

**NUSHAGAK RIVER KING SALMON – STOCK STATUS AND
ACTION PLAN**

ALASKA DEPARTMENT OF FISH AND GAME

**REPORT TO THE ALASKA BOARD OF FISHERIES
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NUSHAGAK RIVER KING SALMON STOCK STATUS AND ACTION PLAN 2022

INTRODUCTION

SYNOPSIS

In October of 2022, the Alaska Department of Fish and Game recommended Nushagak River king salmon as a stock of management concern at the Bristol Bay area Alaska Board of Fisheries (board) meeting in November 2022. This recommendation was based on the guidelines established in the Policy for Management of Sustainable Salmon Fisheries (SSFP; 5 AAC 39.222). The SSFP states that “management concern means a concern arising from the chronic inability, despite use of specific management measures, to maintain escapements for a salmon stock within the bounds of the SEG, BEG, OEG, or other specific management objectives for the fishery...”. Chronic inability is further defined in the SSFP as “...the continuing or anticipated inability to meet escapement thresholds over a four to five-year period...” based on the generation time of most salmon species.

The basis for recommending the stock of concern is the failure to meet the inriver run goal of 95,000 Nushagak River king salmon in five of the past six years. This is despite specific management measures taken by the department to reduce harvest in the sport and commercial fisheries since 2017. The sustainable escapement goal (SEG) of 55,000–120,000 was also likely not met in at least three of the last six years (Table 1). There is uncertainty over whether escapement goals were met in two other years (2019 and 2021) because the lower bound of the SEG (55,000 fish) is within the range of the uncertainty of the primary assessment method (sonar) used to estimate the inriver run. The inriver goal (95,000) is higher than the lower bound of the escapement goal (55,000), however, and this inriver goal was likely not met in five years. Therefore, the inriver goal is the primary criterion department staff used to find a chronic inability to achieve a specified management objective.

This action plan summarizes historical assessment of annual run size and describes the existing regulations and emergency order (EO) authority that the department follows to manage the Nushagak River king salmon return. Options are then presented for potential management actions for the commercial, sport, and subsistence fisheries, and research projects for the Nushagak River king salmon stock. It also includes proposed criteria for future removal of the stock of concern status.

HABITAT AND SETTING

The Nushagak and the Wood Rivers are two large, adjacent river drainages in southwestern Alaska that each flow into Nushagak Bay, an inlet of Bristol Bay, just east of the village of Dillingham, Alaska (Figure 1). The Nushagak River drains 13,400 square miles and has an average discharge of 35,315 cfs, making it the fifth largest river, by discharge, in Alaska. The Nushagak Drainage has two main tributaries: the Nuyakuk River, which drains Tikchik Lakes and enters from the west; and the Mulchatna River, which flows into the Nushagak River from the east. The Wood River is smaller than the Nushagak, with a 1,100 square mile drainage and an average

discharge of 4,800 cfs. The Wood River is marked by five large, oligotrophic lakes that form the Wood-Tikchik Lakes and serve as sockeye salmon rearing habitat. Both watersheds are remote, with no roads except in local villages and towns; habitat is generally considered pristine, with little industrial development.

All five species of Pacific salmon in Alaska return to both the Nushagak and Wood Rivers. Salmon returning to both rivers pass through the Nushagak District, where commercial gillnetters and setnetters may harvest a mixed run of fish bound for either or both rivers.

The Nushagak River is the largest king salmon producer in Bristol Bay; from 2002 through 2021, average run size was 157,792 fish and average escapement was 105,192 fish (Table 1).

