RC 9

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Recommended Kenai River King Salmon Size-based (large fish) Escapement

Frequently Asked Questions

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Over the past several years, the Alaska Department of Fish and Game, Division of Sport Fish has made significant operational and technological improvements to our fish counting sonar systems to produce more timely and accurate run assessments. For example, the use of the newer ARIS sonar on the Kenai River allows our technicians to determine lengths, and ultimately species of salmon at a high level of accuracy that is critical when managing to achieve species-specific escapement goals.

Because of these improvements, the department is proposing to move to an escapement goal for the early- and late-runs of Kenai River king salmon based on a minimum size, or length of fish. This change means moving away from escapement goals based on total number of king salmon of all sizes passing the river mile 13.7 sonar site, to goals based on the number of king salmon, equal or greater in length than 75 centimeters, mid-eye to fork (MEF). Escapement goals based on fish of this size represent most of the female spawners that drive productivity of the stocks. In Southeast Alaska, the department has used escapement goals for king salmon based on fish size for many years, where we base escapement on fish equal or greater than 66 centimeters MEF.

The department is recommending that the sustainable escapement goal range (SEG) for early-run Kenai River king salmon be 2,800 – 5,600 king salmon 75 cm or greater MEF. For Kenai River late-run king salmon, the recommended sustainable escapement goal is 13,500 – 27,000 king salmon 75 cm or greater MEF.

Using a goal based on size results in reduced escapement goal ranges because they will include only large fish. However, the probability of producing maximum sustained yield (MSY) and maximum recruitment with early-run Kenai River king salmon 75 cm or greater MEF can still be achieved when compared to the probability of achieving the goal using the current escapement goal for fish of all sizes. A detailed explanation can be found in question #7 below.

Similarly, using a size-based escapement goal for the late-run Kenai River king salmon, the probability of producing MSY is similar to the probability of producing MSY with the current escapement goal for fish of all sizes. A detailed explanation can be found in question #8 below.

A report detailing the spawner-recruit analysis and escapement goal recommendation is nearing completion. The department will provide a web link to that report as soon as it is completed, prior to the Upper Cook Inlet Board of Fisheries (board) meeting. Until then, the department has developed the following list of *Frequently Asked Questions* to provide answers to some of the most commonly asked questions.

1) **Why make a change from the existing escapement goal that is based on fish of all sizes to a goal that is based only on large fish?**
   The number of large fish, those 75 cm or larger, mid-eye to fork (MEF) can be assessed quickly and more accurately. Large fish abundance can be assessed using only the sonar, and fish of this size represents most of the female spawners that drive productivity of the stock. Estimates of the inriver run of fish of this size passing the sonar can be generated daily rather than the current twice-weekly updates, making management more responsive to changes in abundance.

2) **Why make a change to a large fish escapement goal now?**
   This is the last step in our sonar transition and will provide more accurate inseason information for fisheries management, because the information about large king salmon abundance will be more accurate and timely.

3) **What is a "large fish goal"?**
   A large fish goal is an escapement goal based only on fish greater than a chosen size. For the Kenai River, king salmon 75 cm MEF or greater in length has been chosen to establish the escapement goal. In Southeast Alaska, nearly all king salmon stocks have goals based on fish greater than a minimum size (66 cm MEF).

4) **Will the new goals be lower than the existing goals?**
The new goals will have a lower numeric value because they will only include large fish, but they will provide similar probabilities of producing MSY for both runs, and maximum recruitment for the early-run, as well as avoiding overfishing as estimated for the current goals.

5) **What are the new recommended sustainable escapement goals (SEGs) for the early and late Kenai River king salmon runs?**
For Kenai River early-run king salmon, the department recommends an SEG of 2,800–5,600 king salmon 75 cm MEF or greater in length. For Kenai River late-run king salmon, the department recommends an SEG of 13,500–27,000 king salmon 75 cm MEF or greater in length.

6) **Why are these goals sustainable escapement goals and not biological escapement goals?**
There is still considerable uncertainty in the abundance of large fish in previous years. This uncertainty includes the run reconstruction, especially with the estimation of escapement, and the lack of return data from escapements at the lower bound of the goal.

