CHINOOK NEWS

Photo by Terry Thompson © ADF&G

SPRING 2016

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WE WANT YOUR FEEDBACK!

PLEASE SEND COMMENTS OR QUESTIONS TO

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Contents

Welcome to Chinook News

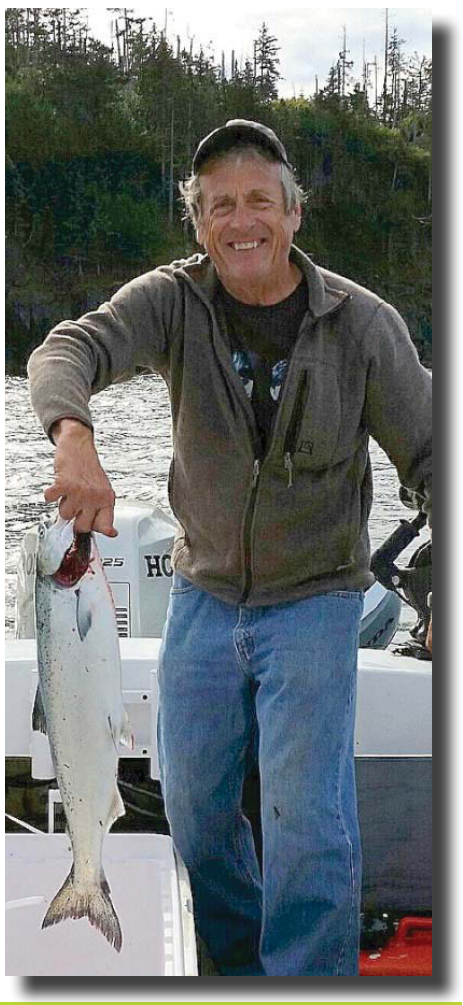
Welcome to volume three of *Chinook News*. This paper gives a sense of what the Alaska Department of Fish and Game (ADF&G) has been doing with Chinook salmon research over the past year. Published by the department, our goal is to keep you informed of Chinook Salmon Research Initiative projects funded by the Alaska Legislature.

In this edition, we'll take a look at several of the Chinook salmon indicator stocks around the state. 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.

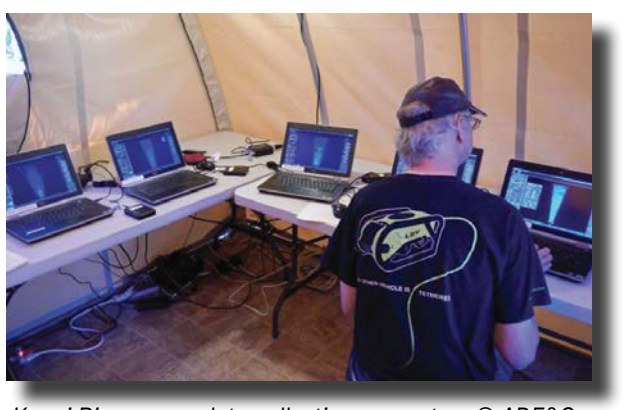
While this will be the last year of the work funded by the Chinook Salmon Research Initiative, the department remains committed to the long term health and sustainable management of all of our fisheries resources.

Please take a few minutes to read about these critically important research projects, and be sure to share this publication with your friends and family.

Sincerely,



Susitna River Chinook salmon © ADF&G.



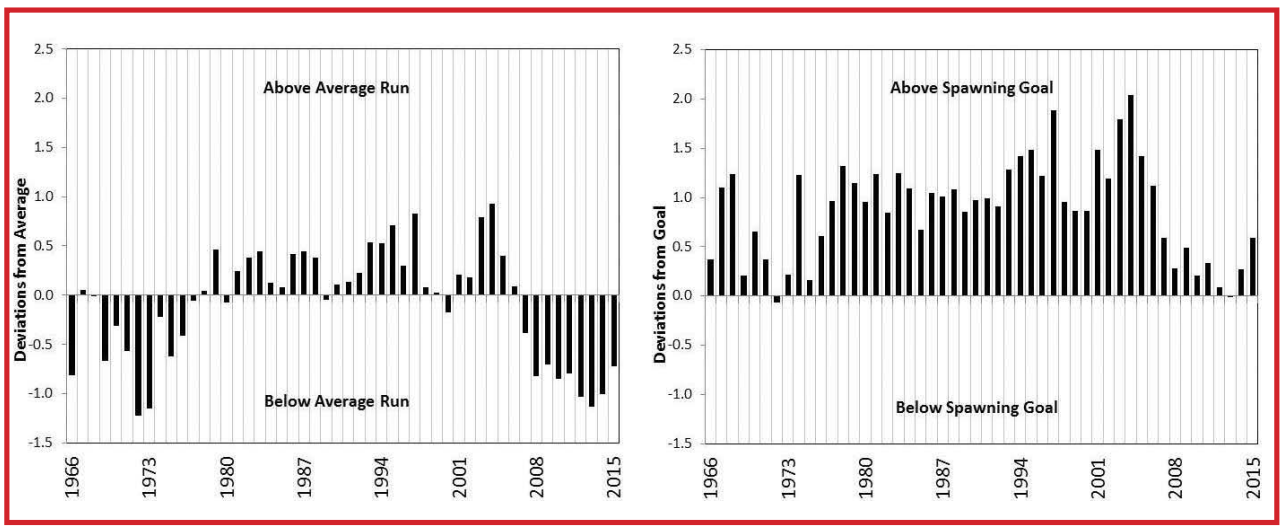
Kenai River sonar data collection computers © ADF&G.

Alaska's Chinook Production

Ed Jones, Chinook Salmon Research Initiative Coordinator

For nearly a decade now, Alaskans have been scratching their heads, baffled by a lack of Chinook salmon. Fluctuations in abundance are normal but the recent downturn in productivity seen from essentially northern British Columbia all the way to the Yukon River has been unprecedented.

In Alaska it all began in 2007 and since that time managers have had their hands full trying to achieve spawning goals. And goals are very important. Years of study have shown that too few, and ironically, too many spawning Chinook salmon can be detrimental to future production. During big years, sport anglers, commercial fishers, and subsistence harvesters all reap the benefit of surplus production; however, in periods of poor production, managers often have to curtail or even close fisheries to pass enough fish to the spawning grounds to maintain adequate levels of spawning abundance. And these management decisions are not easy, having potential social and economic impacts, but they are vital to the health of fish stocks and future generations to come.

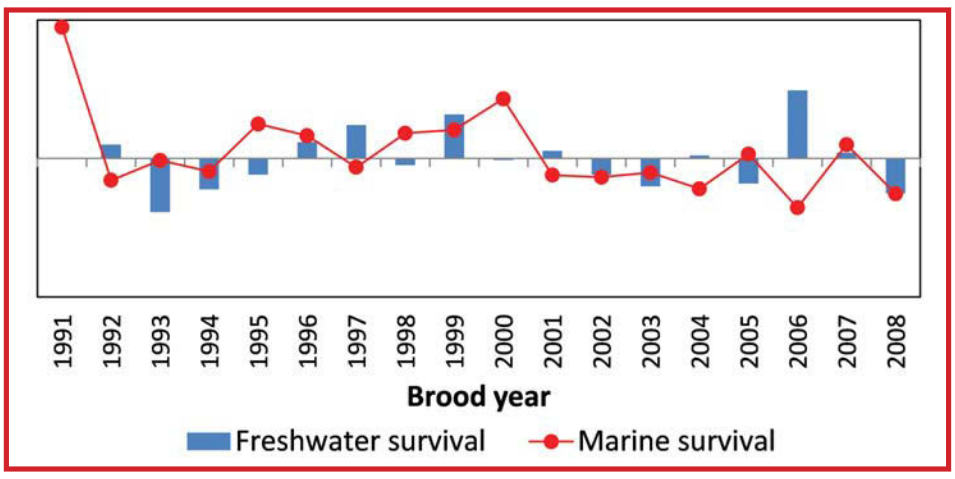


On the left, average run abundance of 21 stocks of Chinook salmon in Alaska; on the right, average spawning abundance relative to the spawning goal for each of these systems.

Alaska has seen dramatic cycles in runs of Chinook salmon and since statehood there have been two distinct and lengthy periods of poor production. Even so, managers did outstanding jobs of attaining spawning goals during these times and now there appears to be some glimmer of light at the end of the tunnel! Throughout the state in 2015, runs of Chinook salmon were dominated by five year old fish, production originating off of the 2010 spawning event. On top of that, there were lots of four year old "jacks," a good signal that the next age class was also doing well. Nothing is definitive, but it has been nearly a decade since Alaska has seen decent Chinook salmon production and perhaps this is the start of good things to come.

The knowledge scientists have of production is pretty much limited to the freshwater environment. The big unknown is what happens once fish migrate to sea as smolt. In Southeast Alaska the department operates four projects that, among other things, estimate the number of smolt leaving the system each year. This research suggests the current poor production does not stem from the freshwater environment but is due to poor marine survival. In fact, freshwater production has been about average in recent years, but for whatever reason, fish have died at excessive rates after entering the ocean.

