

UPDATED  
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# 2013 Kenai River King Salmon

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## Escapement Assessment Post-Season Analyses and Summary Frequently Asked Questions



### BACKGROUND

The Alaska Department of Fish and Game (**ADF&G**) works under the statutory responsibility mandated by **Article VIII** of the Alaska Constitution which requires wild fish stocks to be managed for maximum sustained yield in conjunction with public interest and resource impact. Managing the state's fisheries under the sustained yield principle ensures the protection and continued health of the resource by balancing yearly harvest with species abundance.

Scientifically based assessments of wild salmon stocks are the foundation of the sustained yield principle. These assessments enable ADF&G to develop scientifically defensible **escapement goals** for various salmon stocks. Four types of escapement goals can be utilized to manage Alaska's salmon stocks.

Biological Escapement Goals (BEGs) and Sustainable Escapement Goals (SEGs) are determined by ADF&G based on research programs and management strategies. These goals are based on the number of salmon—by stock and river system—that need to escape to spawn to provide for sustained yields in the future.

Inriver Goals and Optimal Escapement Goals (OEGs) are established by the Board of Fisheries and are based on economic and social considerations.

**Escapement goals** are developed and their achievements are assessed by various methods. For Kenai River king salmon, a **sonar** and netting program at **River Mile 8.6** is the method used to assess achievement of the escapement goal.

The ADF&G inseason Kenai River king salmon assessment program is in transition to improve the accuracy of the assessment. There are three main elements of the transition:

1. A change to the best available **sonar** technology to estimate the number of king salmon.
2. Relocation of the sonar from an area low in the river influenced by tides at **River Mile 8.6**, upstream to an area not influenced by the tide at **River Mile 13.7**.
3. Establish escapement goals for both early- and late-runs of Kenai River king salmon that are based on estimates of passage measured at the **River Mile 13.7** sonar site.

### KENAI RIVER KING SALMON MANAGEMENT

**Q1: What guides the management of the Kenai River early and late king salmon runs?**

A1: ADF&G manages the Kenai River king salmon runs in accordance with the **Kenai River and Kasilof River Early-run King Salmon Conservation Management Plan** and the **Kenai River**

**Late-Run King Salmon Management Plan**. Both were established through the Board of Fisheries process.

**Q2: How does ADF&G measure king salmon escapement on the Kenai River?**

A2: ADF&G uses the best available technology to measure escapement on

the Kenai River. In 2013, king salmon escapement measurements on the Kenai River were based on DIDSON sonar fish counts and inriver test netting data collected at the River Mile 8.6 sonar site, and subtracting inriver fishing mortality (i.e., harvest and release mortality) upstream of this site.

In our commitment to using the best available technology and more accurately estimating king salmon escapement, ADF&G is exploring the use of a different sonar site upstream of River Mile 8.6 out of intertidal waters. Currently ADF&G is testing a second sonar site at River Mile 13.7.

**Q3: Which sonar site was used to manage the Kenai River king salmon returns during the 2013 fishing season?**

A3: ADF&G used the sonar counts at Kenai River Mile 8.6 to manage both the early and late run Kenai River king salmon returns in 2013.

**Q4: Why is there a difference between the actual number of king salmon counted at the Kenai River Mile 8.6 sonar site and the overall passage of king salmon by the site?**

