Photo by Terry Thompson © ADF&G

SPRING 2016

Alaska Department of Fish and Game | P. O. Box 115526 | Juneau, AK 99811-5526
907.465.4100 | www.adfg.alaska.gov

Chinook Salmon Research Initiative

Ed Jones, Chinook Salmon Research Initiative Coordinator

© ADF&G.

Welcome to our second digital edition of the Chinook News, a publication of the Alaska Department of Fish and Game. This edition will highlight Chinook salmon research projects on the Susitna, Kenai, and Kuskokwim rivers and our work to understand where and when mixed stocks of Chinook salmon are harvested throughout Cook Inlet. Each of these projects received funding, derived in part, from the Chinook Salmon Research Initiative. This Initiative was designed as one of the largest and most comprehensive fisheries research programs in Alaska's history.

Alaska has hundreds of Chinook salmon stocks and is perfectly suited to study these resilient fish across a wide geographic range. But, to design a manageable statewide project, twelve Chinook stocks were chosen in 2012 as indicators of the overall health and production of Alaska's Chinook salmon. These indicator stocks provide the bulk of the state's wild Chinook salmon production and thus are vitally important to the subsistence, cultural, and economic sustainability of nearby rural and urban communities.

In total, $15 million was appropriated by the Alaska legislature, which allowed for numerous Chinook salmon research projects over the last three years. This has increased our confidence in estimates of adult spawning abundance, juvenile production and improved our understanding of stock-specific harvests in our marine fisheries.

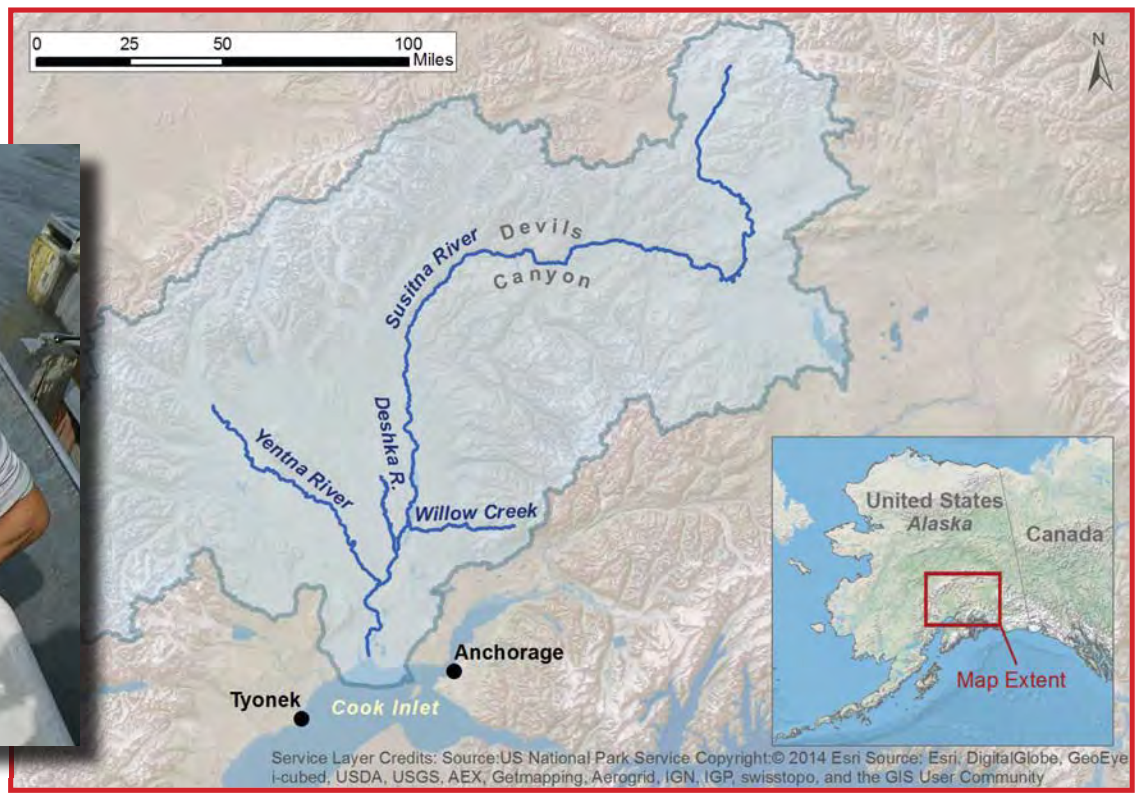
Map showing 12 indicator stocks for the Chinook Salmon Research Initiative. © ADF&G, Division of Sport Fish, Research and Technical Services.

This information ultimately strengthens our confidence in estimates of abundance allowing for more responsive management measures, meaning, when productivity allows, fishers will be afforded opportunity; and when productivity is poor, fish will be passed through to meet necessary spawning requirements to ensure sustainable salmon populations in to the future.

