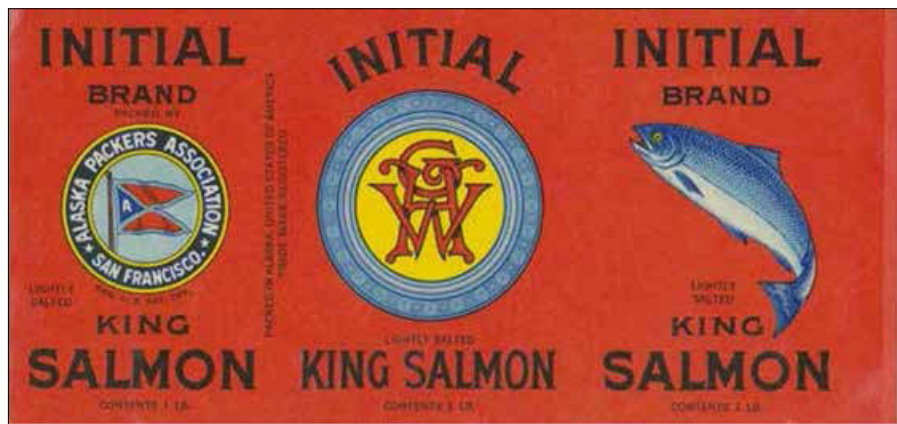
When the Alaska Department of Fish and Game took control of the new state's fisheries, they wanted to do it right. Biologists began gathering information on harvest rates and numbers and by setting up counting weirs, towers and other sampling devices, and through standardized aerial surveys, spawning and total run numbers were estimated. These new methods of collecting information allowed local management biologists to more accurately decide when to open and close fisheries statewide to sustain salmon runs and yields over time.

It took nearly three decades of strict regulation and management, but in 1980 a record run of

(continued on page 10)



Fish trap on Lower Cook Inlet, east shore, 1954. Steve McCutcheon, McCutcheon Collection, Anchorage Museum, B1990.14.5.AkNative.32.19.



Alaska Packers Association, Initial Brand Lightly Salted King Salmon. Alaska State Library Historical Collections ASL-MS108-02.

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salmon surged back into Alaska waters. The management plan set forth years before had paid off and the 1980s represented the triumph of management for Alaska's fisheries.

Sustainability

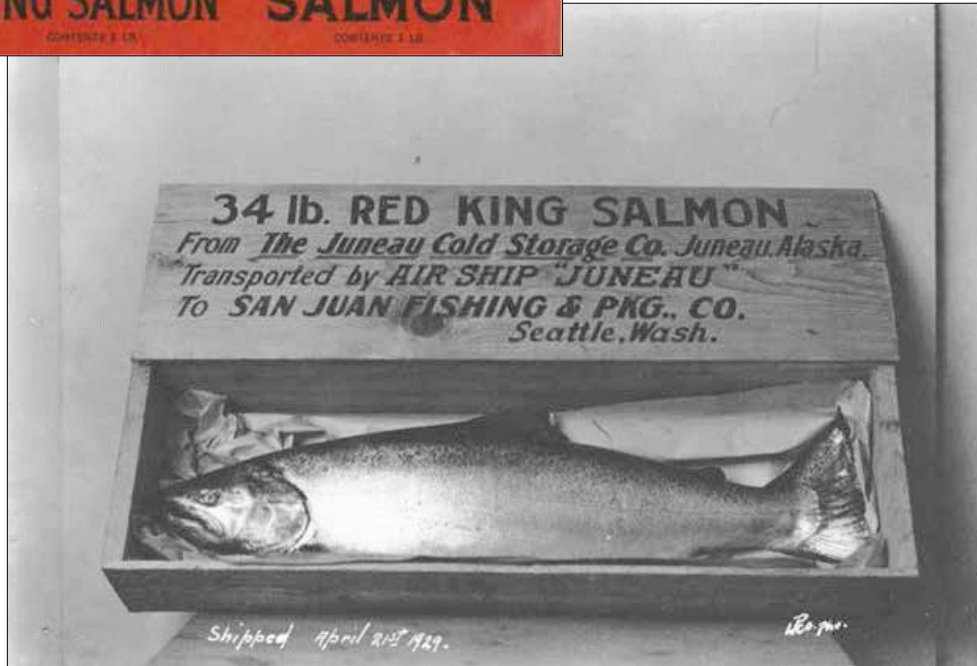
The fish were back, and now the main concern was to not let them disappear again. This was accomplished

through a policy of sustainable yield as directed by the state's constitution. The sustainable yield principle allows harvest of fish that are in excess of the spawning numbers needed to maintain healthy and viable populations. Salmon in Alaska are managed to achieve runs that are abundant and renewable for future generations.