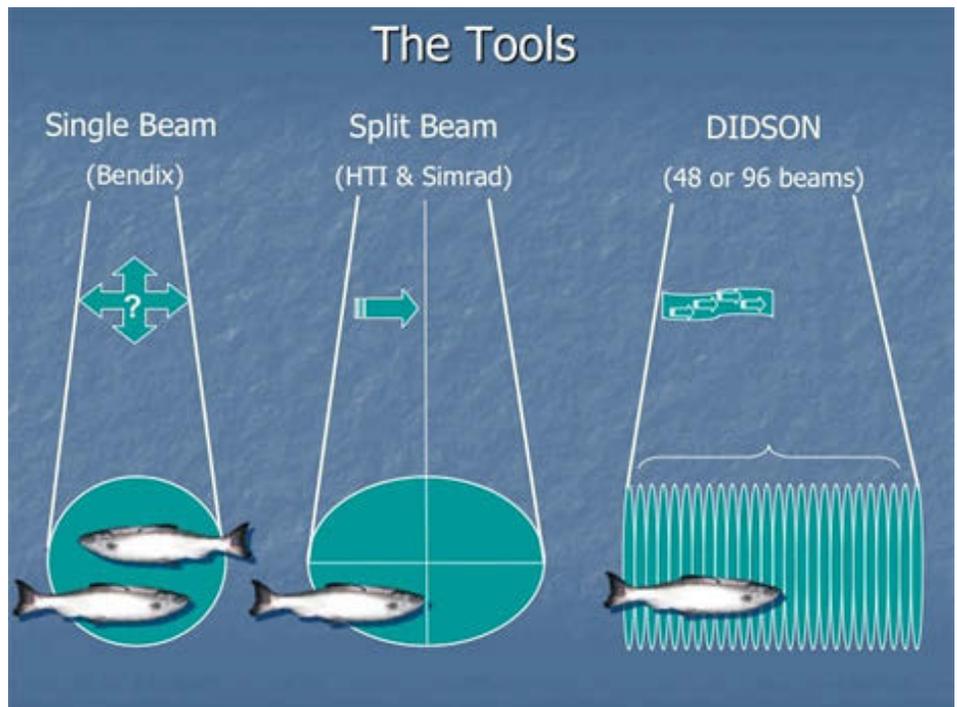
A4: The sonar at River Mile 8.6 only counts fish moving up the middle of the river, and we know from other means such as gillnetting and a mark-recapture project that some fish pass by the sonar site that are not observed by the sonar. To account for these unobserved fish, we use an expansion factor. Based on information gathered during 2006 through 2012, the expansion factor for the early run is 1.55 and the expansion factor for the late run is 1.28.

**Q5: Will ADF&G use the same expansion factor in 2014?**

A5: Yes

**Q6: Does the abundance of small fish affect the escapement estimates or inseason management decisions on the Kenai River king salmon runs?**

A6: Yes, but not very much. "Small" fish, primarily those fish that spent only one year in salt water (1-ocean) and are less than 20 inches in size (mid-eye to fork) were observed in the past. Although their abundance was likely not accurately assessed, other sources of data besides sonar and netting indicate they have been a small fraction of the total run. These fish do not have any appreciable effect upon escapement estimation or inseason management. ADF&G



**Three types of sonar used to count fish**

plans to improve our assessment of "small" fish in the future to better understand their contribution to escapements and stock productivity, and possibly develop a large fish escapement goal as an alternative approach.

**Q7: Does the sonar detect fish that are less than 20 inches in size?**

A7: Yes, but less accurately than large fish. Both the formerly used split-beam and the newer imaging sonar (i.e., DIDSON and ARIS) detect fish, even pink salmon, regardless of size. Nearly all large fish counted by the sonar are king salmon, so this count is very accurate. To count small king salmon we use additional information from our netting program to determine the proportion of all species of small fish counted by the sonar that are king salmon.

**Q8: Did ADF&G modify the inriver netting research program in 2013 during the Kenai River early king salmon run?**

A8: Yes. In 2013 ADF&G began sampling near shore 2-3 times a week in addition to the daily mid-river netting done in the past. Although not used to assess achievement of the escapement goal, the near shore netting was done to better understand relative abundance and composition of fish migrating in this area of the river. In addition, near shore netting a few days throughout the summer would provide data for future research plans to assess king salmon composition across the entire river. This is needed because the sonar at River Mile 13.7 spans the entire river, whereas the sonar array at River Mile 8.6 does not.



# COMPARING SONAR COUNTS AND OTHER ESTIMATES

## Q9: Is it feasible to count fish at the Kenai River Mile 13.7 sonar site?

A9: Yes, the sonar research project was successful in 2013 and ADF&G will continue this research in 2014. ADF&G is in the process of refining objectives and study design for 2014 sonar research to ensure that the River Mile 13.7 sonar will operate under all conditions of water flow and fish passage, including the possibility of large numbers of pink salmon that may be present in 2014.