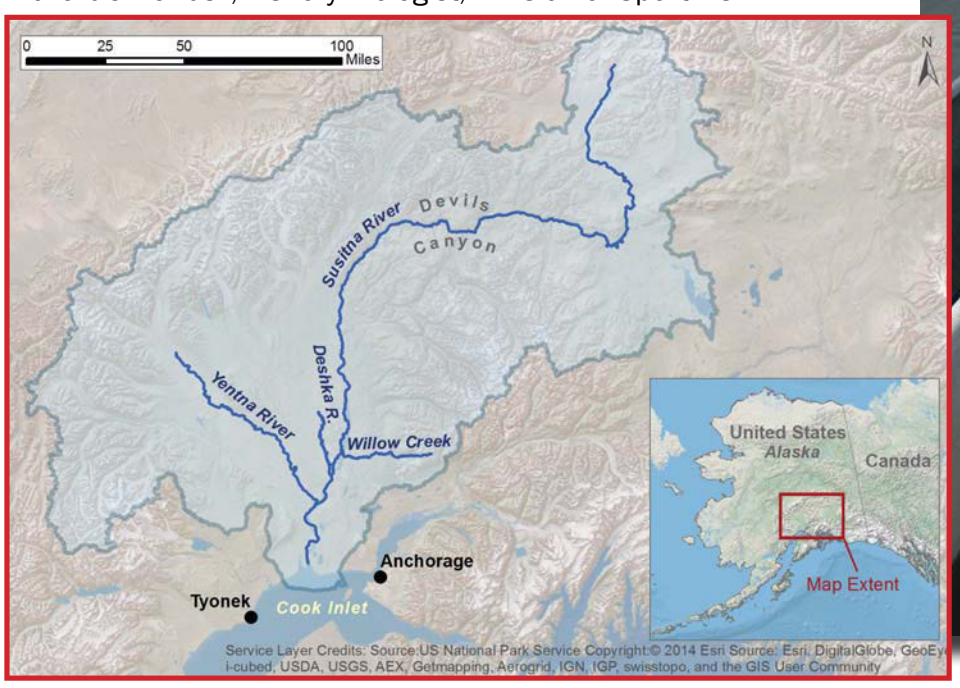
I have always said there are two main ingredients in any good recipe for Chinook salmon production, one being adequate spawning abundance and the other being good marine survival. Management has taken care of the first ingredient by ensuring adequate spawning abundances over time, as for the second ingredient, improved marine survival, well that is up to Mother Nature!



Average freshwater and marine survivals of Chinook salmon from the Chilkat, Taku, Stikine, and Unuk rivers in Southeast Alaska.

Susitna River

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



The Susitna River drainage.

Susitna River Chinook salmon © ADF&G.

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 are 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 what proportion of the total spawning abundance is represented by these counts. By running concurrent mark-recapture and aerial index

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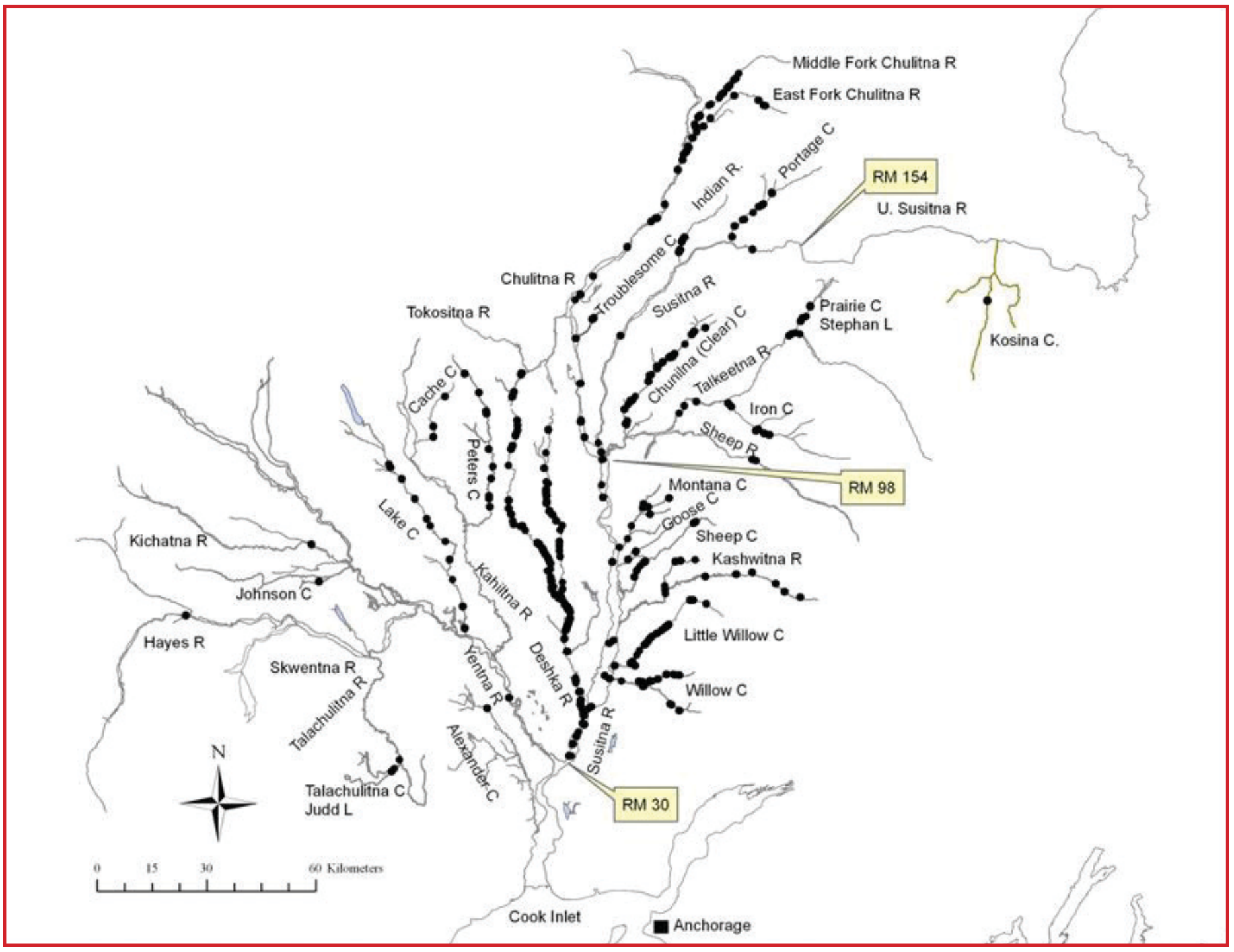
SUSITNA RIVER *(continued from page 2)*



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

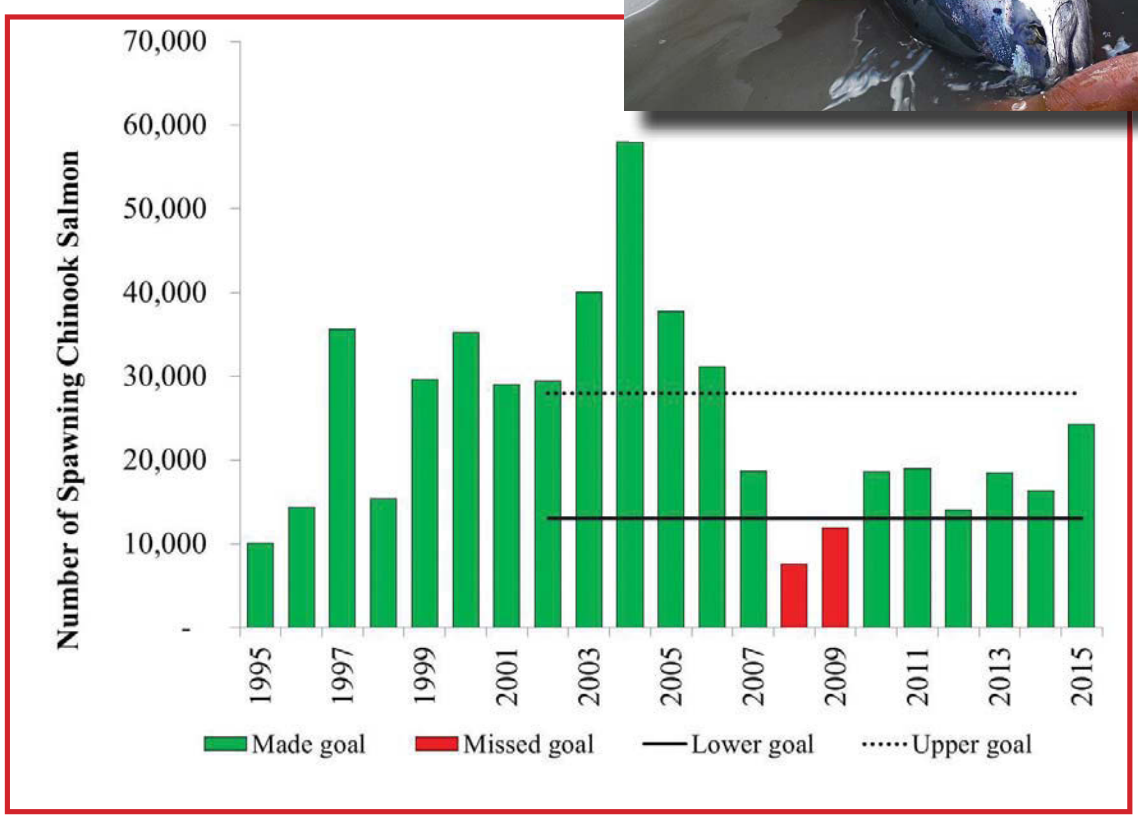
counts, the department plans to establish a correction factor for expanding the aerial index of spawning abundance to the total spawning abundance. In addition, historical aerial index counts will also be expanded to total spawning abundance in each year, giving a 34-year history of the actual number 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 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.

Marking a Chinook salmon © ADF&G.