The Board of Fisheries is primarily responsible for developing fishery management plans, allocating resources among users, and establishing regulations. The board process in essence shields the department from allocative and political influences that are inherent with such lucrative industries. Much of today's success can be credited to those who had the foresight and vision to establish these boards over a half century ago.

Managers use several methods to ensure that salmon populations can support fisheries, the most critical of which is escapement goal management. To make sure an adequate number of salmon reach the spawning grounds to produce new generations of fish, a set number are allowed to escape the fisheries. In many cases escapement goals have a lower and an upper bound.

Obviously, fish must be left to spawn annually, but



Wooden shipping box from 1929. Alaska State Library Historical Collections. Winter and Pond. Photographs, 1893-1943. ASL-PCA-97.

detailed studies have shown that in many cases too many fish can also be a problem. If too many salmon crowd the spawning grounds, fertilized eggs can be disturbed and released from the gravel to die or be eaten by scavengers. Lakes and streams can also become so crowded with spawning fish that they die from competition for spawning areas or stress before they even get the chance to reproduce. Intense competition among juveniles for precious food and habitat resources can also result. In order to avoid this, salmon numbers are controlled by closely monitoring harvest and escapement levels for each river system. During periods of poor production this can cause hardships, leaving managers with the difficult decision of closing fisheries in order to pass fish to the spawning grounds.

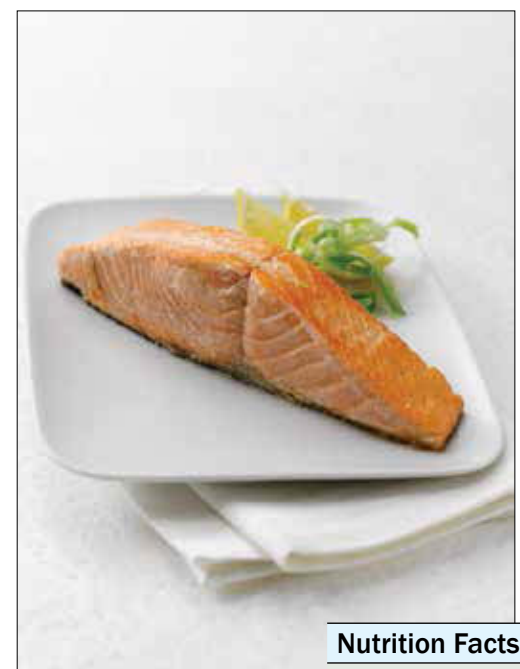
Fortunately, production tends to cycle and in most years surplus yield is available for harvest. In the world of salmon management, achieving escapement goals is the number one priority of the Alaska Department of Fish and Game. ∞



King salmon from Southcentral Alaska. © Mark Emery.

Chinook Fast Facts

- The Chinook salmon, or king salmon, is Alaska's official state fish.
- Chinook salmon nicknames: king, tye, spring, blackmouth, tule, quinnat, and chin.
- Chinook salmon often have long up-stream spawning migrations. Those that spawn in the headwaters of the Yukon can travel more than 2,000 miles and may spend up to three months inriver.
- Chinook salmon are anadromous, meaning they are born and spawn in fresh water, but spend most of their life in marine waters.
- Chinook are the largest of all the five species of Pacific salmon. At maturity, they average 20 to 40 pounds and between 30 and 50 inches long, but can exceed 100 pounds and 55 inches.
- The largest sport-caught Chinook was 97 pounds taken from the Kenai River in 1985.
- The largest commercially caught Chinook weighed 126 pounds and was taken in a Petersburg fish trap.
- Chinook are the longest lived of all five species of Pacific salmon. The whole life cycle typically is three to eight years depending mostly on the amount of time at sea, which ranges from one to five years.
- Small Chinook salmon that mature after spending only one winter in the ocean are commonly referred to as "jacks," which are nearly 100% males.
- Chinook grow rapidly in the ocean and often double their weight during a single summer season.
- Female Chinook lay from 3,000 to 14,000 eggs; generally, the larger she is, the more eggs she will lay.
- Chinook juveniles divide into two types: ocean type and stream type. Ocean type Chinook migrate to saltwater in their first year. Stream-type spend one full year in fresh water before migrating to the ocean.
- In North America, Chinook salmon range from Monterey Bay in California to the Chukchi Sea in Alaska.
- Alaska's major Chinook populations return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku, and Stikine Rivers. Important runs also occur in many smaller streams.
- There are numerous stocks of Chinook throughout Alaska. Some stocks are in decline while others are at equilibrium or increasing. ∞



Plated Alaska king salmon. Photo courtesy of Alaska Seafood Marketing Institute.