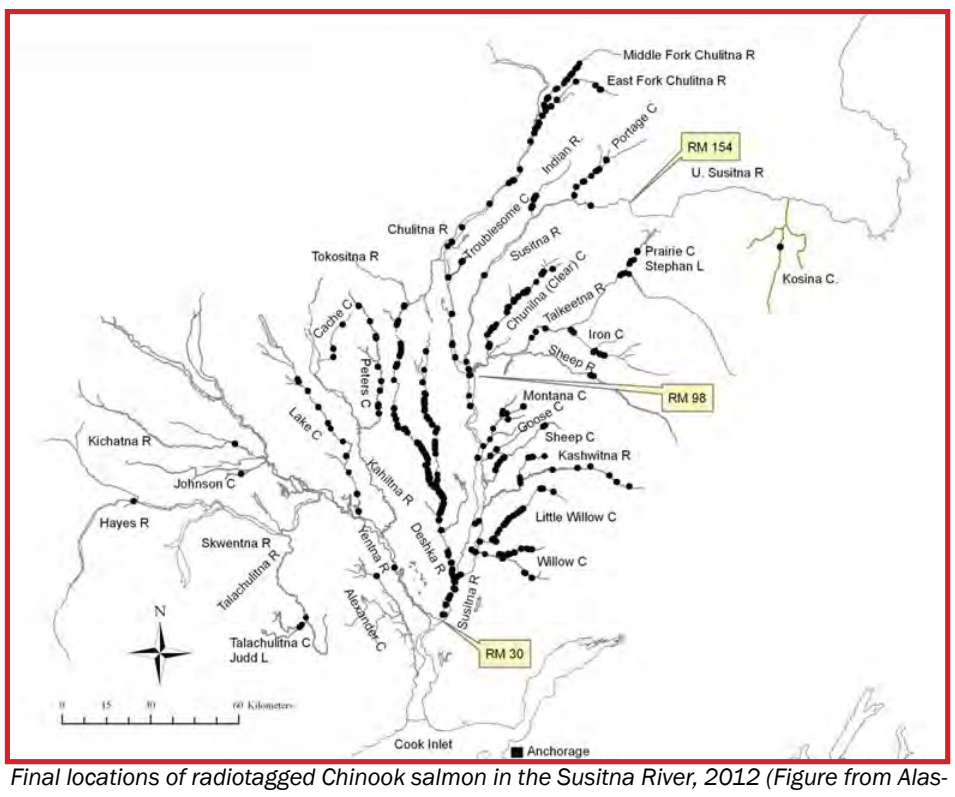
Susitna River

Richard J. Yanusz, Fishery Biologist, Division of Sport Fish

© ADF&G.



The Susitna River drainage.



Final locations of radiotagged Chinook salmon in the Susitna River, 2012 (Figure from Alaska Energy Authority). Note: RM means "river mile."

Draining into upper Cook Inlet northwest of Anchorage, the Susitna River supports a large run of Chinook salmon. A mark-recapture study in 1985 estimated about 114,000 fish spawned in the watershed. The study was repeated in 2014 indicating just over 90,000 fish spawned. Identical tagging and recapture field work was again done in 2015, and the data is currently being analyzed to produce another estimate of the Chinook salmon spawning abundance.

Currently, Chinook salmon spawning abundance in the Susitna River is evaluated each year using indices, and one index is estimated by counting fish at a weir on the Deshka River. The weir count in 2015 was within the escapement goal range for the sixth year in a row since falling below the lower end of the goal in 2008 and 2009. The other index is based on aerial counts of spawning Chinook salmon on each of a dozen clearwater tributaries throughout the Susitna drainage. All but one of the aerial counts also fell within their respective spawning goal ranges in 2015.

Radiotagging studies were also performed from 2012 to 2015 and fish were tracked using aerial surveys and spawning was documented in most major spawning tributaries. With the exception of some feasibility work in the fall of 2013, no major studies on juvenile Chinook salmon in the Susitna River have been conducted by the department. However, the Susitna-Watana hydropower studies in 2013 and 2014 for the Alaska Energy Authority included several juvenile salmon assessments (http://www.susitna-watanahydro.org/).

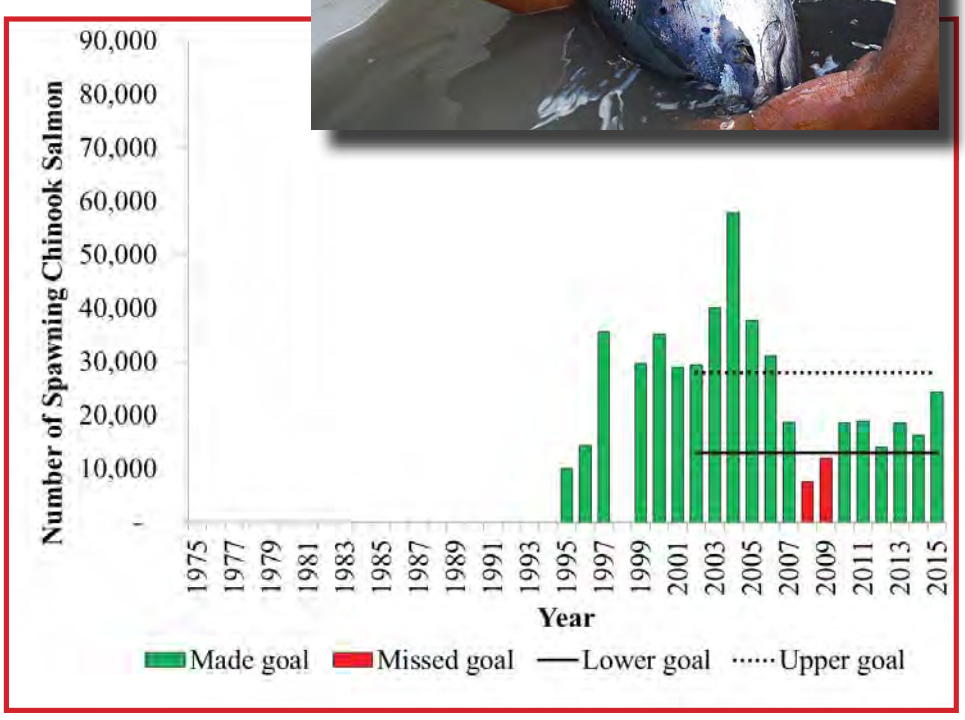
Aerial index counts in the Susitna River have been done every year since 1981. An underlying question has been just what proportion of the total spawning abundance is represented by these counts. By running concurrent mark-recapture and aerial index counts, the department plans to establish a correction factor for expanding the aerial index of spawning abundance to the total spawning abundance. In addition, historical aerial index counts will also be expanded to total spawning abundance in each year, giving a 34-year history of the actual number of spawners.