## Q10: How do the king salmon counts at the Kenai River Mile 13.7 sonar site compare to the counts at the River Mile 8.6 sonar site?

A10: **Table 1** is our assessment of king salmon passage by size of fish using the RM 8.6 and the RM 13.7 sonars. The RM 8.6 estimates use the expansion factors described previously in Q4 (1.55 for early run and 1.28 for late run).

Estimates of large king salmon were similar in both the early and late runs. Note that the RM 13.7 estimate does not take into account spawning and sport harvest of king salmon that occurred between RM 8.6 and RM 13.7 during the late run.

**A more detailed analysis in the future will account for these fish.**

Daily passage of large king salmon (> 30 inches) at the two sonar sites were similar by run as shown in **Figure 1** to the right.

The sonar assessments (RM 8.6 and 13.7) are directly comparable in that they use the same midriver netting data to estimate abundance of small king salmon. However, because small king salmon in the run are under-represented in the midriver netting data, both sonar estimates of small king salmon are low relative to other measures of abundance.

The sonar is able to count large king salmon (greater than 30 inches) directly because they are likely not confused with smaller species of salmon like sockeye. On the other hand, estimating the number of small king salmon (less than 30 inches) requires an estimate of the relative abundance of small and large king salmon. For example, if the

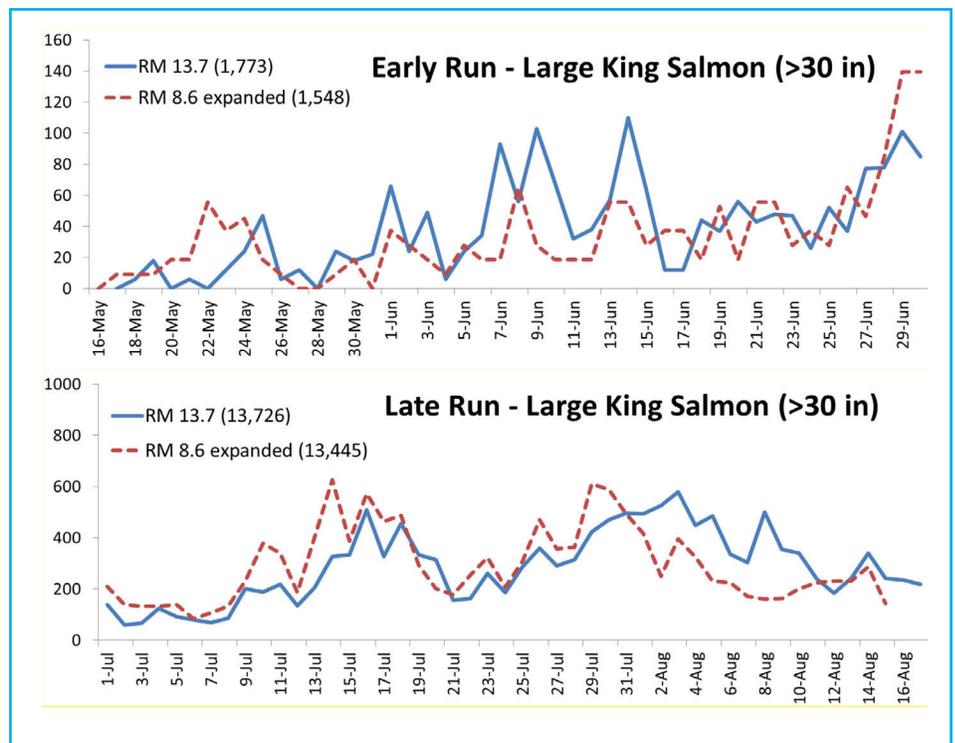
**Table 1. Assessment of king salmon passage by size of fish using RM 8.6 and RM 13.7 sonars.**

Assessment	Small King Salmon (< 30 in)	Large King Salmon (> 30 in)	All Sizes
Early Run			
RM 8.6 sonar	489	1,548	2,037 <sup>a</sup>
RM 13.7 sonar	593	1,773	2,366
Late Run			
RM 8.6 sonar	3,570	13,445	17,015 <sup>b</sup>
RM 13.7 sonar	4,293	13,726	18,019

<sup>a</sup> When the inriver harvest and catch-and-release mortality of 5 fish is subtracted from this estimate, the result is the early run king salmon escapement of 2,032 fish.