Nutrition Facts	
Serving Size (oz)	3.5
Calories	230
Protein (g)	26
Fat (g)	13
Saturated Fat (g)	3
Sodium (mg)	60
Cholesterol (mg)	85

The Impact of Bycatch

Nicole Kimball, Federal Fisheries Coordinator

Last October and again this month, the North Pacific Fishery Management Council (Council) received a report on Chinook salmon bycatch in the Bering Sea pollock fishery, given that the new bycatch management program has been in place for three years. The reports included information on the status of Alaska's Chinook salmon stocks, what impact Chinook salmon bycatch has on total runs, and information to help the Council evaluate individual vessels' fishing and bycatch performance under the program.

The reports provided the Council important information, especially regarding the impacts of Chinook salmon bycatch on western Alaska stocks in light of low runs. The reports used genetic information and age data to determine the number of Chinook salmon that would have returned to river systems had bycatch not occurred in 2011 and 2012, and then compared that to run strengths. Under the program's first two years, the impact of the actual bycatch on coastal western Alaska river systems ranged from 1.6 percent to 2.0 percent of the total run. Put another way, the runs might have been 1.6 percent to 2.0 percent larger had bycatch been zero.

The current program is made up of hard caps and incentive plans to keep salmon bycatch as low as possible under all conditions of salmon abundance, for every vessel. The Council spent a lot of time reviewing the impacts as well as determining whether industry incentive plans are working as intended. The incentive plans are a critical part of the program, and ever more important in times of low Chinook salmon abundance when bycatch levels are not anywhere near cap levels.

Chinook salmon bycatch in the Bering Sea pollock fishery in 2013 was about 13,032. In 2012, 11,352 Chinook salmon were caught in the Bering Sea pollock fishery. Both of these numbers are well below the 10-year average. These are also two of the lowest bycatch numbers in recent years, well under the overall bycatch cap of 47,591 Chinook salmon in any one year and up to 60,000 fish in any two out of seven years. At current abundance and bycatch levels, the caps are not as important as making sure the plans which set incentives for fishermen to avoid salmon remain as strong as possible.

After several days of Council discussion and public testimony, Alaska Department of Fish and Game Commissioner Cora Campbell made a motion to analyze several specific ways to improve Chinook salmon bycatch controls in the Bering Sea pollock fishery. The motion passed unanimously and provided clear direction that, despite evidence that the current bycatch management program is working to reduce bycatch in a situation of historically low Chinook salmon abundance, the Council must continue to improve the program. Campbell spoke about the severe restrictions in place for subsistence users in western Alaska and that given the importance of Chinook salmon the Council must consider the impacts of any level of removals to those users.

Commissioner Campbell's motion focuses on changes to the program that will result in additional reductions in Chinook salmon bycatch, beyond the levels of bycatch seen today. Changes being considered include beginning and ending the pollock season sooner to eliminate fishing late in the year when bycatch rates can be higher, requiring all vessels to be subject to a 'hotspot' closure program throughout both pollock seasons, requiring the use of salmon excluder devices, and reducing the number of Chinook salmon the pollock fishery is managed to on an annual basis by as much as 60 percent in years when abundance of salmon in Coastal Western Alaska is low. These changes are clearly designed to ensure that all users of Chinook salmon are operating under a program that is responsive to the current low levels of Chinook salmon abundance and productivity in Western Alaska.



Alaska pollock from the Bering Sea pollock fishery. Chinook salmon bycatch in that fishery has been declining. © ADF&G.

In addition, the Council has asked that regular reports on impacts and effectiveness be provided to the Council and public. This would allow everyone to understand how the program is truly working as salmon stock status changes and genetic identification become more refined.

The Council also spent a lot of time discussing a better approach to balancing chum and Chinook salmon bycatch. The commissioner's motion requested an analysis of changes needed to combine chum salmon bycatch avoidance measures with the Chinook salmon bycatch reduction program. This will allow for a more targeted system of salmon management overall and will allow measures to avoid chum salmon to be put in place without weakening protection measures for Chinook. The most recent genetic data tells us that about 25 percent of the chum bycatch in the Bering Sea pollock fishery is from coastal western Alaska or the Upper/Middle Yukon River, with most Alaska chum caught in the summer months. The motion clearly states the Council's goals: to prioritize Chinook salmon bycatch avoidance while preventing high chum salmon bycatch and focusing on avoidance of Alaska chum salmon stocks, and allowing flexibility to harvest pollock in times and places that best support those goals.