The sport harvest of Chinook salmon in the Susitna River has been estimated each year since 1979 using a mail-out questionnaire. The sport harvest can be added to the actual number of spawners in the Susitna River, as calculated above, to estimate the actual Chinook salmon run entering the river each year. Trends in the run and fishing pressure in the river can be examined from 1981 through 2017 to give a more accurate and long-term picture of changes in the Chinook salmon runs over time.

The actual number of spawners can also be compared with concurrent marine harvest studies in Cook Inlet to assess how much fishing pressure the marine fisheries are putting on Susitna River Chinook salmon. Total run will then be estimated by combining the marine commercial, sport, and subsistence harvests, inriver sport harvests, and the total spawning abundance. This will allow an analysis of the entire productivity of Susitna River Chinook salmon and potentially room for establishing spawning abundance goals for the entire drainage. Radio telemetry work sheds light on distribution and timing patterns and this information can be used to aid management when evaluating fishing regulations by area.

Portions of the Chinook salmon stock in the Susitna River have been regularly monitored for up to 36 years. The studies initiated in 2012 are new and significant additions to these long-term evaluations and generate a much more thorough and accurate understanding of the Susitna River Chinook salmon stock. Over the next two years the department plans to continue efforts to refine the relationship between aerial index counts and the actual total spawning abundance as estimated through mark-recapture and radio telemetry studies.

© ADF&G.



Counts of Chinook salmon at the Deshka River weir and the upper and lower escapement goal.

Kenai River

Tim McKinley and Tony Eskelin, Fishery Biologists, Division of Sport Fish

Effective fishery management requires accurate and timely information. As more accurate and precise information becomes available it enables more informed management decisions. For Kenai River Chinook salmon sport fisheries, managers have quite a bit of information at their disposal, obtained through years of research mostly funded by federal dollars received through the Dingell-Johnson Act and matched by state funds. Managers use this information to achieve spawning abundance goals which helps to accomplish Alaska Department of Fish and Game's mission to protect, maintain, and improve the fish resources of the state, and fits within guidance from Alaska's Constitution to manage our fisheries for sustained yields. Additional funding provided by the Chinook Salmon Research Initiative has been a "shot in the arm" to this research, allowing the department to identify harvests of Kenai Chinook salmon in Cook Inlet sport and commercial marine fisheries, as well as furthering our knowledge of spawning distribution through radio telemetry studies.

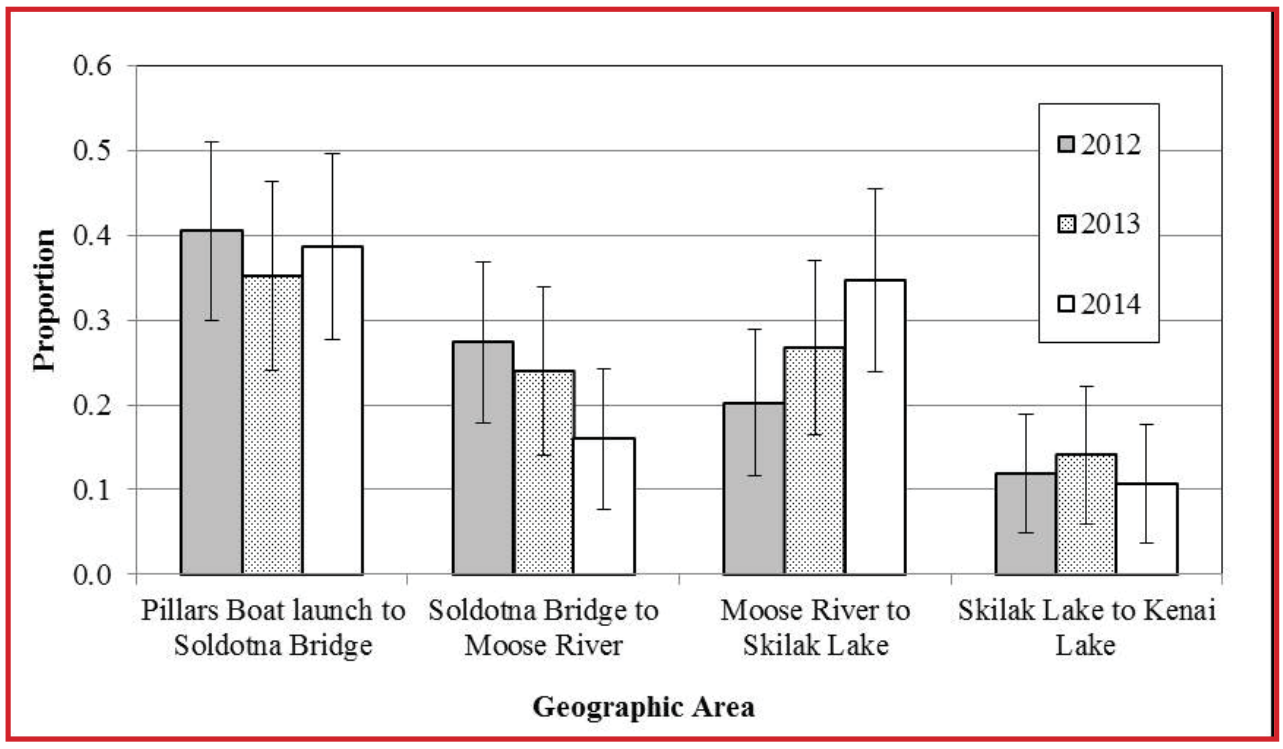
Through careful evaluation, it was found that Kenai River Chinook salmon could be counted more effectively by moving the historical sonar site, located at rivermile 9, further upstream to rivermile 14 and entirely above tidal influence. In 2015, after two years of counting fish using sonar at both locations, the decision was made to transition completely to the new upriver sonar site; however, this change prompted questions about the magnitude of sport harvest downriver of the new sonar site and the proportion of the run that spawns below the new sonar.