<sup>b</sup> When the inriver harvest and catch-and-release mortality of 1,620 fish is subtracted from this estimate, the result is the late run king salmon escapement of 15,395 fish.

**Figure 1. Daily passage of large king salmon (>30 in) at sonar sites RM 8.6 and 13.7.**



sonar counts 100 large king salmon migrating upstream and the nets show one-half of all king salmon are large, then an estimated 100 small king salmon also passed the sonar site. Information about relative abundance of small and large fish is obtained from the netting program that samples the same mid-river section covered by the RM 8.6 sonar.

It appears that small king salmon tend to migrate closer to the river bank and therefore are more likely than large king salmon to evade detection by our standard mid-river netting program at RM 8.6. A preliminary netting study in 2013 found a higher percentage of small king salmon nearshore than mid-river. Sizes of fish sampled by the standard mid-river netting program were not representative of sizes

of fish entering the river in 2013, especially during the early run.

**Q11: How do the king salmon counts at the Kenai River sonar sites compare to the 2013 mark-recapture estimates?**

A11: **Table 2** is our assessment of king salmon abundance by size of fish using the two sonars (RM 8.6 and RM 13.7 as shown before in A10), using mark-recapture for large fish only, and using expansion of king salmon counts at tributary weirs during the early run only. All abundance estimates for large king salmon are comparable and show that the assessment of large fish at RM 8.6 was accurate during 2013. During the early run, the estimate of small king salmon from the expanded weir counts was much higher than the two sonars. This indicates that the RM 8.6 sonar underestimated

the number of small king salmon entering the Kenai River during the 2013 early run. Although we have no comparable estimate for

small king salmon during the late run, we believe that the extent of underestimation was not as great as observed during the early run.

Assessment	Small King Salmon (< 30 in)	Large King Salmon (> 30 in)	All Sizes
Early Run			
RM 8.6 sonar	489	1,548	2,037
RM 13.7 sonar	593	1,773	2,366
Mark-recapture	-	2,121	-
Expanded weir counts	3,760	1,431	5,191
Late Run			
RM 8.6 sonar	3,570	13,445	17,015
RM 13.7 sonar	4,293	13,726	18,019
Mark-recapture	-	15,000	-

## KENAI RIVER EARLY-RUN KING SALMON

**Q12: What is the escapement goal for the Kenai River early-run king salmon and which sonar was used to count fish?**

A12: ADF&G used the established OEG of 5,300-9,000 fish and sonar counts at River Mile 8.6 to manage the Kenai River early king salmon fishery in 2013. The OEG is established by regulation and was not changed by the Board of Fisheries in March 2013.

**Q13: What was the 2013 Kenai River early-run king salmon escapement estimate?**

A13: The 2013 Kenai River early-run king salmon escapement estimate was 2,032 fish.

**Q14: What was the 2013 estimated count of Kenai River early-run king salmon upstream of the River Mile 8.6 sonar?**

A14: Kenai River early-run king salmon primarily spawn in the tributaries to the Kenai River upstream from the River Mile 8.6 sonar. There are counting weirs on the upstream tributaries that are the major producers of king salmon. Preliminary weir counts on these tributaries (Killey River, Funny River and Quartz Creek), were nearly 3,200 fish. The majority of these

fish were small males. Preliminary estimates are that about 1,042 of these fish were greater than 30 inches in size.

**Q15: Historically, what percentage of the Kenai River early-run king salmon run were 1-ocean fish (nearly all of which are less than 20 inches in size)?**

A15: Our assessment of fish of this small size is based on sonar, mid-river netting, and catch data. Prior to 2009, we did not see many of these fish and they represented a very small percentage of the run. We saw many more of these small fish in 2010, 2012, and 2013. Based on data from weirs on some of the tributary streams we probably underestimated how many of these small fish entered the river during these years. In 2013 there were an unusually large number of these small fish that were seen during the early run at weirs on tributaries. ADF&G observed many more small fish than usual in other king salmon runs in Alaska, including the Anchor, Deshka and Taku Rivers.