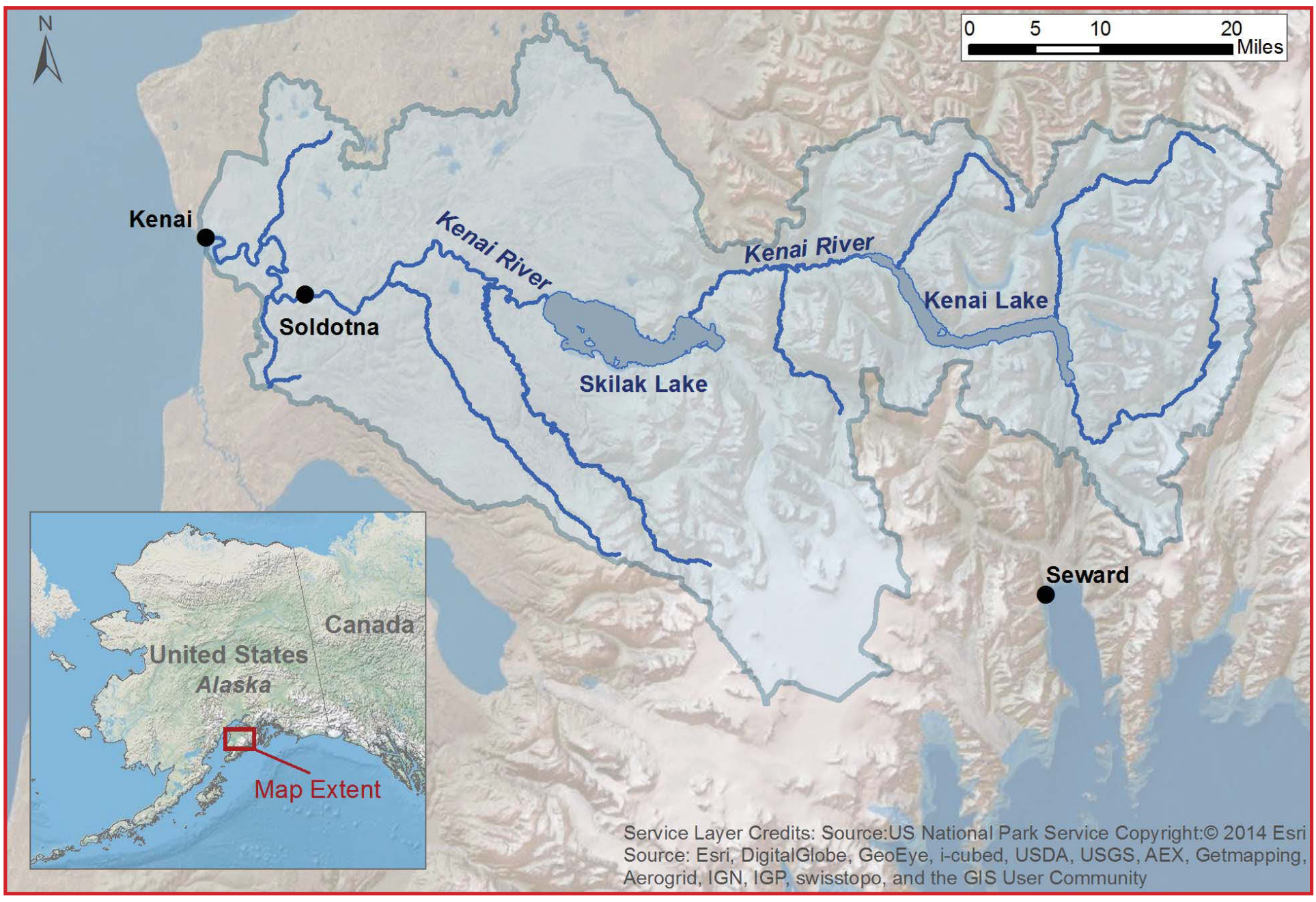


Counts of Chinook salmon at the Deshka River weir 1995 to present.

Kenai River

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

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



The Kenai River drainage.

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.

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 geo-

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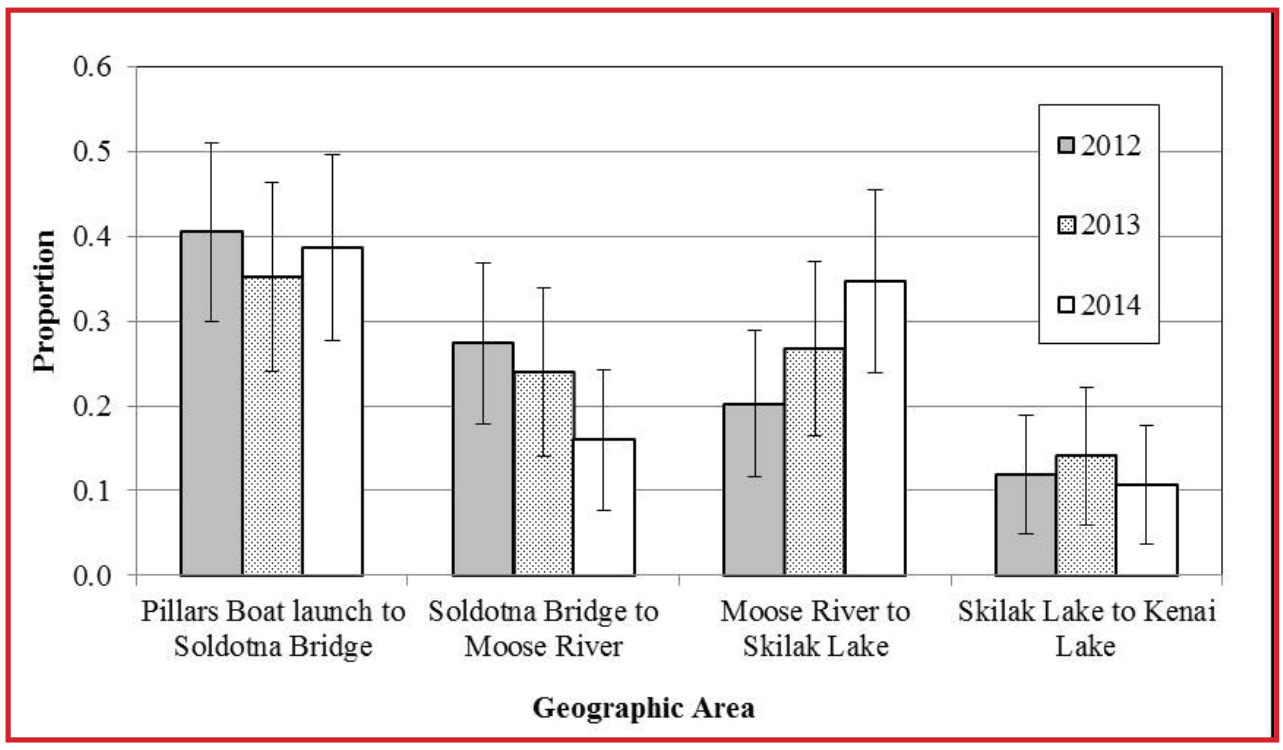
KENAI RIVER *(continued from page 4)*

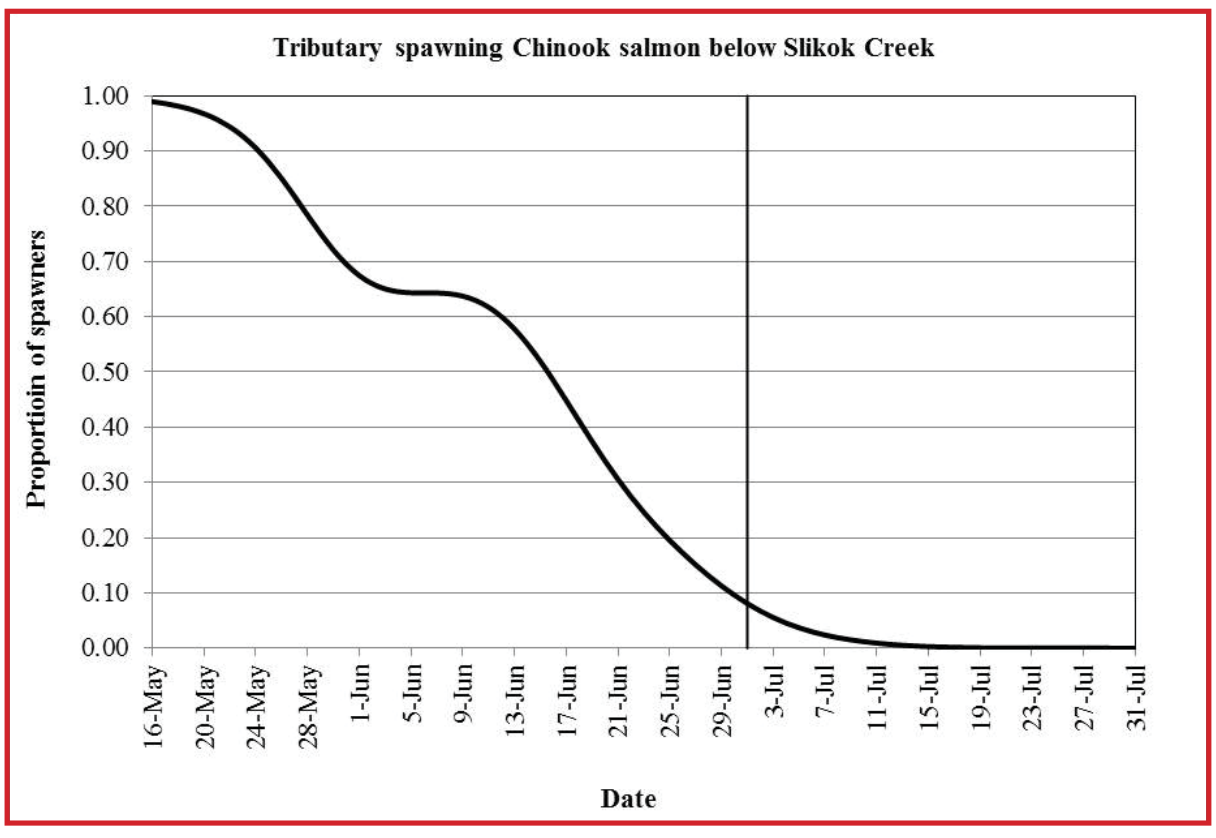
graphic area has not changed nor has the proportion of mainstem spawners that enter the river during the early run. Also, early- and late-run mainstem spawners are distributed in the same areas.