The ADF&G tagging crew releasing a Chinook salmon from the tagging cradle in the lower Kenai River © ADF&G.

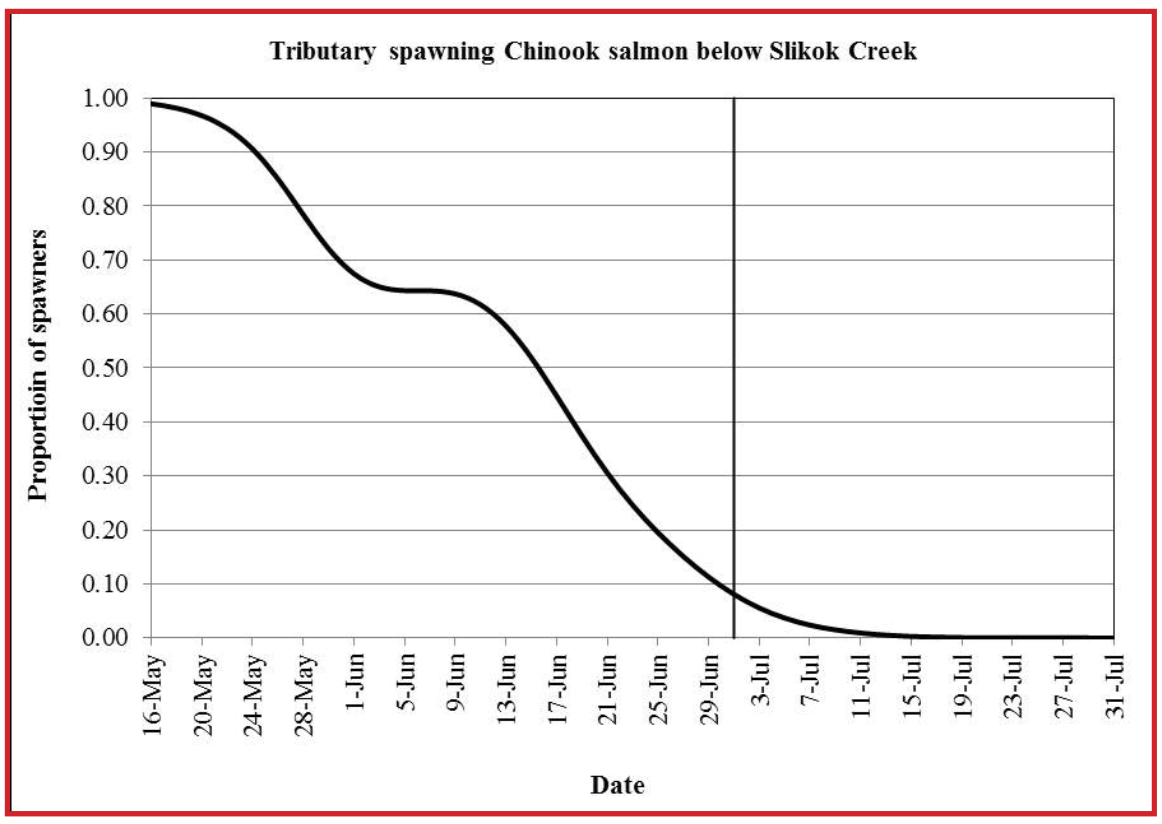
A creel survey that asked anglers questions about where in the river they harvested their fish, was used to estimate the sport harvest downstream of the new sonar site. It was found that in the late run, harvest below the new sonar site was at times over half of the total inriver harvest. As a result, a creel survey will be continued on an annual basis in order to provide accurate and timely information to aid managers in decisions about restricting or liberalizing the fishery.

Radio telemetry studies indicated that about 5 percent of the Chinook salmon run spawns downstream of the new sonar site. As a result, it was decided that estimating these numbers directly on an annual basis was not necessary and final spawning abundance and total run estimates would simply be expanded to account for this small proportion of spawners.