**Q16: Did the 2013 Kenai River early king salmon run meet the established OEG?**

A16: No. The estimated escapement of 2,032 fish did not attain the OEG

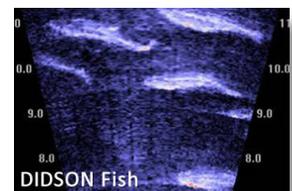
of 5,300-9,000 or the SEG of 3,800-8,000 fish. The early run was the lowest by historical standards.

**Q17: What actions did ADF&G impose on the sport fishery in 2013 to restrict harvest during the Kenai River early-run king salmon run?**

A17: The sport fishery was restricted to catch-and-release at the beginning of the season followed by a complete closure on June 20. The closure extended through July in the middle river area to protect tributary spawning king salmon. In addition, the use of bait was prohibited in the lower river sport fishery in early July to protect early run king salmon.

**Q18: How many king salmon were harvested in the Kenai River early-run king salmon fishery prior to July 1?**

A18: No harvest was allowed. The Kenai River early-run king salmon inriver sport fishery was restricted effective May 16 to non-retention of king salmon. Our estimate of release mortality for the early run is five king salmon.



# KENAI RIVER KING SALMON LATE RUN

## **Q19: What is the escapement goal for Kenai River king salmon late-run and which sonar was used to count fish?**

A19: ADF&G used the sonar counts at River Mile 8.6 to manage the fishery in 2013, based on the established sustainable escapement goal of 15,000-30,000 fish.

## **Q20: What was the 2013 Kenai River king salmon late-run escapement estimate?**

A20: The 2013 Kenai River king salmon late-run escapement estimate was 15,395 fish.

## **Q21: Did the 2013 Kenai River king salmon late-run meet the established escapement goal?**

A21: Yes. The preliminary estimated escapement of 15,395 Kenai River king late-run salmon met the SEG of 15,000-30,000 fish. The return was low compared to historical averages.

## **Q22: What actions did ADF&G impose on the commercial, sport, and personal use fisheries to restrict harvest during the Kenai River king salmon late-run?**

A22: ADF&G managed the Kenai River king salmon late-run conservatively and imposed management restrictions on the commercial, sport and personal use fisheries. Restrictive actions were taken earlier in 2013 in an effort to prevent closures later in the season.

In the lower river sport fishery, the use of bait was prohibited July 1, the start date of inriver management for the Kenai River king salmon late-run. The sport fishery was restricted to catch-and-release on July 25, followed by a closure of the sport fishery on July 28 until the season ended on July 31. The bait restrictions remained in effect through mid-August to provide additional protection for king salmon.

In the commercial fishery, a strategy was implemented in the Upper Subdistrict set gillnet fishery allowing fishing opportunity to maximize sockeye salmon harvest, while limiting king salmon catches, until an accurate inseason assessment could be made of Kenai River king salmon run strength. This strategy included opening the Upper Subdistrict set gillnet fishery during regular Monday and Thursday fishing periods, but limiting additional fishing to times when sockeye salmon were abundant on the east side beaches. The Upper Subdistrict set gillnet fishery was closed on July 27 until the season ended on August 15.

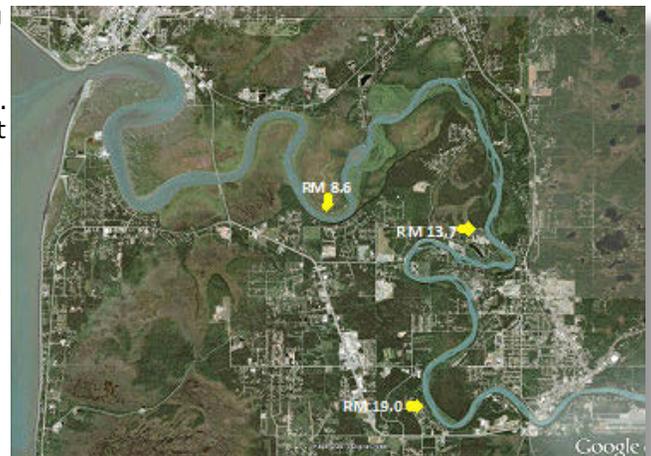
Retention of king salmon was not allowed in the personal use fishery.