STOCK ASSESSMENT AND ESCAPEMENT GOAL HISTORY

Stock Assessment and Run Timing

The department has assessed king salmon on the Nushagak River since the mid-1960s, using a variety of methods. From the mid-1960s to the late 1970s the department estimated escapement of Nushagak River king salmon using various combinations of tower counts and/or aerial surveys (Nelson 1987). By the mid-1990s the department began assessing king salmon escapement with a sonar project at Portage Creek (Figure 1). Aerial surveys were discontinued in 1995, and king salmon passage was assessed only by Bendix sonar. In the early 2000s, Bendix sonar technology was becoming increasingly less reliable and harder to service, and in 2005 the department began transitioning the Nushagak sonar project to Sound Metrics technology (i.e., DIDSON and ARIS). During this transition, the department realized the estimates based on Bendix sonar were smaller than estimates based on DIDSON sonar. A Bendix-DIDSON conversion study was undertaken in 2011 to address this issue (Buck *et al.* 2012). Through this report the department converted all previous estimates of abundance into DIDSON-equivalent numbers. Numbers from this report may therefore not match prior ones (such as Annual Management Reports).

King salmon arrive at the Nushagak District earlier than sockeye salmon, but there is substantial overlap in their run timing from late June through mid-July. King salmon pass through the district from early June to late July; the middle 50% of the run (i.e., the 25th-75th percentiles) is from June 19 through July 3. Sockeye salmon pass through from mid-June to late July; the middle 50% is from July 1 through July 10 (Figure 2). The best run timing data come from Portage Creek sonar (king and sockeye salmon) and from District harvests (sockeye salmon only). It takes salmon approximately two days to travel from the District to the sonar site (Figure 1).

Escapement Goals and Inriver Goal

A drainage-wide sustainable escapement goal (SEG) for Nushagak River king salmon was established by the department in 2007 and revised in 2012 to the current SEG range of 55,000–120,000 fish (Fair *et al.* 2012). This SEG was based on the historical sonar counts and assumed that the annual king salmon sonar count was a complete count (i.e., a census) of the entire run. However, we now know the Nushagak River sonar project only provides an index (i.e., a partial count) because the sonar only ensonifies part of the river channel. Results from two different studies (2011–2014 and 2014–2016) indicate the sonar currently undercounts fish by 19% to

65% (Maxwell et al. 2020; Central Region Research Group, ADF&G, Division of Commercial Fisheries, Soldotna).

In the mid-1990s, the board also established an inriver goal of 95,000 for king salmon (5 AAC 06.361). This goal is made up of the following components:

- A. A biological escapement goal of 55,000 – 120,000 fish;
- B. A reasonable opportunity for subsistence harvest of king salmon; and
- C. A king salmon sport fishery guideline harvest level of 5,000 fish, 20 inches or greater in length.

From 1966 through 2022, Nushagak River king salmon escapement ranged from a low of 39,926 fish (preliminary) in 2022 to a high of 331,270 fish in 1983 (Table 1). During the six years from 2011 through 2016, annual escapements averaged 107,704 king salmon. After 2016, there was a decline in productivity, as measured both by total harvest and escapement. During the next six years, from 2017 – 2022 (the recent period of reduced production), annual escapements decreased to an average of 52,742 fish. The decline in escapement was mirrored by a decrease in total harvest (sport, subsistence, and commercial combined), which fell from an average of 41,965 (2011–2016) to 35,533 fish (2017–2021). Nushagak River king salmon failed to achieve the inriver goal of 95,000 king salmon in five of the last six years and has likely failed to meet the SEG of 55,000–120,000 in three or more years in the last six (Figure 3).

HARVEST MANAGEMENT

Nushagak District salmon fisheries are regulated by four different management plans that all can interact with each other across species in both the Nushagak and Wood Rivers. Notably, king salmon can be harvested in the Nushagak District in both a directed king salmon fishery and in a sockeye salmon fishery that incidentally harvests king salmon due to overlapping run timing. Restrictions in the sockeye salmon fishery to reduce king salmon harvest can thus also reduce harvest of sockeye salmon. Management is complicated by many factors, as summarized in the following list:

- A. The Nushagak-Mulchatna King Salmon Management Plan (5 AAC 06.361). Among other things, this establishes the Inriver Goal, sets various triggers based on inseason run projections to the Nushagak and Wood Rivers, and affects management of sockeye and king salmon;
- B. The sockeye salmon management plan (5 AAC 06.367);
- C. The coho salmon management plan (5 AAC 06.368), which sets goals for Nushagak River coho salmon, and establishes triggers;
- D. The Wood River Special Harvest Area plan (5 AAC 06.358), which establishes criteria for opening the Wood River Special Harvest Area (WRSHA) based on inseason counts of Nushagak River coho and sockeye salmon, and Wood River sockeye salmon. Essentially, this plan allows excess sockeye salmon to be harvested in the WRSHA at times when the Nushagak District is restricted to conserve Nushagak River stocks of coho and sockeye salmon.