Early run Chinook salmon predominantly spawn in tributaries. 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 of 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.



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.

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. Since 1976, on average 89,000 fish have been harvested from commercial and subsistence fisheries each year. 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 funded mark-recapture studies to estimate total spawning abundance and when coupled with total harvest allows for total run enumeration.

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

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

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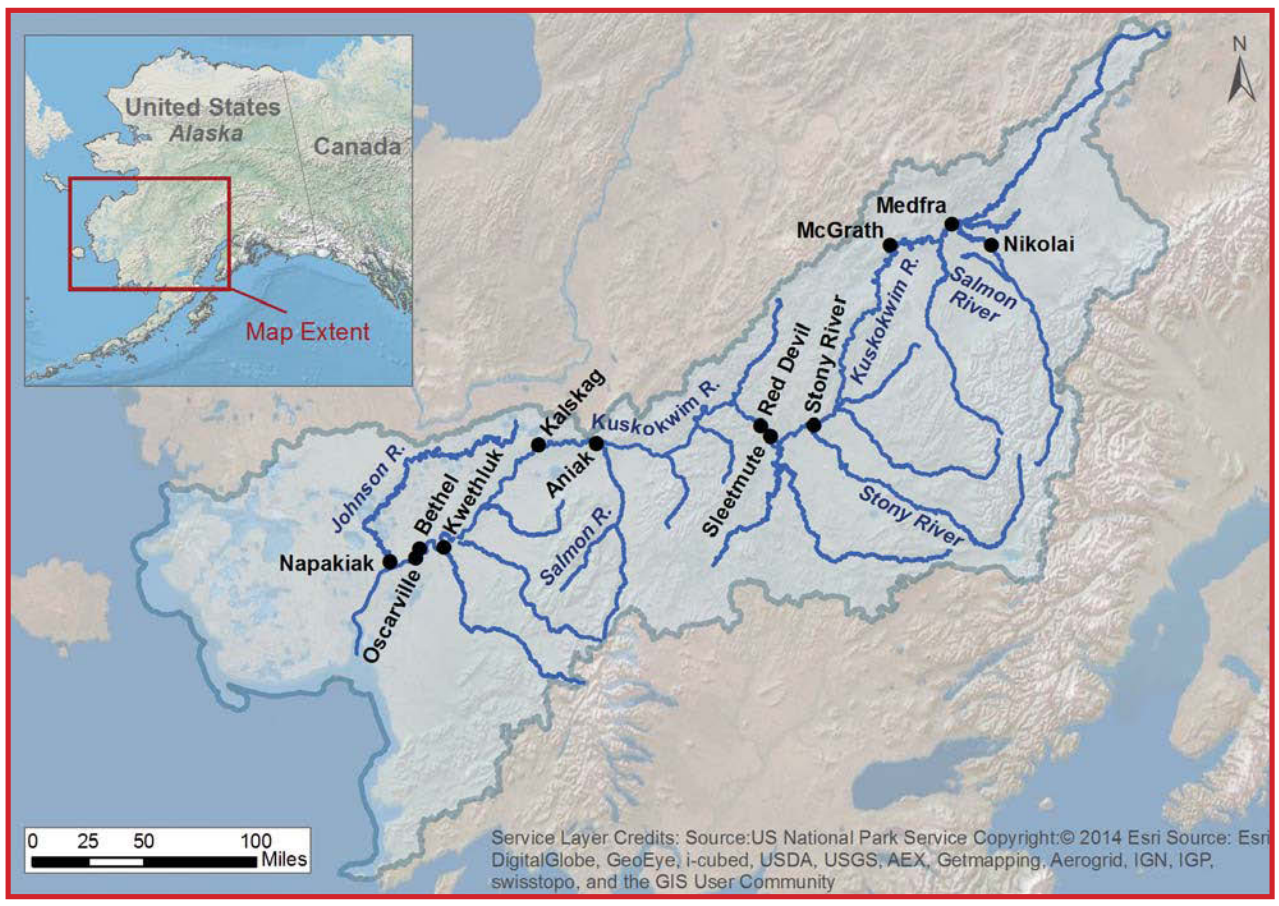
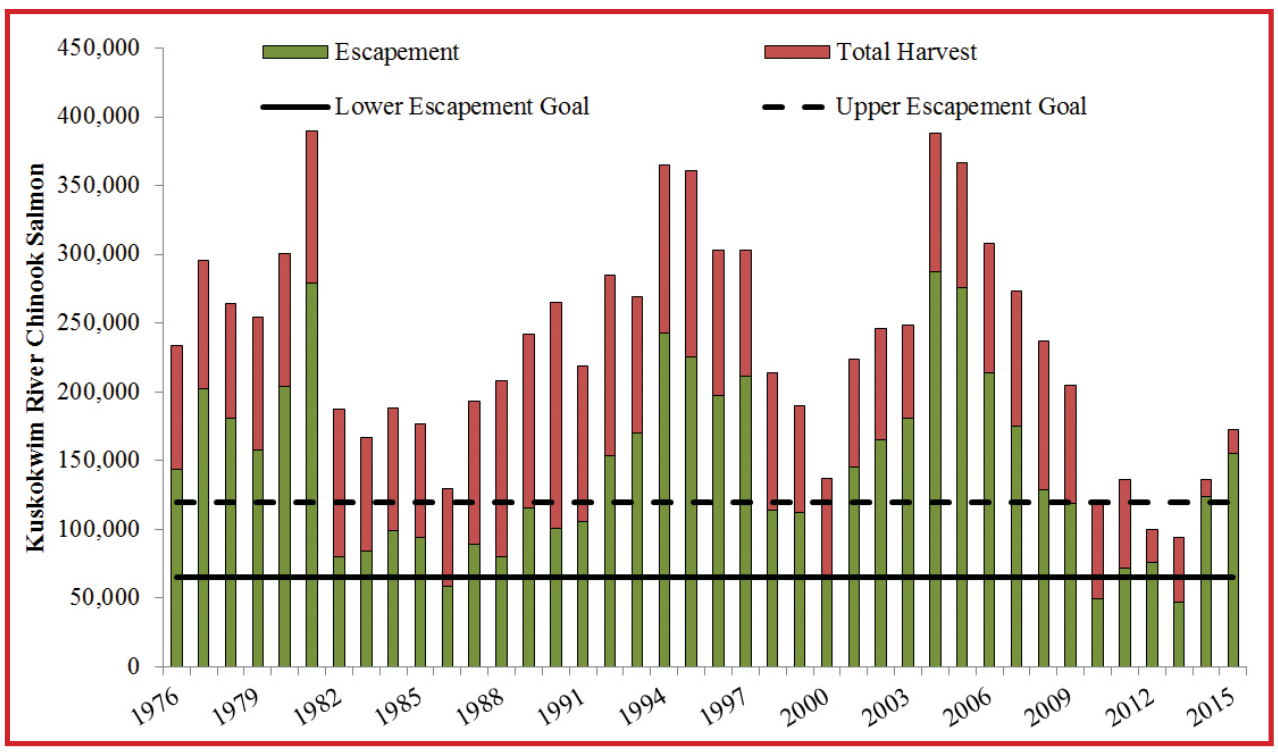
ABUNDANCE OF ADULT KUSKOKWIM RIVER CHINOOK SALMON *(continued from page 5)*

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.



Kuskokwim River watershed.



Kuskokwim River Chinook salmon escapement and harvest, 1976 to present.

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.

Netting for Chinook salmon on the Kuskokwim River © ADF&G. Photo by Terry Thompson.

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.