In the Kenai River watershed, Chinook salmon spawn above tidal influence throughout the mainstem and in many of its tributaries. Spawning distribution studies were conducted in the early 1980s and 1990s and were reinitiated in 2010. Results have shown that the largest groups of mainstem spawners are still downstream of the Soldotna Bridge as previously documented in the earlier studies. Also, the proportion of mainstem spawners by major geographic area has not changed nor has the proportion of mainstem spawners that enter the river during the early run. Also, early- and late-run mainstem spawners are distributed in the same areas.



Proportion of Kenai River mainstem spawners by geographic area, 2012 –2014.



Proportion of radiotagged tributary spawning Kenai River Chinook salmon migragion by date passing by Slikok Creek (rivermile 19), 2010 –2014.

Wing-mounted antenna used in aerial tracking © ADF&G.

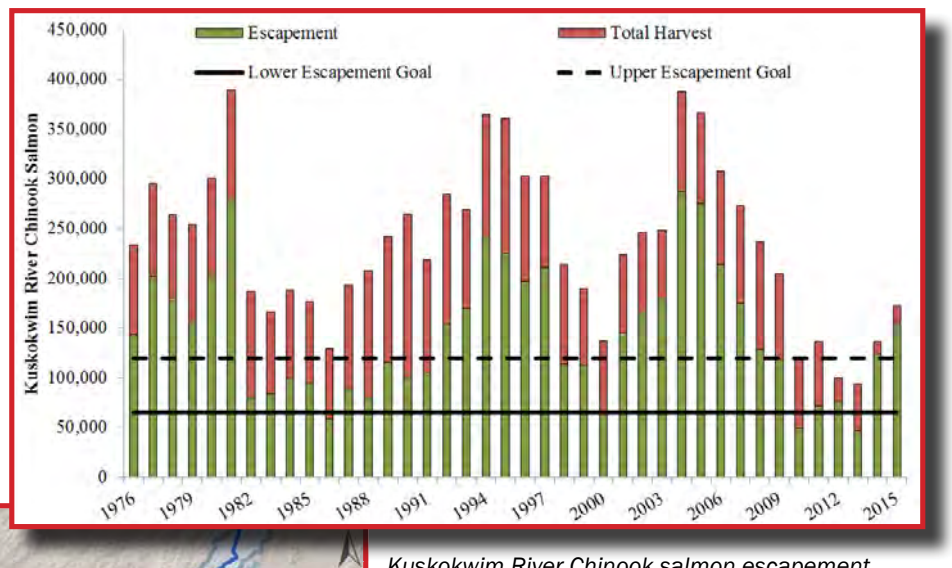
Early run Chinook salmon predominantly spawn in tributaries and in order to protect these tributary fish during the current period of poor production, managers have halted harvest of Chinook salmon in the early run in the entire drainage and in the late run upstream Slikok Creek, the lowest known Chinook salmon spawning tributary at rivermile 19.

The recent radio telemetry work has validated and refined the research performed in the early 1980s and 1990s. This has also facilitated the generation of secondary abundance estimates by incorporating counts from weirs operated by the U.S. Fish and Wildlife Service on the Funny River, Killey River, and Quartz Creek, and by Fish and Game on the Russian River. Further studies and analyses are ongoing and will provide managers with even more information to facilitate timely and effective management strategies.

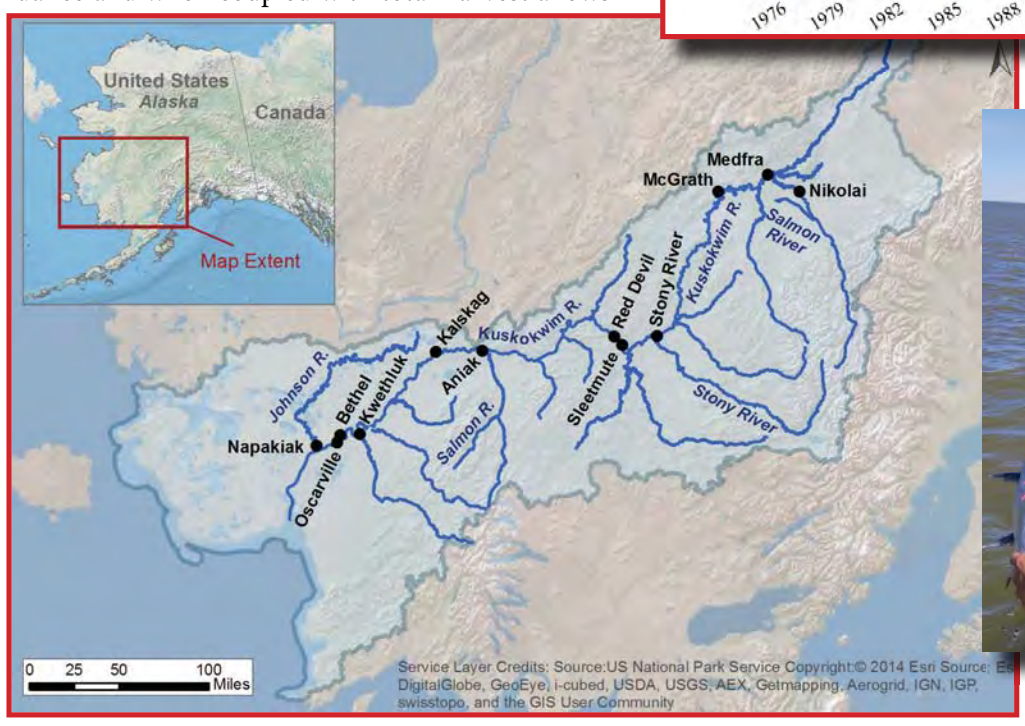
Abundance of Adult Kuskokwim River Chinook Salmon