ACTION PLAN FOR ADDRESSING STOCK OF CONCERN**COMMERCIAL FISHERIES ACTIONS****Past Management Actions**

Past management actions to conserve king salmon have focused on 1) closing the directed king salmon fishery, and 2) reducing incidental catch of king salmon in the sockeye salmon fishery by reducing time and area. Restrictions have usually been early in the sockeye salmon run when king salmon are more abundant. In years when sockeye salmon runs are very large and king salmon runs are small, this means harvesting far fewer sockeye salmon than are available and possibly exceeding the escapement goals into the Wood and Nushagak Rivers; in some years, this may also be overly cautious because king salmon are also being underestimated at the sonar site, as described above. An improved method to assess king salmon would thus give a more accurate estimate of king salmon escapement, while allowing sockeye salmon management to be more informed.

King salmon conservation measures implemented since runs began to decline in 2017 are listed below:

2017

- No openings were allowed in the directed commercial king salmon fishery;
- Commercial sockeye salmon fishery was delayed past the 100,000 fish trigger until Wood River sockeye salmon escapement exceeded 157,000 fish.
- Sockeye salmon escapement in Nushagak and Wood Rivers as a result of delayed commercial fishing opening was estimated to be 1,088,000 fish.
- Management result: king salmon harvest of 33,400 fish and an escapement index of 56,500 fish.

2018

- No openings were allowed in the directed commercial king salmon fishery.
- No other actions taken.
- Management result: king salmon harvest of 36,600 and an escapement index of 97,200 fish.

2019

- There were no openings allowed in the directed commercial king salmon fishery;
- Commercial sockeye salmon fishery was delayed past the 100,000 fish trigger until Wood River sockeye salmon escapement exceeded 110,000 fish.
- Sockeye salmon escapement in Nushagak and Wood Rivers as a result of delayed commercial fishing opening was estimated to be 318,000 fish.
- Management result: king salmon harvest of 22,700 fish and an escapement index of 47,900 fish.

2020

- There were no openings allowed in the directed commercial king salmon fishery;
- Commercial sockeye salmon fishery was delayed past the 100,000 fish trigger until Wood River sockeye salmon escapement exceeded 126,800 fish.
- Sockeye salmon escapement in Nushagak and Wood Rivers as a result of delayed commercial fishing opening was estimated to be 412,000 fish.
- Management result: king salmon harvest of 7,500 fish and an escapement index of 42,700 fish.

2021

- There were no openings in the directed commercial king salmon fishery;
- The commercial sockeye salmon fishery was delayed until Wood River sockeye salmon escapement exceeded 110,400 fish;
- Sockeye salmon escapement in Nushagak and Wood Rivers as a result of delayed commercial fishing opening was estimated to be 1,155,000 fish.
- Management result: king salmon harvest of 4,300 fish and escapement index of 55,200 fish.

2022

- There were no openings in the directed commercial king salmon fishery;
- Commercial sockeye salmon fishery was delayed past the 100,000 fish trigger until Wood River sockeye salmon escapement exceeded 146,900 fish.
- Sockeye salmon escapement in Nushagak and Wood Rivers as a result of delayed commercial fishing opening was estimated to be 1,145,000 fish.
- Management result: king salmon harvest of 5,300 fish and escapement index of 44,200 fish.

Proposed Management Actions

Action #1: Status Quo

Specific actions: Manage according to current regulations.