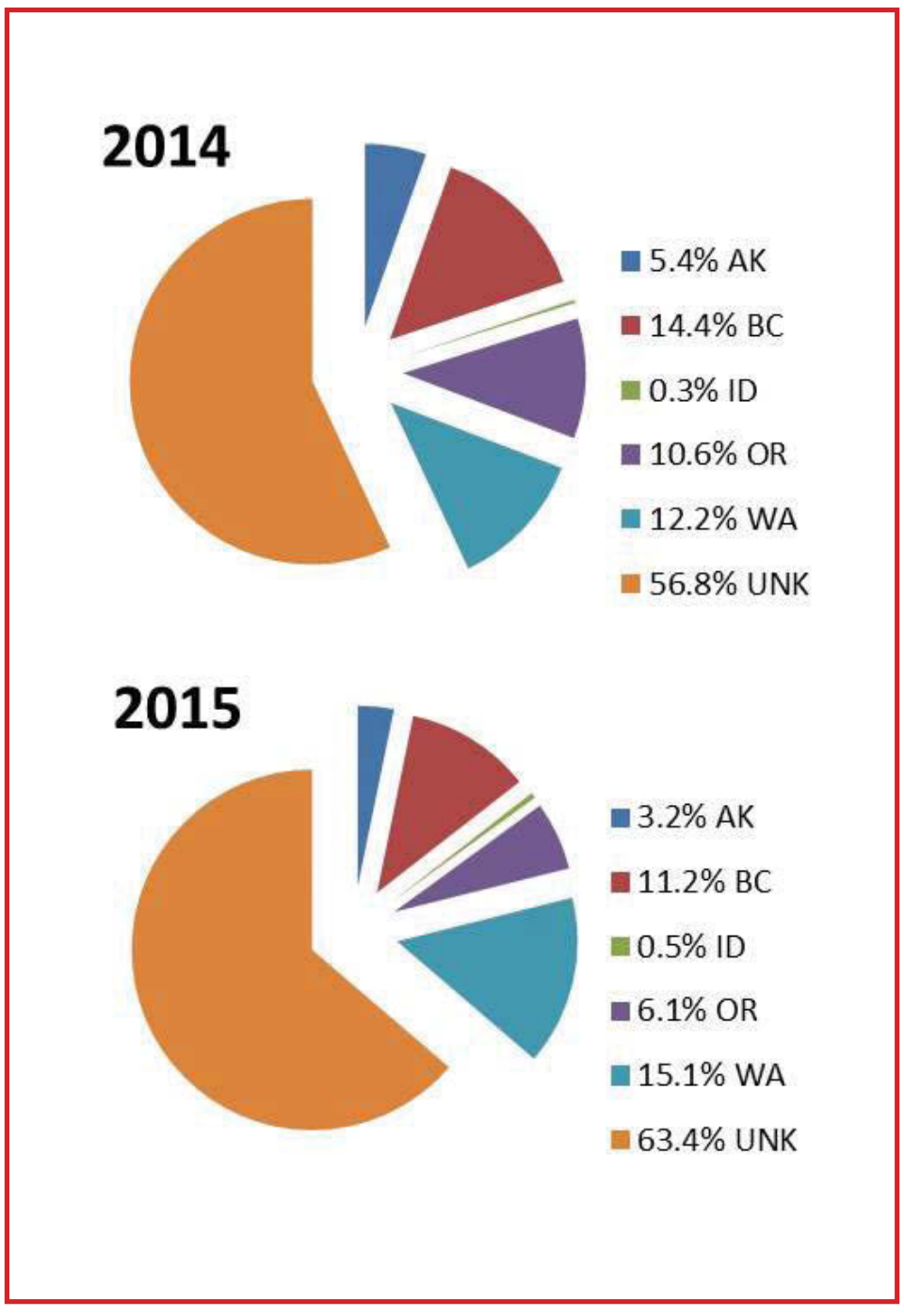
Cook Inlet Marine Sport Harvest Sampling

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.



Origin of release for adipose finclipped 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.

Axillary fin sample. © ADF&G. Photo by Terry Thompson.

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.

The commercial harvest from the Kenai and East Foreland sections has been over 95 percent Kenai River mainstem fish. Results from the Kasilof section have been more variable with Kenai River mainstem fish making up between 50 and

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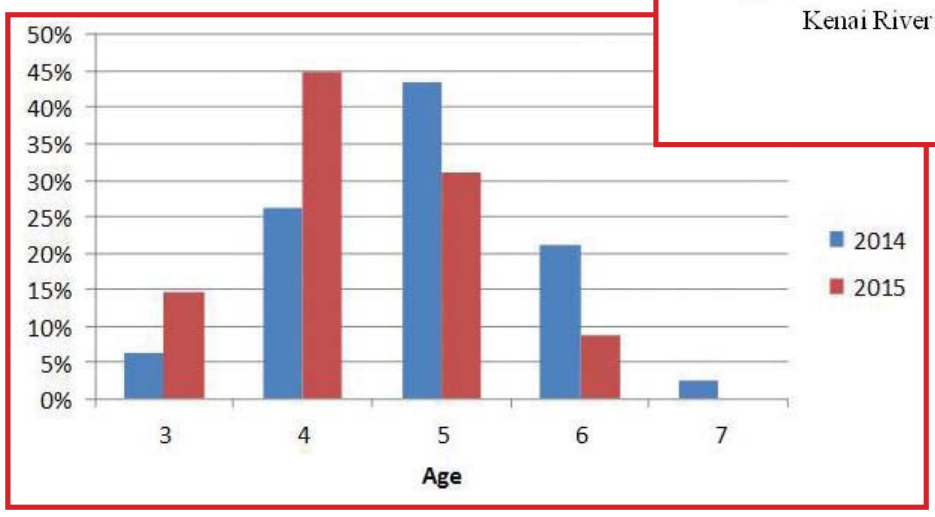
MARINE SAMPLING IN COOK INLET *(continued from page 7)*

75 percent of the harvest. For the first time in 2015, several Kasilof section openings were restricted to within 600 feet of the mean high tide line and results showed a lower percentage of Kenai River mainstem fish than in unrestricted Kasilof section openings. Those results will be useful to managers in developing management strategies.

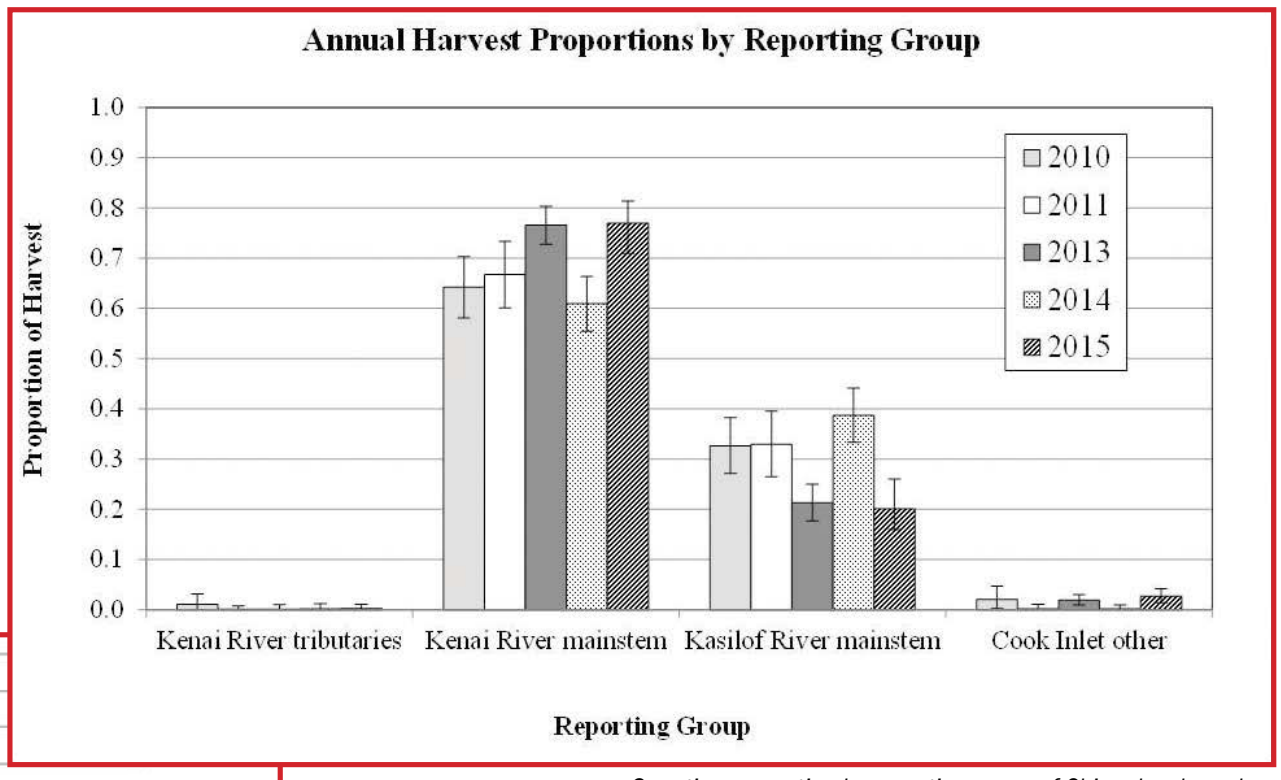
North Cook Inlet Sampling–Northern District Set Gillnet and Tyonek Subsistence

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.



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

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.



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

Measuring the length of a Chinook salmon © ADF&G. Photo by Terry Thompson.

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 that have 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.

Nushagak River Chinook Salmon Research

Charles Brazil, Fishery Biologist, Division of Commercial Fisheries

The Nushagak River, located in Southwestern Alaska, flows over 200 miles from its headwaters into Bristol Bay near Dillingham. The Nushagak drainage has two main tributaries: the Nuyakuk River, draining Tikchik lakes from the west; and the Mulchatna River, flowing into the Nushagak River from the east. The Nushagak supports one of the largest wild runs of Chinook salmon in the world and these fish are important to the local subsistence, commercial, and sport users. Total run has ranged between 90,000 and 500,000 fish since 1975. Total harvest has averaged about 75,000 fish and fluctuated from 25,000 to 200,000 during the same time period. Harvest rates are viewed as healthy, averaging about 30 percent with a high of 60 percent. Historically, out of the ten lowest total runs, seven of those have occurred since 2007, but the spawning goal has always been achieved, regardless.

In the Nushagak River, measures of Chinook salmon spawning abundance were originally made using aerial surveys that began in the late 1960s and continued until 1978. Then in 1979, estimates of inriver run strength were made using sonar operated 30 miles upriver of Dillingham. While sonar can count individual fish, there are multiple species of salmon migrating in the river while counting is occurring. Therefore it is necessary to estimate the proportion of each species present in the river and apply those proportions to the total sonar count to arrive at species-specific counts. This is accomplished by test-fishing with gillnets immediately below the sonar.

Nushagak River. © ADF&G.