7) **How does this new "large fish goal" for the early run compare to the existing goal that includes fish of all sizes?**
The new early run SEG range for large king salmon provides probabilities of attaining MSY and maximum recruitment similar to the current SEG range provided for king salmon of all sizes. The new recommended SEG upper bound (5,600) is lower than the upper bound of the existing goal, so that the new goal is more consistent with the upper bounds of escapement goals of other Alaskan king salmon stocks. The existing early-run SEG upper bound had been set higher than necessary in 2013 as a precaution against uncertainty in the data and maximizing recruitment. This resulted in a lower probability for optimizing yield (0.06), and made the existing upper bound higher than other Alaska king salmon stocks with respect to number of spawners that produce MSY. The new recommended early-run SEG range has the third highest lower bound and fourth highest upper of 22 other Alaskan king salmon stocks relative to spawning escapement producing MSY. The new recommended early-run SEG upper bound also has a greater probability of producing optimal yields (increased from 0.06 to 0.27) and probability of optimal recruitment (increased from 0.75 to 0.85).

8) **How does this new "large fish goal" for the late run compare to the existing goal that includes fish of all sizes?**

The SEG range for large king salmon provides similar probabilities of attaining MSY and avoiding overfishing as the current SEG range does for king salmon of all sizes. The probability of producing MSY with the new recommended SEG would be 0.66 for the lower bound and 0.43 for the upper bound, whereas the probability of producing MSY with the current SEG is 0.73 for the lower bound and 0.40 for the upper bound. The risk of overfishing at the new recommended SEG lower bound is 0.33 compared to 0.28 for the current SEG lower bound. This new SEG recommendation is precautionary given uncertainty in our knowledge of production of late-run large fish, but is consistent with escapement goal ranges of other Alaska king salmon stocks. The new recommended late-run SEG has the 7th lowest lower bound and 9th lowest upper bound of 22 Alaskan king salmon stocks relative to spawning escapement producing MSY.

9) **Why was 75 cm mid-eye to fork length chosen as minimum size considered for the goal?**

75 cm MEF length is the smallest king salmon that the imaging sonar can reliably distinguish from all sizes of sockeye salmon. Ninety percent of all female Kenai River king salmon are 75 cm MEF or greater in length and more than half of all king salmon of this size are female. King salmon smaller than 75 cm MEF include all of the 1-ocean fish (age 1.1) and nearly all of the 2-ocean fish (age 1.2), which are primarily males.

10) **The Upper Cook Inlet Escapement goal memo presented at the October 2016 Work Session referenced a forthcoming escapement goal of 34 inches in length or greater for Kenai kings. Why is the goal now in units by length from the middle of the eye to the fork of the tail, and measured in centimeters?**

Initially, total length and inches was used so that the public could more easily relate to the size of fish to which the escapement goals refer. However, the department measures fish using the metric system for international reference reasons, and additionally salmon are measured mid-eye to fork due to the change in length that can occur with the same individual within the season, but the conversion does involve further estimation and rounding. In the end, the decision was made to stay with the measure and units in which the department collects information and used in the escapement goal analysis.

11) **How will a large fish goal affect management of the fisheries?**

Our inability to assess small fish reliably inseason will no longer be a contributing factor in the timeliness and accuracy of decision making on inseason management actions. Therefore, whatever management actions we take will more likely be the appropriate action.

12) Will you continue to estimate the abundance of small king salmon?

Yes. The netting and harvest sampling programs will continue to collect data to estimate abundance of all sizes of king salmon but the estimation of abundance of small fish will become a post-season task. These small fish do spawn so estimation of total run abundance is an important component needed for understanding overall production of Kenai River king salmon.

13) Will a large fish goal impact harvest or management of fish less than 75 cm mid-eye to fork length?

The department is not recommending any changes to the harvest patterns or levels of small king salmon.

14) Will the sonar project change how it conducts sampling?

The sonar program will remain the same. The ARIS sonar system, located at the river mile 13.7 site, is composed of multiple individual transducers scheduled to operate 10 minutes per hour for each location, 24 hours per day. There will be 1–3 spatial strata (distances from shore) sampled per transducer and 2–5 transducers deployed in the river at any given time. Detailed information on the sonar program can be found in the project operational plan: http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.2A.2016.13.pdf

15) How do you measure fish?