Background: Management in the Nushagak District is largely guided by the *Nushagak-Mulchatna King Salmon Management Plan*. However, the department has been operating well outside of the management plan triggers in response to large sockeye returns and weak king salmon runs. Production levels of both sockeye and king salmon have changed since the time when the management plan was developed in the 1990's. Sockeye salmon runs (Wood and Nushagak combined) tripled from an average of 5.4 million (1988-1997) to a recent 10-year average of 16.7 million (2013-2022). Conversely, king salmon productivity has declined by more than 30% since 2008 in both the Nushagak River and statewide. Nushagak king salmon average total run was more than 220,000 (1988-1997) and declined to a recent average of 117,000 fish (2013-2022). This large sockeye salmon and weak king salmon production regime creates conflicting Nushagak District fishery management goals. Following plan triggers to manage to stay within SEG goal range for

large sockeye salmon runs conflicts with limiting king salmon harvest to achieve their goals. Management of these conflicting goals is complicated by the early season overlap of king and sockeye salmon run timing (Figure 3). This is further aggravated by large sockeye returns that reach the Wood River 100,000 trigger earlier into the king salmon run timing (Figure 4). This triggers commercial fishing when king salmon are more likely to be in the fishing district and susceptible to harvest. In recent years, early season commercial fishing in the Nushagak District was delayed well past the regulatory trigger of 100,000 Wood River sockeye salmon (see above, *past management actions*). This results in large numbers of sockeye going unharvested into both the Wood and Nushagak systems. Sockeye escapement goals in both systems have been exceeded in many recent years (Table 1). Despite conservative management, king salmon counts were below the inriver goal for five of the last six years. Attempting to keep abundant sockeye salmon escapement within SEG ranges requires liberal management, exactly opposite of what weak king salmon management requires.

Benefits: Allows discretionary management to balance inseason indicators to achieve both sockeye and king salmon goals.

Detriments: Discretion on conflicting goals without addition prescriptive regulatory guidance sets management up for failure to achieve one or both goals (keep sockeye escapement within SEG range vs meet king salmon SEG and inriver goals).

Action #2: Develop new regulations that would allow early season opening of the Wood River Special Harvest Area (WRSHA).

Specific Action: Allow the Wood River Special Harvest Area (WRSHA) to be opened for commercial fishing to harvest Wood River sockeye salmon while the Nushagak District remains closed to allow king salmon to pass through the district into the Nushagak River.

Background: The WRSHA was originally created to allow fishing opportunity on Wood River sockeye salmon while protecting Nushagak River coho salmon. In 1997 it was modified to again provide harvest opportunity on strong Wood River sockeye salmon returns while protecting weak Nushagak River sockeye salmon returns. The last several years the department has delayed fishing in the commercial district to protect weak Nushagak River king salmon returns. Delaying fishing results in managers having to fish harder once fishing starts in an attempt to control Wood River escapement. This has increased foregone harvest of Wood River sockeye salmon and resulted in early openings of the WRSHA under the surplus escapement provision. Adding language to allow use of the WRSHA to protect Nushagak River king salmon would potentially delay opening the commercial fishing district 1-4 days. Triggers should be established to guide use of this area if this action is implemented.

Benefits: These provisions will allow for early season harvest of Wood River sockeye salmon while reducing king salmon commercial harvest. This will help control Wood River sockeye salmon escapement when the commercial district is closed to protect Nushagak River king salmon.

Detriments: Fishing in the WRSHA disadvantages many users because it has limited area, is challenging to access, and not all users can fish there. These provisions will also shift effort from the Nushagak District to other Bristol Bay Districts. This will increase the likelihood of forgone sockeye salmon harvest for the Nushagak River.

Action #3: Create an Optimum Escapement Goal for Nushagak River sockeye salmon.

Specific Action: For example, establish an OEG as follows

When Nushagak River king salmon are not projecting to meet the inriver goal by June 25 and

- 1) When Nushagak River sockeye salmon forecast is 3 million fish or less the department shall manage for a Nushagak River sockeye salmon escapement OEG of 370,000 to 1.5 million.
- 2) When Nushagak River sockeye salmon forecast is 3-6 million fish the department shall manage for a Nushagak River sockeye salmon escapement OEG of 370,000 to 2.4 million.
- 3) When the Nushagak River sockeye salmon forecast is greater than 6 million fish the department shall manage for a Nushagak River sockeye salmon escapement OEG of 370,000 to 3.5 million.