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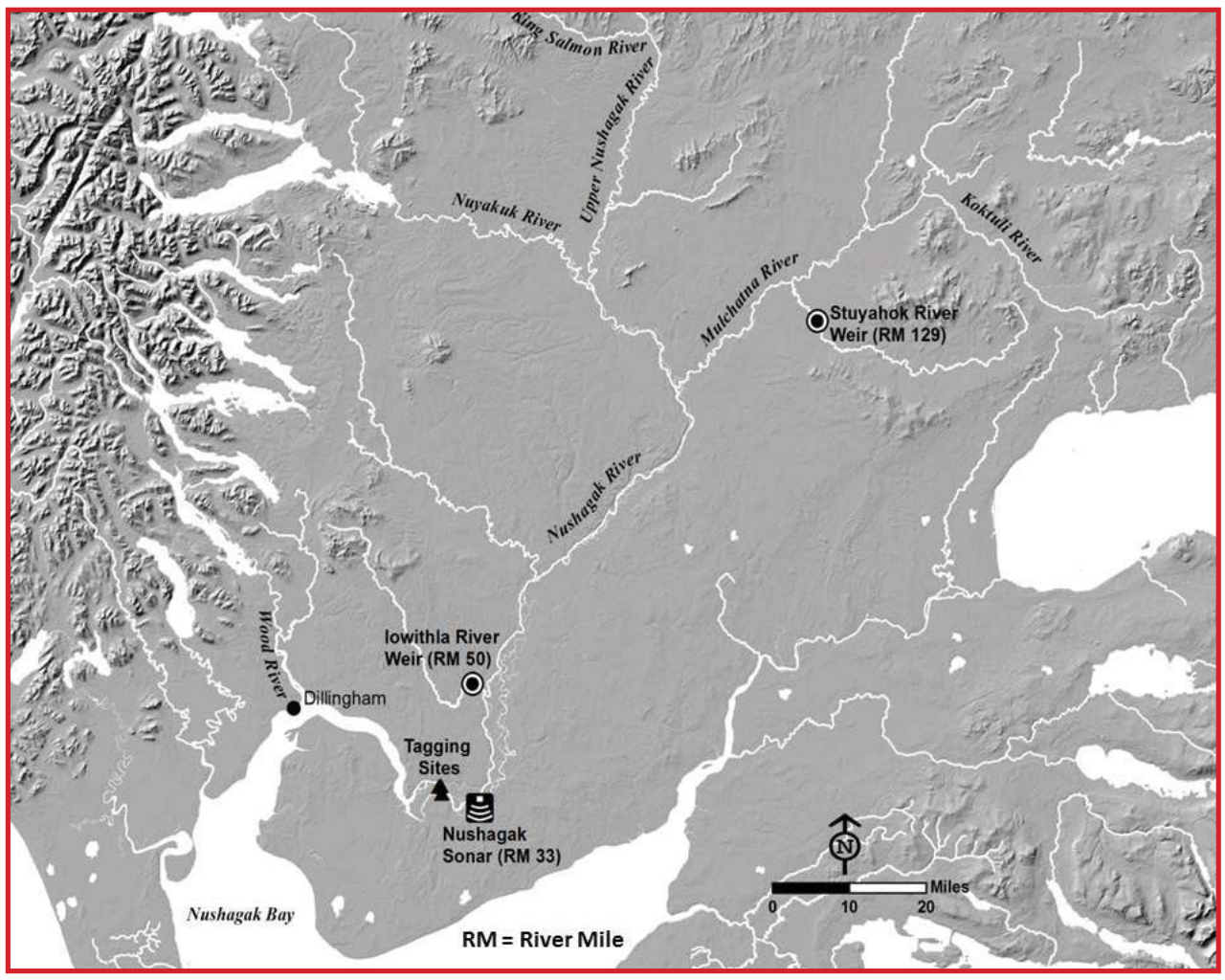
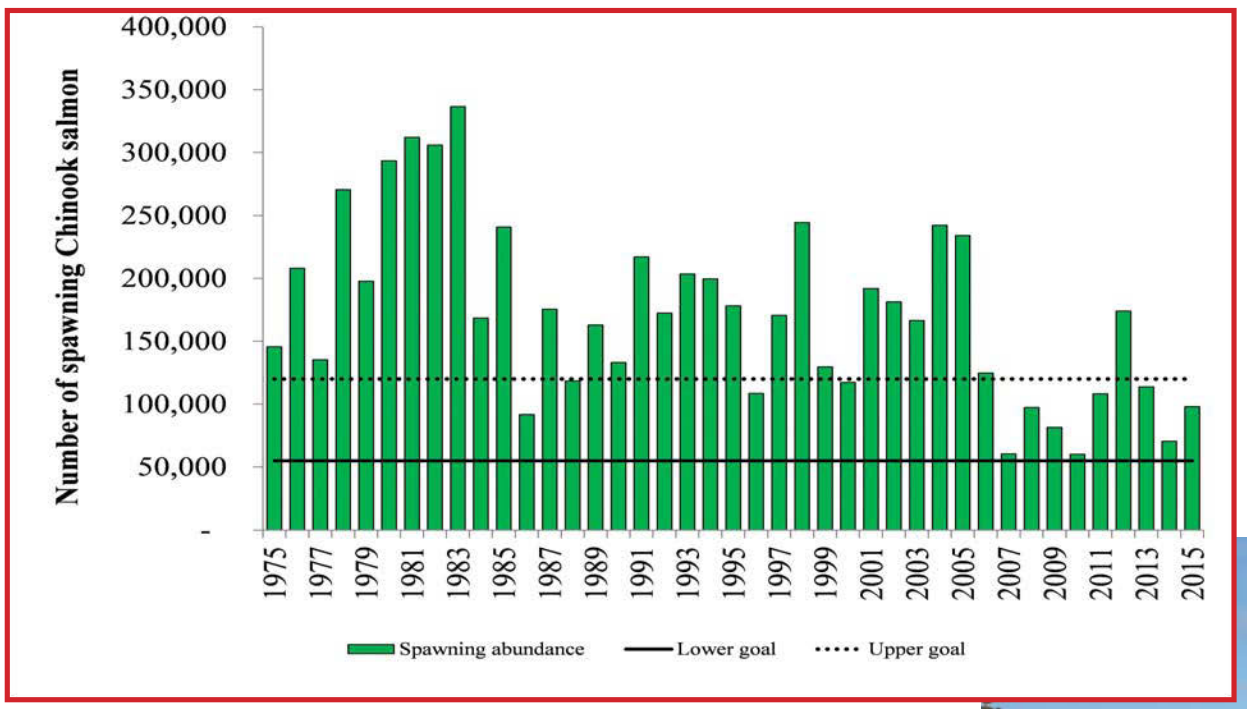
NUSHAGAK RIVER CHINOOK SALMON RESEARCH *(continued from page 8)*

In the summer of 2015, the department partnered with the Bristol Bay Science and Research Institute through LGL Alaska Research Associates to conduct a mark-recapture study to estimate the inriver run of Chinook salmon in the Nushagak River. This study resulted in an independent estimate of inriver run numbers for comparison to the sonar count. Event one of this two-event mark-recapture study marked nearly 2,500 Chinook salmon in the lower Nushagak River. Fish were captured using non-lethal drift gillnets and by rod and reel angling. All healthy fish were marked with a passive integrated transponder, or PIT tag, dart tags, and with a clip of the left axillary fin, a small fin located next to the pelvic fin.

Fish tagged at Scandinavian Slough and near the Nushagak Sonar were sampled for age, sex, and length information. Preliminary results show 44 percent of the fish had spent three years in the ocean, and 41 percent had spent two years in the ocean, and 62 percent were males. As part of event two of the mark-recapture study, over 4,000 Chinook salmon were sampled and counted through weirs placed across the Iowithla and Stuyahok rivers and through rod and reel sampling and carcass recovery efforts at various other tributaries. All fish were checked for the presence of marks applied during event one and sampled for age, sex, and length information. Of the total, about 2 percent possessed marks previously applied during event one and preliminary data indicate 56 percent of the fish had spent two years in the ocean, 34 percent had spent three years, and about 74 percent were males. On average, fish sampled throughout the project were about 30 inches in length. The preliminary 2015 inriver run estimate from the mark-recapture project is 127,000 Chinook salmon, approximately 1.3 times greater than the sonar count of 98,000. Interestingly, the same work performed in 2014 resulted in an inriver run estimate of 91,500 Chinook salmon, again, approximately 1.3 times that of the sonar count of 70,500.

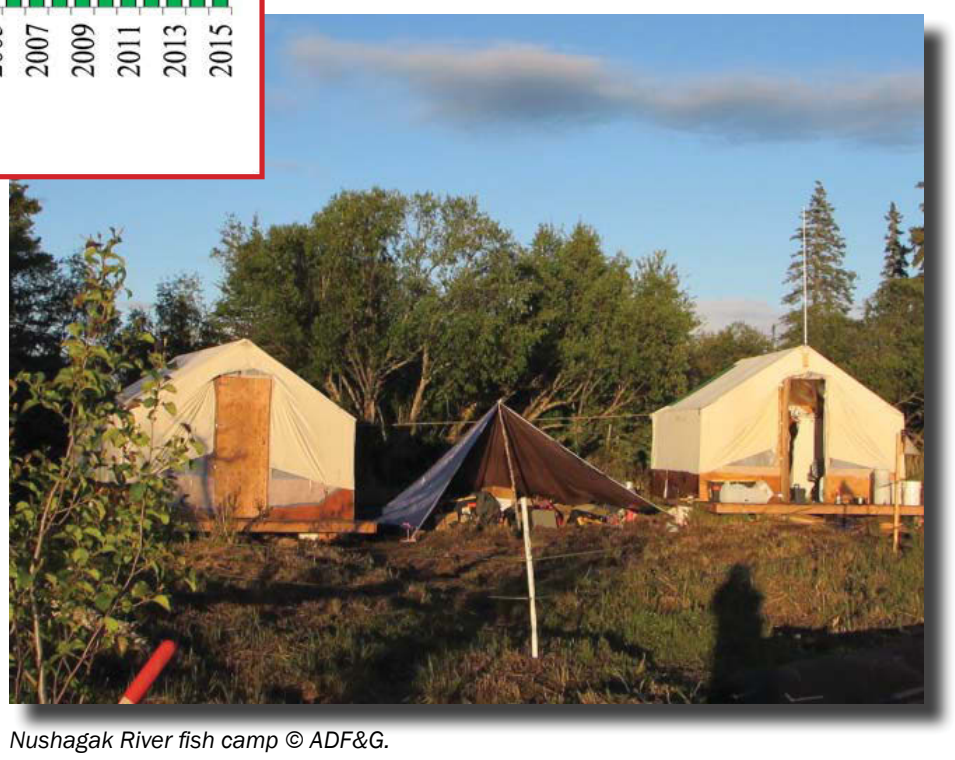


Tagging and escapement enumeration projects, Nushagak River Drainage.