Zachary Liller, Fishery Biologist, Division of Commercial Fisheries

The Kuskokwim River is the largest subsistence Chinook salmon fishery in the state of Alaska and when coupled with commercial fisheries, on average 89,000 fish have been harvested each year since 1976. Subsistence harvest is estimated annually through an extensive house-hold survey program and commercial harvest is reported to the Alaska Department of Fish and Game using a fish ticket program. Reliable estimates of Chinook salmon abundance are critical for the sound management of these important fisheries and the department uses a statistical model to determine how many Chinook salmon come back to the Kuskokwim River each year. Like many good measuring devices, the model needs to be calibrated from time to time. In 2014 and 2015, the Chinook Salmon Research Initiative has funded mark-recapture studies to estimate total spawning abundance and when coupled with total harvest allows for total run enumeration.



Kuskokwim River Chinook salmon escapement.



Kuskokwim River watershed.

Releasing a tagged Chinook salmon into the Kuskokwim River. © ADF&G. Photo by Terry Thompson.

This research confirmed that the statistical model represented the relative changes in Kuskokwim River Chinook salmon abundance, and although total abundance in both 2014 and 2015 was well below average, drainage-wide spawning abundance goals were achieved due to conservative management actions and sacrifices by local residents.

The run in 2015 was particularly encouraging, being the largest since 2010 when five consecutive years of record low runs began. The 2015 run was actually 22 percent larger than the 2014 run size and nearly double that seen in 2013. Moreover, a relatively large percentage of the 2015 run was made up of young Chinook salmon or "jacks," which is often a good sign of a strong age class and bodes well for future runs. The 2015 run was even large enough to support some local fisheries, and if runs continue to improve, area residents will ultimately see increased harvest opportunities, vital to meet basic subsistence needs. These results are being shared with State, Federal, and local stakeholder advisory groups to assist with preseason planning for the 2016 season and development of appropriate management strategies.

This research also provided a unique opportunity to monitor Chinook salmon spawning distribution during two years of very low harvest. During these two years, an unprecedented proportion of the total spawning abundance was found in headwater tributaries, far upriver from the community of McGrath which sits 475 miles from the river mouth. As a result, a brand new fish weir was funded through the Chinook Salmon Research Initiative and installed on one of the more prolific headwater tributaries. Operation of this weir is a cooperative venture with MTNT Limited, an Alaska Native Corporation representing the communities of McGrath, Takotna, Nikolai, and Telida, the Alaska Department of Fish and Game, and the US Fish and Wildlife Service. This new project received wide-spread support from local communities and recently was approved for funding by the US Fish and Wildlife Service through 2019. Operating this project for a few years will allow the department to "ground truth" the aerial salmon monitoring program conducted throughout the headwaters of the Kuskokwim River.

This research provided the first extensive dataset for describing when and how fast Chinook salmon travel through the lower Kuskokwim River, the area where most harvest takes place. The long-standing assumption that fish bound for the headwater tributaries are usually the first to hit the river was backed up by this work. However, research also showed that fish spawning in the lower reaches of the drainage were just as common early as they were late. This work also showed that Chinook salmon took their time traveling through the lower portions of the Kuskokwim River and sped up as they progressed further upriver. This improved understanding of movement characteristics will allow fisheries managers to make more informed decisions about the timing and duration of harvest opportunities.

The next steps in this research are to complete the final year of abundance estimation in 2016 and transition into a full review of the statistical model's performance. A collaborative review is planned to begin in the fall of 2016 and the review team will include staff from Department of Fish and Game and the US Fish and Wildlife Service with input from biologists representing Tribal non-governmental organizations, and colleges and universities. The timing of this review will coincide with the escapement goal review process for the 2019 Alaska Board of Fisheries meeting on Kuskokwim Area finfish. Review results will be available to the public through news releases, the department website, and publication series.

Radio tag insertion. © ADF&G. Photo by Terry Thompson.

Mark-recapture research for population estimation

How many fish are there? Fisheries managers must make sure that adequate numbers of spawning adults return to sustain salmon production. But how do you tell how many adults escaped or how many juveniles were produced or hatched? For many stocks, returning adults are counted using a weir or sonar, but sometimes these methods are not possible or practical. In these cases, the tool of choice is often the "mark-recapture" technique.

Very simply, a mark-recapture project works like this:

To begin, you need to define the population of interest. For instance, it could be the spawning population in the Taku River or the number of juvenile salmon leaving the system to rear in the ocean. You must then sample the population and mark as many individuals as possible. In doing so, you need to try and capture fish that are representative of the entire population. This is often referred to as the "marking event." Marks can be as simple as finclips, but they can also include tags such as radio tags, coded wire tags, or spaghetti tags, just to name a few.

Next, the marked fish are released and allowed to thoroughly mix with unmarked fish.

After mixing, you must then recapture some of these marked fish by sampling the population again and looking for the presence and absence of marks. This is often called the "recapture event." If a large enough fraction of the population was marked, you will recapture some marked fish.

Finally, you can estimate the total population abundance with some very simple math. For instance, if you marked 1,000 fish in the marking event and then sampled 1,000 fish in the recapture event and found that 100 were marked (10%), then because you know the percentages of marked fish must remain the same between the two events, the total population abundance must be 10,000 (1,000 x 1,000/100). Although presented simply here, mark-recapture research is often more complex.