Background: The creation of an OEG for Nushagak River sockeye salmon gives additional guidance to managers to restrict early season fishing. The tiered OEG presented here seeks balance between allowing for restrictive actions to protect king salmon while at the same time setting upper guidelines for controlling sockeye salmon escapement.

Benefits: An OEG would provide guidance for incrementally more conservative management steps gauged to the forecast sockeye salmon run size. Setting OEG goals that are higher than the upper end of the SEG will allow more conservative management and less fishing. Less fishing, especially early season, will reduce king salmon commercial harvest. A tiered OEG will provide a sliding scale of implementation to reduce the potential for sockeye salmon over escapement as sockeye salmon run size increases while providing for king salmon conservation.

Detriments: This would forego harvest on sockeye salmon resulting in lost economic opportunity. Conservative management does not necessarily mean that king salmon goals will be achieved. Current goals may be unattainable given the lower productivity of this stock compared to the productivity levels that were used to establish the goals.

Action #4: Reduce net mesh size and/or net length.

Specific Action: Develop new regulations to provide authority to reduce mesh size and net length to reduce king salmon commercial harvest.

1. 5 AAC 06.331 Gillnet specifications and operations (a)(1) in the Nushagak District gillnet mesh size may not exceed 4.75 inches for the conservation of king salmon from June 1 until July 15 unless changed by emergency order.
2. In the Nushagak District, the drift and set gillnet length will be determined by commissioner.

Background: Current regulation for gillnet specifications is mesh size must be no greater than 5.5 inches. A significant portion of fishery participants already have nets that have 5-inch mesh or less. Mesh size is important because of the size selective harvest of gillnets. Recently, Bristol Bay sockeye salmon are smaller than historical averages (Figure 5). This is especially important in the mixed stock Nushagak District fishery where the Wood River is dominated by smaller 2-ocean fish. Work done by BBSRI on Nushagak District Test Fish suggests that reducing mesh size to 4.75-inch would increase harvest rate of these smaller fish. This would reduce the time needed to harvest sockeye salmon and increase the harvest of smaller 2-ocean fish. While an incremental reduction to 4.75-inch has been shown to increase harvest rate on sockeye salmon it is not expected that king salmon harvest would be reduced by this incremental mesh size reduction. Currently drift gillnet length regulation is 150 fathoms for single permit operator and 200 fathoms for dual permit operators. Set gill net length is 50 fathoms. Reducing net length would reduce harvest of both sockeye and king salmon.

Benefits: Reducing mesh size to 4.75-inch may increase annual sockeye salmon harvest, reduce chances of sockeye salmon overescapement, reduce commercial fishing time for sockeye salmon because the fleet is more efficient, and fewer/shorter openers translates into less king salmon harvest. Shorter nets would result in less total gear in the water and reduced harvest of king salmon.

Detriments: Participants that do not have 4.75-inch mesh nets will be required to either buy new nets or fish in other districts where smaller mesh size is not required. Shorter net length may decrease total sockeye salmon harvest making it potentially more difficult to keep sockeye salmon escapement within SEG bounds. Depending on how much net length reduction is required participants may need to cut their nets. Smaller mesh size and shorter lengths does not necessarily mean that sockeye or king salmon goals will be achieved.

Action #5: Reduce fishing time and area. Reduce king salmon commercial harvest potential.

Specific Action:

AREA REDUCTION – for example, use current EO authority to reduce fishing area for the drift gillnet fleet by closing all waters of the Nushagak District north of 58 44.80 N. (Figure 6). Allow set gillnets to operate in their traditional areas. Set gillnet fishing will be restricted by time to achieve allocation targets. After July 1, when the majority of king salmon migration through the district is complete, the reduced area will no longer be implemented.