Nushagak RIver escapement from 1975 to present.

Axillary fin. Used with permission © Genevieve Anderson.



Nushagak River fish camp © ADF&G.

Life at the Weir

Fish weirs have been traditionally used as a tool to either trap or direct fish movement through river systems. In the modern era they have become a vital tool for the assessment and management of salmon populations throughout Alaska. Operated in some the most remote and scenic areas of Alaska, the weir presents unique challenges and experiences. Throughout the summer, the work load revolves around salmon migration. After the initial labor of installation, the frequency and abundance of salmon moving upstream will determine the amount of attention required from the weir crew which normally consists of two to three technicians. Daily operations entail passing fish through the weir, age, sex, and length sampling, cleaning debris from the weir, inspecting the weirs for holes, radio and phone contact with the area office, and basic camp maintenance. Working on a weir can best be described as getting paid to camp and applying fisheries science in some of the greatest places in Alaska. This does not mean it is easy. When the fish are in high abundance and during installation and break down of the weir, the days are long and strenuous. When the work is finished, or when the shift is over, technicians are free to explore the area around them or just rest, relax, eat, and sleep. The location of the weirs often places technicians in areas of abundant outdoor activities, including hiking, boating, wildlife viewing, swimming, and fishing. Safety is paramount in all activities and the department provides training and equipment necessary to properly prepare crews for extended time in the field. Salmon weirs are an essential tool for the department to assess, study, and manage salmon populations in Alaska. Working on a weir project can be an exciting, fun, and educational time where outdoor living and fisheries science collide to make for rewarding and memorable experiences.

Juvenile Yukon River Chinook Salmon Abundance and Ecology

Katie Howard, Fisheries Scientist, Division of Commercial Fisheries

Large vessels and trawls have been used for a number of years to survey the northeastern Bering Sea for Yukon River juvenile Chinook salmon. These surveys have provided important information such as run forecasts to managers, and subsistence and commercial fishers. Over the past two years, research funded through the Chinook Salmon Research Initiative has been testing whether a smaller vessel (approximately 60 feet in length) and trawl could be used to collect these data, but at lower cost than when using a large vessel (approximately 120 feet in length or more). This work has shown it is possible to collect these data at less than half the previous cost, though some modifications to the survey design are necessary to accommodate the smaller vessel.

Data collected from these surveys has also provided new insights into the early marine life history of juvenile Yukon River Chinook salmon. When combined with data collected using other funding sources, research showed that the average juvenile Yukon River Chinook salmon length increased over 200 percent in the first few months at sea. While impressive, this was the lowest increase found among the other species of salmon sampled from the Yukon. Coho salmon length increased approximately 300 percent, and pink and chum salmon length increased up to a whopping 400 percent during their first few months in the marine environment. We've also gathered new information on diets of juvenile Chinook salmon and how those diets are different in particularly warm years. Over time it may be possible to understand how diet may affect survival of juvenile Chinook salmon.

This work also sheds light on what factors might affect the abundance of juvenile Chinook salmon in a particular cohort. We found that the production (number of returns per spawner) generated from a given spawning event appears to be determined before September of a cohort's first year in the ocean. This information is important and suggests that the differences between good and bad years are likely caused by something that happens sometime between when the eggs are laid in gravel and September of a fish's first year in the ocean, typically two years later.

ADF&G and Alaska Pacific University researchers retrieving the catch during the 2015 trawl survey on ADF&G's R/V Pandalus. *© ADF&G. Photo by Sean Larson.*

Salmon captured during the marine trawl survey, from top to bottom: pink salmon, chum salmon, sockeye salmon (Norton Sound origin), Chinook salmon, and coho salmon. © ADF&G. Photo by Katie Howard.

Recent information has shown a pronounced uptick in juvenile Yukon River Chinook salmon abundance, which should translate into improved adult Chinook salmon runs down the road. Current measures of juvenile abundance give a leading indicator of productivity, and this information can be used to predict runs three years into the future. The current expectation for the Yukon River Chinook salmon run in 2016, based on the juvenile data collected 3 to 4 years ago during trawl surveys, is for a run similar to last year and a modest increase from previous years. The runs in 2017 and 2018 should see an even larger improvement and may be adequate to provide increased subsistence opportunity compared to recent years. The information gathered from these vessel trawl surveys is being shared with fishermen and managers to assist with preseason planning and development of appropriate management strategies.

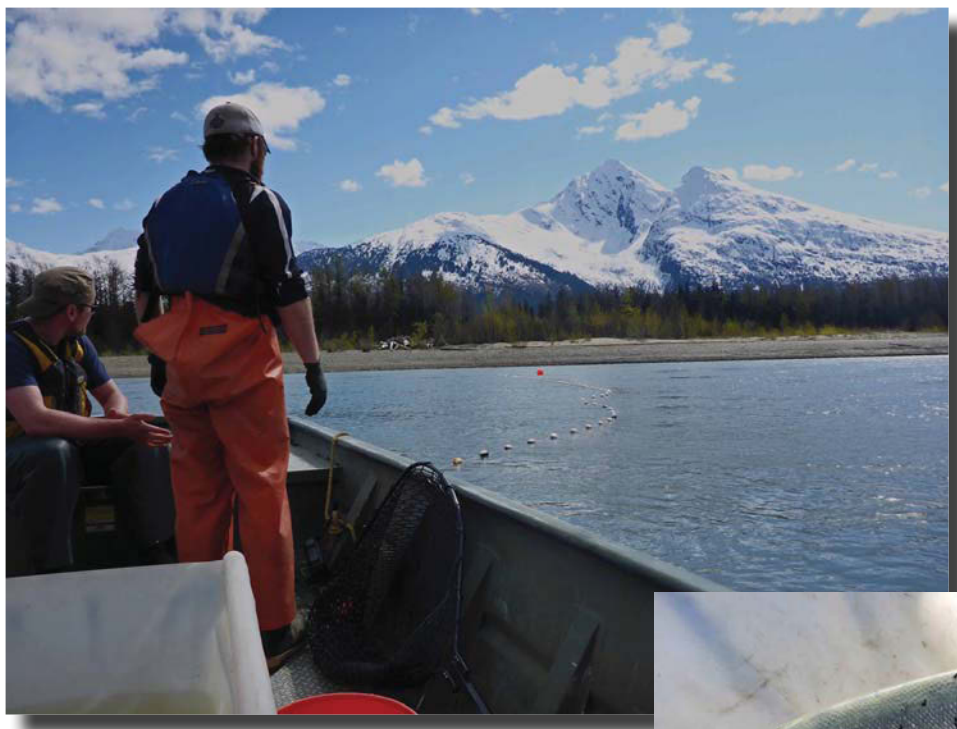
The next steps in this research are to refine the small vessel survey design in 2016 and to seek opportunities to continue surveying juvenile Yukon River Chinook salmon in the northeastern Bering Sea to better understand causes of mortality at this critical life stage. Continuation of this research would ensure that run size forecasts would continue to be available to managers and stakeholders. Additionally, with this new survey capacity developed through the Chinook Salmon Research Initiative, we are actively seeking external funding to use this less expensive survey platform to gain new insights on Kuskokwim and Nushagak river Chinook salmon stocks that presumably rear in the southeastern Bering Sea. The Kuskokwim River is the largest subsistence Chinook salmon fishery in the state and the management tools and insights gained from this type of work could be of great benefit to stakeholders, comparable to that seen for Yukon River fisheries.

© ADF&G. Photo by Sarah Webster.

Chinook salmon captured at the same survey station. Juvenile Chinook salmon show the greatest differences in size at capture than any other species, likely representing multiple ages of fish that leave freshwater (1- and 2-year old fish). Most juvenile Chinook salmon leave freshwater as 2-year old fish and resemble the bottom fish at capture. © ADF&G. Photo by Katie Howard.

Southeast Alaska Chinook Salmon Stock Assessment

Philip Richards and Brian Elliott, Fishery Biologists, Division of Sport Fish



ADF&G staff drift gillnetting for Chinook salmon on the lower Taku River © ADF&G.