The information presented to the Council clearly indicates that the current Chinook bycatch management program is reducing bycatch and that impacts of current bycatch levels on Alaska stocks are low. Still, the Council and the State of Alaska consider this a critically important issue due to the current state of Chinook salmon runs and the hardships imposed on subsistence users. The requested analysis will be reviewed by the Council at an upcoming meeting, and the State of Alaska will continue to press for reductions in salmon bycatch. ~



NMFS onboard observer sampling a commercial catch. Photo courtesy of NOAA.



NOAA ship R/V Oscar Dyson supporting research of the pollock fishery in the Bering Sea. Photo courtesy of NOAA.

How Big is an Adult Chinook Salmon?

That's a question a lot of people ask. The answer may surprise you. Let's put this in some context.

Bert Lewis, Fishery Biologist

Chinook salmon (*Oncorhynchus tshawytscha*) are the largest of the five Pacific salmon species. Known in Alaska to exceed 100 pounds, the Chinook looms large as a Native cultural icon, a highly sought-after sport fish, and a valuable commercial species. Also known as king salmon, these fish have long supported important commercial, subsistence, and sport fisheries and are of particular interest because of their significance ecologically, economically, and culturally in rural and urban Alaska.

Chinook salmon are unique among salmon. They exhibit greater life history diversity than other species, spending one to three years in freshwater and then one to five years in the ocean before returning to spawn. The longer time they spend in the ocean compared to other salmon is partly responsible for their large size.

Abundance of Alaska Chinook salmon stocks has declined in recent years and scientists believe this poor production is mostly due to reduced marine survival. During these periods of poor production, fishery managers often impose more restrictive limits and even closures. Although these actions are designed to maintain adequate numbers of spawning fish, impacts to subsistence cultural and spiritual activities, sport fishing opportunities, and economic benefits from the sport charter and commercial industries have occurred. All of these groups have seen restrictions on harvest.

In addition to declines in abundance, some populations of Alaska Chinook salmon are now smaller and younger when they return to spawn

compared to historical values. In some cases, in areas where runs were once dominated by Chinook salmon having spent four years in the ocean, runs are now primarily smaller fish that spent three years in the ocean. This is not a new trend. Dr. Bill Ricker documented a similar significant decrease in Alaska Chinook salmon size between 1960 and 1974. Declines in size and changes in age structure have been well documented in populations of other Pacific salmon. However, we do not know the mechanisms behind these changes, but evidence suggests the blame lies somewhere in the ocean.

There are many possible reasons for the decline of size and age of returning adult salmon. This trend suggests that some common factors are responsible for the consistent pattern across a broad geographic range. Pacific salmon researchers have found that changes in size and age at maturity is potentially caused by many factors:

1. people harvesting the largest fish,
2. climate and marine environmental changes, and
3. competition for food and space resources in the ocean with other salmon and marine species.

Regardless of the causes of declining size and age some of the trends toward smaller and younger fish provide insight into how this species may be responding to these changing conditions. Declines in age means smaller females are returning to spawn and smaller fish carry fewer eggs; thus, reproductive potential is greatly reduced. Larger fish also have the ability to dig larger nests, or redds, and deposit eggs

deeper into the gravel which benefits egg survival especially during cold winter months. Furthermore, there is some evidence that through genetics smaller fish tend to produce smaller fish and larger fish produce larger fish.

These trends potentially have implications for resource management. Escapement goals in Southeast Alaska are based on returns of large Chinook salmon greater than 28 inches in total length. Since 95 percent of female Chinook salmon are at least five years of age, large fish escapement goals focus on the part of the spawning population containing nearly all of the eggs and avoid smaller sized Chinook salmon which are nearly 100 percent males and far more difficult to assess. The recent trend for fewer older Chinook salmon has resulted in the majority of large fish returning after spending only three years in the ocean, instead of longer.

These are important life history changes we hope to learn more about as the Alaska Department of Fish and Game continues to develop and improve Chinook salmon research across the state. *~*

The largest Chinook on record was caught near Petersburg in a commercial fish trap in 1949; the fish weighed an astonishing 126 pounds.



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