Estimates of total length are made from images generated from the ARIS sonar. The accuracy of lengths obtained using the ARIS sonar were independently verified by using a fish of a known length tethered in front of the ARIS sonar beam. Fish greater than 75 cm MEF as measured by the ARIS are almost certainly king salmon. Harvested fish sampled in commercial and sport fisheries are measured mid-eye to fork of tail in centimeters.

16) What is the total length of a fish that measures 75 cm mid-eye to fork?

Total length of a king salmon that measures 75 cm mid-eye to fork is approximately 33.3 inches in total length as measured in a straight line from the tip of the snout to tip of the tail.

17) Will there be any changes to the inriver netting program?

The inriver netting program will continue as operated during 2016 when we sampled both the nearshore and offshore areas and where nearly the entire channel width is sampled. It is possible the netting program will be modified in the future in an effort to improve capturing a representative sample of king salmon of all sizes. Detailed information on the

netting program can be found in the project operational plan:
http://www.adfg.alaska.gov/FedAidPDFs/ROP.SF.2A.2016.09.pdf

18) **Will a large fish goal impact existing regulations?**
The current optimal escapement goal listed in the Kenai River early-run king salmon management plan and the escapement goal range and management trigger point contained in the late-run king plan will need to be updated to complement a large fish goal range. Conversions to these numbers, that would remain neutral to the effect on board intent, will be provided to the Board of Fisheries for consideration at their February 2017 Upper Cook Inlet meeting in Anchorage.

19) How do you estimate the harvest of large fish in the commercial fishery?
Total commercial harvest is derived from fish tickets submitted to the department. The department samples the commercial set gillnet harvest inseason for age, sex, length (MEF), and genetic material. This information is used to stratify the harvest by size and different biological groupings (Kenai River mainstem, Kenai River tributary, Kasilof River, and Cook Inlet other).

20) How do you estimate the harvest of large fish in the sport fishery?
Sport harvest downstream of the Soldotna Bridge is sampled as part of the creel survey and can be stratified by size. These size samples are used as proxy for the size of fish harvested above the Soldotna Bridge. Estimates of total harvest above the Soldotna Bridge are provided by the Statewide Harvest Survey.

21) How do you estimate the harvest of large fish in the personal use fishery?
The personal use fishery harvest will be estimated post-season based on returned personal use permits that report fishing in the Kenai River dipnet fishery. Length samples from fish taken in the commercial set gillnet fishery will be used as proxy for size of fish harvested in the personal use fishery.

22) How will the Kenai River king salmon fishery be managed if size or age composition of the run changes over time?
Similar to all other department escapement goals, over time, these large fish goals will allow for sustainable fisheries with normal variation in size compositions. Size or age compositions of the annual king salmon runs depend on the survival or strength of individual brood years, with multiple brood years comprising each annual run. The size or age composition of the run is different each year. In recent years, when abundance of Kenai River runs were well below average, the composition of small fish was higher. However, in 2015 and 2016 the abundance of fish and composition of large fish increased in both runs.

23) Does run timing of large fish differ from fish of all sizes?

Because the department has a more accurate assessment of large fish – they can be measured directly from sonar sampling, while small fish are estimated based on the sonar and netting data combined – we have better estimates of run timing of large fish than for all fish. Based on ARIS data from the 2013 – 2016 the early-run large king salmon passage estimates in comparison to the passage estimates for all king salmon, show the same median date of passage of June 11. In all four years, the early-run large king salmon midpoint occurred within 2 days of the midpoint for all early-run king salmon and in two years, the early-run large king salmon midpoint occurred 1 or 2 days before the midpoint for all early-run king salmon.

For the late run, the median date of passage observed in the 2013–2016 ARIS data was 3 days later for large king salmon in comparison to all king salmon. In all four years, the late-run large king salmon run midpoint occurred 3 to 4 days later than the midpoint for all late-run king salmon. The run timing of late-run large king salmon midpoint based on mean run timing is July 27 and is July 24 for all late-run king salmon. On average, for the late-run approximately 32% of the large fish late-run has passed the River Mile 13.7 sonar by July 20, and approximately 62% of the large fish late-run has passed by August 1.

24) How would later run timing of large fish affect management decisions?

It is likely that management actions will continue to occur during the same time period they have historically been implemented. The department uses multiple sources of information to aid in determining run timing inseason, such as commercial set gillnet harvest, inriver test netting, inriver sport harvest, and sonar passage.