Marine Sampling in Cook Inlet

Barbi Failor, Tony Eskelin, and Adam St. Saviour, Fishery Biologists, Division of Sport Fish

Chinook salmon returning to rivers in Southcentral Alaska are harvested in several Cook Inlet marine and freshwater fisheries, and in particular, interest has increased on identifying harvests of Kenai and Susitna river stocks in the mixed stock marine fisheries. Each year, sonar and mark-recapture studies are used in the Kenai and Susitna rivers, respectively, to estimate inriver abundance. After accounting for inriver harvests, total spawning abundance is estimated. And when inriver abundance is combined with estimates of marine harvest, total run size is then identified. Estimates of stock-specific harvest in marine fisheries can be challenging to determine yet recent advances in genetic stock identification techniques coupled with the development of a genetic baseline for Cook Inlet Chinook salmon has facilitated the discrimination of the various Chinook salmon stocks in the mixed stock fisheries.

Cook Inlet Marine Sport Harvest Sampling

During the summer, department staff are stationed at each of the major fishing access points on the lower Kenai Peninsula where returning sport anglers are interviewed about their trip and biological samples are collected from harvested Chinook salmon. Staff measure the length of each fish, collect scales for age analysis, and take genetic tissues for stock identification. In addition, heads are collected from any fish missing an adipose fin, a mark indicating the fish may have been released from a hatchery or captured and tagged in a wild stock tagging study. All of these heads are later examined for the presence of a coded wire tag which has information that can identify when and where the fish was tagged and released as a juvenile.

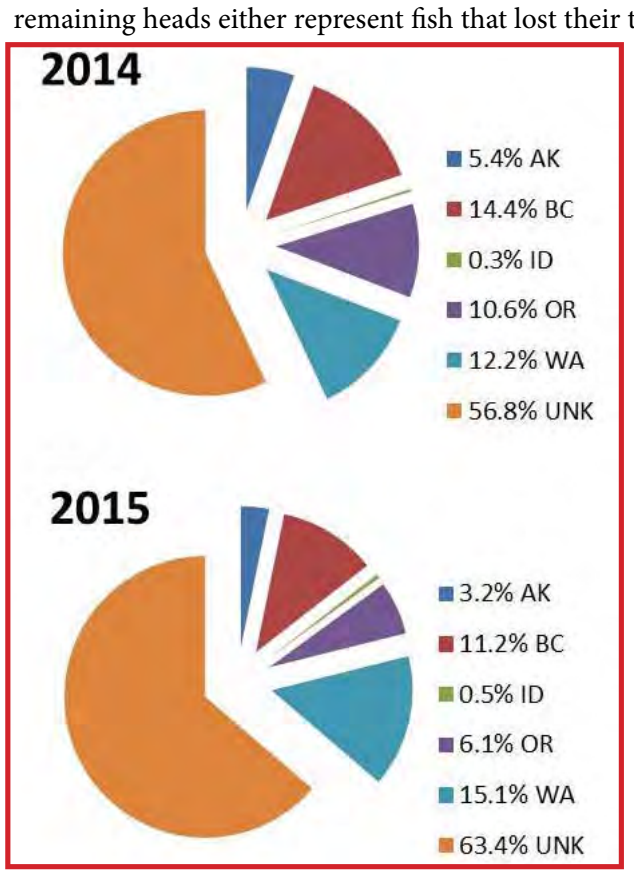
Genetic tissues collected in 2014 and 2015 are currently being analyzed. In the meantime, some interesting results are available regarding the heads collected from fish missing their adipose fins. In 2014 and 2015, 368 and 847 heads were collected, respectively, representing approximately 15 percent of the fish sampled by staff in both years, and of these fish, 7 percent contained coded wire tags. The remaining heads either represent fish that lost their tags, were naturally missing their adipose fin, or most likely, represent fish that were released from hatcheries with adipose fin clips but not tagged with coded wire tags as part of a mass-marking release. Such releases occur in just a handful of areas along the coast, Cook Inlet being one of them, the other being the Columbia River. Once the genetic analyses are complete, a more thorough understanding of the stock composition of the entire sample will be known.

Scale sample. © ADF&G. Photo by Terry Thompson.

Between 2014 and 2015, the Cook Inlet marine sport harvest sampling program was able to conduct over 3,700 angler interviews encompassing over 15,700 angler-days of fishing. Over 7,000 sport-harvested Chinook salmon were sampled for biological information and genetic samples collected through December 2015. Results will contribute to improved estimates of stock-specific harvests for Kenai and Susitna river Chinook salmon.