With the signing of the Pacific Salmon Treaty with Canada in 1985, Chinook salmon management and research in Southeast Alaska became a significant department focus. For over 20 years, Chinook salmon projects in Southeast provided estimates of adult and juvenile abundance, marine harvest, and juvenile-to-adult marine survival which allows for a full run reconstruction of a year class cohort. Because budgets and personnel were prioritized many years ago, today the Chinook programs on the Chilkat, Taku, Stikine, and Unuk rivers, referred to herein as the Southeast indicator stocks, are second to none. Data, as has been gathered for the Southeast indicator stocks, helps us understand:

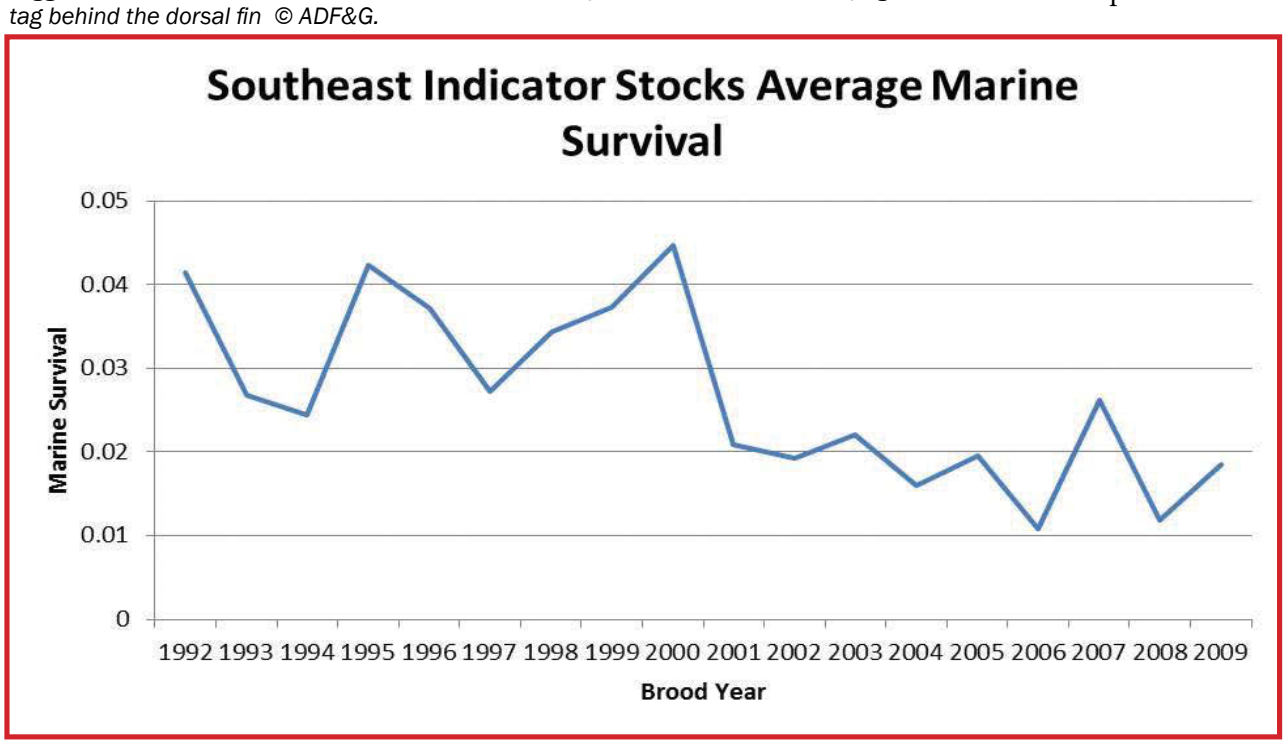
1) how many juveniles (smolt) are produced annually
2) marine survival (juvenile to adult survival rate)
3) how many fish are harvested
4) when and where fish are harvested
5) where juveniles rear in freshwater
6) where fish rear in the ocean
7) how many fish spawn
8) where fish spawn, and
9) the age, sex, and size of both spawning and harvested fish

With any stock assessment project the priority is to estimate the number of fish that come back to spawn each year. For the Southeast indicator stocks, spawning abundance is estimated using mark-recapture projects and observer counts. In addition, marine sport and commercial harvest studies coupled with juvenile tagging programs take place. More detailed information on the nuts and bolts of these efforts can be found in the Chinook News – Winter 2015 publication.

Like other Alaskan Chinook salmon stocks, juveniles from the Southeast indicator stocks typically spend two years in freshwater before migrating to the sea in April and May. After rearing in the ocean from one to five years, mature Chinook salmon return to their natal freshwater systems from April to August. And although these Chinook salmon enter their freshwater systems over a span of several months, spawning takes place during a much shorter period of time between late July and early September. After eggs are deposited, they will incubate throughout the fall and winter and fry will typically emerge from the gravel in February. These fry then rear for just over a year before migrating to the sea as spring smolt.

Spawning abundance is estimated for many Chinook salmon stocks along the coast. The estimates for the Southeast indicator stocks are considered some of the best and most reliable, having taken place consistently over a lengthy period of time. But what makes the stock assessment program for the Southeast indicators unique among all others is the ability to estimate the number of juveniles leaving each system on an annual basis, and when coupled with tagging studies, the ability to estimate stock specific marine harvest and marine survival.

Tagged Chinook salmon from the lower Taku River ready for release; note blue spaghetti tag behind the dorsal fin © ADF&G.



Average marine survival from 1992 to 2009. Note: Data are only available through the 2009 brood year. Adult Chinook salmon from brood year 2009 returned to their natal streams to spawn in 2014 and 2015 as five and six year olds, allowing fishery researchers to determine marine survival for the 2009 brood year. Subsequent brood years (2010 and later) are still rearing in the ocean and have not yet returned.

ADF&G staff seining for Chinook salmon smolt in the lower Taku River © ADF&G.

Many years of tag recovery information has shown that Chinook salmon from the Chilkat and Unuk rivers primarily rear in and around Southeast Alaska whereas Chinook salmon from the Taku and Stikine rivers rear in the Gulf of Alaska and Bearing Sea. These fish are primarily harvested in commercial troll and gillnet fisheries and sport fisheries in Southeast Alaska and harvest rates for these stocks are healthy and average around 20 percent.

Research for the Southeast indicator stocks has shown that juvenile abundance has fluctuated normally; however, the recent downturn in production was due to poor marine survival and for some reason fish have been dying at higher rates than normal after migrating to the ocean. Historically marine survival averaged about four percent for the Southeast indicator stocks; however, in recent years it has dipped below two percent. In other words, for every 100 juveniles that migrate to sea, less than two fish have returned to spawn as adults, less than half of the historical average.

Detailed stock assessment information like what is gathered for the Southeast indicator stocks is rare and takes time, money, and patience to gather. In 2015 the department was once again able to continue the research for the Southeast indicator stocks funded in part through the Chinook Salmon Research Initiative and this work will take place again in 2016.

Chignik River weir © ADF&G.

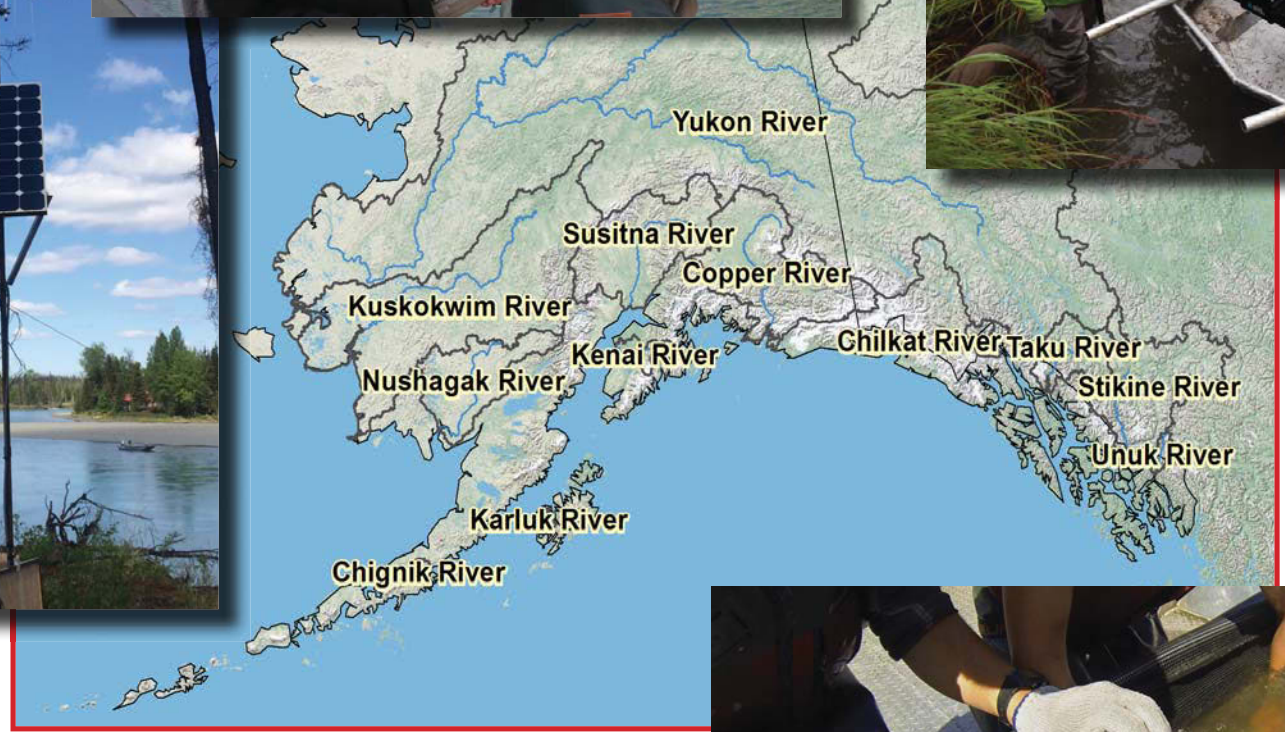
Fish wheel and drift gillnet tagging event on the Chilkat River © ADF&G.

It has been nearly a decade since Alaska has seen decent Chinook salmon production ...[but] perhaps this is the start of good things to come. -Ed Jones, Chinook Salmon Research Initiative Coordinator

Cook Inlet stock assessment in the Homer harbor © ADF&G.

Sonar unit on H-mount ready for deployment on the Kenai River © ADF&G.

Radio tag tracking tower on the Kenai River © ADF&G.



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

Radiotagging Kuskokwim River Chinook salmon © ADF&G.

Chinook salmon research on the Susitna River © ADF&G.

ADF&G staff seining for Chinook salmon smolt in the Copper Riiver © ADF&G.