## **Q23: How many late-run Kenai River king salmon were harvested inriver in 2013?**

A23: Inriver sport fishing mortality was 1,620 late-run Kenai River king salmon, including 1,578 fish harvested and 42 fish from release mortality.

## **Q24: How many late-run Kenai River king salmon were harvested commercially in 2013?**

A24: An estimated 2,256 late-run Kenai River king salmon were harvested in the Upper Subdistrict set gillnet commercial fishery in 2013. This estimate is based on the total harvest of king salmon in the fishery and genetic stock identification data collected from harvested king salmon. A total of 426 king salmon were harvested in the Central District drift gillnet commercial fishery.



*Sonar locations on the Kenai River*

## FUTURE PLANS FOR ESTIMATING KENAI RIVER KING SALMON ESCAPEMENT

### **Q25: Did ADF&G conduct a full escapement goal review for the early and late Kenai River king salmon runs after the 2013 season?**

A25: No. There was no need to update the escapement goal as the current interim goals were just established in March of 2013 after an independent technical peer-review. These interim escapement goals are matched to the current River Mile 8.6 assessment, from which we will be managing the fishery in 2014.

### **Q26: Which tools will ADF&G use in 2014 to manage sport and commercial fisheries in-season?**

A26: During 2014, ADF&G will look at all indicators of run strength. However, the sonar at River Mile 8.6 will remain the primary tool to determine abundance and to implement strategies outlined in management plans to achieve the escapement goals established for each run.

The newly discovered shortcomings of the RM 8.6 assessment are primarily limited to small fish, estimates of which are based on mid-river netting. Improvements to the netting program are being planned for 2014; these include standardized nearshore netting to better characterize the numbers of small versus large king salmon entering the river.

# KENAI RIVER KING SALMON RESEARCH

## Q27: In addition to improving the assessment, what research is ADF&G doing to increase understanding of Kenai River king salmon runs?

A27: ADF&G has improved the genetic baseline for Kenai River king salmon populations. Through increased sampling of smaller tributary populations and mainstem spawning populations, we can now discriminate between major tributary and mainstem spawning populations, which aids in reconstructing runs. This project is complete.

ADF&G has been combining an inriver netting project with genetic stock identification techniques to estimate inriver abundance of both runs independent of the sonar. This project includes the operation of weirs (currently funded by USFWS) at major tributaries of the Kenai River where most of the early-run spawns. This is an ongoing project.

ADF&G is conducting a comprehensive coded wire tag recovery and genetic sampling of marine harvests in Central and Lower



Cook Inlet. This sampling includes the Homer, Deep Creek, and Ninilchik recreational fisheries (beginning in 2014); and the Upper Subdistrict set gillnet commercial fishery (began in 2010). This will allow us to determine the stock-specific harvest of both runs of Kenai River king salmon in these marine harvests. This is an ongoing project.

A contractor completed a sonic tagging study to determine marine migration patterns of Chinook salmon in Central Cook Inlet.

ADF&G is conducting research focused on genetic stock identification of inriver sport harvests of Chinook salmon. Genetic sampling of the inriver harvest, especially at critical times (end of June - beginning of July) and places (upstream of Soldotna bridge) will allow us to better discriminate between inriver harvests of early versus late-run fish. This is an ongoing project.

To generate an estimate of Kenai juvenile abundance ADF&G is planning to conduct coded wire tag releases and adult recoveries with genetic sampling to estimate smolt abundance by run. This project will start in 2015.



ADF&G has begun the implementation of a Local and Traditional Knowledge project to look at historic trends in Kenai River Chinook abundance and use. This project is scheduled to be conducted in 2014 and 2015.

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