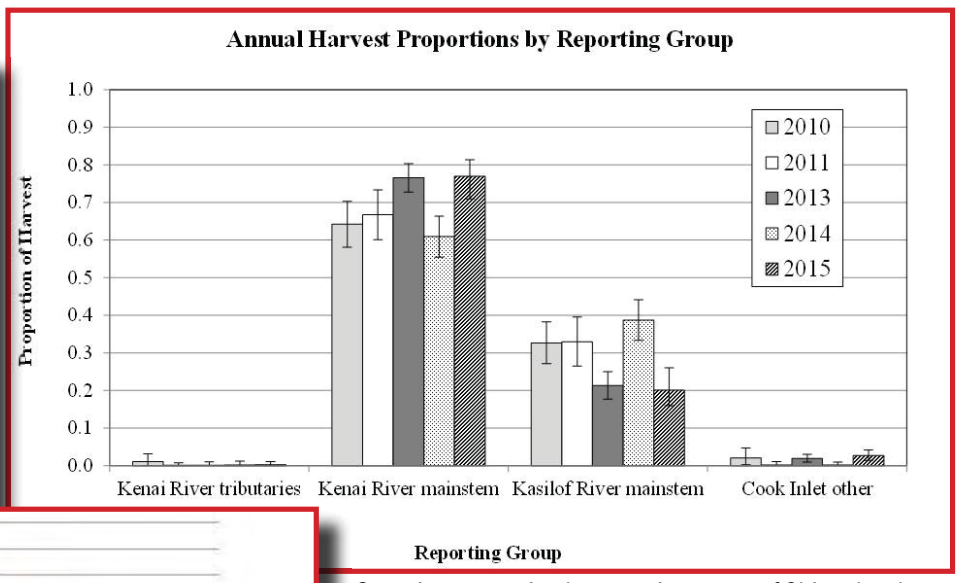
Marine Commercial Sampling–Eastside Set Gillnet

The Eastside set gillnet fishery, located along the eastern shore of Cook Inlet between Ninilchik and Boulder Point, harvests the majority of Chinook salmon caught in the Cook Inlet commercial fishery. In 2015, nearly 7,800 fish were harvested, which was below the historical average of approximately 9,400 fish, but higher than the recent five year average of nearly 4,300 fish. The Eastside set gillnet fishery has been sampled for age, sex, and length composition since 1987 and for genetics since 2010. There are five years of genetic-based estimates characterizing the stock composition of the harvest separated by four geographic reporting groups: "Kenai River mainstem", "Kenai River tributaries", "Kasilof River mainstem", and "Cook Inlet other". Since 2010, Kenai River mainstem fish have composed on average 69 percent of the commercial harvest, while Kasilof River mainstem fish have made up nearly all of the remainder, averaging 29 percent. Harvest of fish within the "Kenai River tributaries" and "Cook Inlet other" reporting groups have composed a very small fraction of the harvest, with a combined maximum of 3 percent of the harvest in any year.

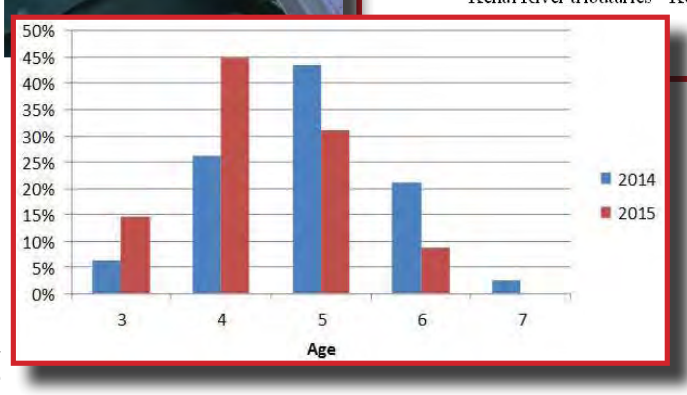


Coded wire tag rates and origin of release for adipose fin-clipped Chinook salmon sampled in the Cook Inlet marine sport fishery, 2014–2015. Note: AK = Alaska, BC = British Columbia, ID = Idaho, OR = Oregon, WA = Washington, UNK = unknown.

© ADF&G. Photo by Terry Thompson.



Genetic compostion by reporting group of Chinook salmon harvested in the Eastside set gillnet fishery, 2010–2015.



Age composition of Chinook salmon harvest in North Cook Inlet marine fisheries, 2014–2015.

North Cook Inlet Sampling–Northern District Set Gillnet and Tyonek Subsistence

The Northern Cook Inlet Chinook salmon marine harvest stock composition study will enter the third year of data collection in 2016. Its primary purpose is to estimate the stock-specific harvests of Chinook salmon from the Tyonek subsistence fishery and the Upper Cook Inlet Northern District commercial set gillnet fishery to improve understanding of stock productivity. Chinook salmon harvested in these fisheries are sampled at ports, processors, and on the fishing grounds for genetic tissue, scales for aging, sex, length, and coded wire tags. Following the 2016 field season, genetic mixed stock analysis techniques will be used to estimate the proportion and number of Chinook salmon harvested in these fisheries by reporting group (Upper Cook Inlet Northwest, Susitna-Matanuska, Knik-Turnagain, and Kenai Peninsula) for harvest timing and location and age, sex, and length compositions of the harvests will also estimated.

To achieve reliable stock composition estimates, the target sampling rate is 70 percent of the Chinook salmon harvested in the Northern District and 40 percent in the Tyonek subsistence fishery. In 2014, crews were able to sample 55 percent of the nearly 1,400 Chinook salmon harvested in the Northern District and 28 percent of the estimated Tyonek subsistence harvest of just over 700 fish. In 2015, crews were able to sample 73 percent of nearly 1,500 Chinook salmon harvested in the Northern District and 47 percent of the estimated Tyonek subsistence harvest of 745 fish.

Age and sex composition estimates in 2014 and 2015 indicated that 48 and 40 percent, respectively, of the Chinook salmon harvest was female. The dominant age class in 2014 was five year old fish, which has lived three years in the saltwater, and in 2015, the catch was dominated by four year old fish. These age and sex composition estimates were similar to those seen at weirs in the North Cook Inlet Management Area.