TIME REDUCTION – For example, drift gillnet fishing time will be restricted to no more than six hours per tide cycle and shall open one hour before high tide. This option would be used in

conjunction with triggers for escapement on the Wood and Nushagak Rivers. Set gillnet fishing will be restricted by time to achieve allocation targets. After July 1 reduced time will no longer be mandatory.

Background: Time and area are two primary harvest control tools in commercial fisheries management. A reduction of time or area reduces harvest potential. King salmon harvest will be reduced when nets are in the water for less time. Reduced time and/or area will likely result in less drift gillnet boats fishing in the district as participants would go to other less restricted districts. Reducing the area of the commercial fishing district also reduces the amount of time that migrating fish are in the area where they can be caught. It is not known exactly how long it takes for migrating salmon to pass through the district. Based on what is known about swim rate a reasonable estimate would be that it takes 12-24 hours to migrate through the commercial fishing district. By reducing the size of the district as proposed above, the time a fish takes to migrate through the district is also reduced.

Benefits: Reduced area and time decreases the time that migrating king salmon would be susceptible to drift gillnet gear.

Detriments: Reduced area could result in a more congested fishery. Reduced time and area may not be able to control sockeye salmon escapement effectively.

Action #6: Close commercial fishing.

Specific Action: Use current EO authority to keep commercial fishing closed in the Nushagak District until July 1, excepting Igushik Section set gillnet.

For example, establish closure trigger options to not open the fishery until 1) king salmon sonar count projections exceed 95,000 inriver goal or 2) close commercial fishing for sockeye salmon until king salmon sonar count projections exceed lower bound of SEG (currently 55,000).

Background: All these options seek to balance the need to protect Nushagak River king salmon and control sockeye salmon escapement. There are trigger numbers or dates in most of these options that can be adjusted to make the options more or less protective of king salmon. This option, again with negotiable triggers, is the most protective of king salmon and provides the least ability to control sockeye salmon escapement. In 2021 and 2022, this option with proposed triggers would probably have resulted in no commercial fishing in the Nushagak District prior to July 1.

Benefits: This will reduce king salmon commercial harvest through 75% of their run timing.

Detriments: This will allow potentially large numbers of sockeye salmon to go unharvested.

Summary Table of Commercial Fishery actions.

| Fishery/Action # | Summary | Specific Action |
|-------------------------|--|--|
| CF/#1 | Status quo. | Continue managing under current regulations. |
| CF/#2 | Develop new regulations to open the WRSHA in early season. | Board action needed. |
| CF/#3 | Create an OEG for Nushagak River sockeye salmon. | Board action needed. |
| CF/#4 | Reduce mesh size and/or net length. | Board action needed. |
| CF/#5 | Reduce time and area to reduce king salmon commercial harvest potential. | EO authority. |
| CF/#6 | Close commercial fishing. | Board Action needed. |

SPORT FISHERIES ACTIONS

Past Management Actions

The commissioner may, by EO, change bag and possession limits and annual limits and alter methods and means in sport fisheries (5 AAC 75.003). These changes may not reduce the allocation of harvest among other user groups. And emergency order may not supersede provisions for increasing or decreasing bag and possession limits or changing methods and means specified in regulatory management plans established by the Alaska Board of Fisheries.

The department has repeatedly used EO authority to reduce harvest of Nushagak River king salmon in the sport fishery and such actions have become more frequent since 2010 with restrictive actions being taken in five of the last six years.

Management measures have been implemented since 2017 as follows:

2017

- Effective June 23, bag and possession limits for fish over 20” reduced to one per day, one in possession. Annual limit reduced to two fish.

2018

- No Action

2019

- Effective July 3, bag and possession limits for fish over 20” reduced to one per day, one in possession. Annual limit reduced to two fish.
- Effective July 10, retention of all king salmon and the use of bait prohibited.

2020

- Effective July 10, bag and possession limits for fish over 20” reduced to one per day, one in possession. Annual limit reduced to two fish.

2021

- Effective June 27, bag and possession limits for fish over 20” reduced to one per day, one in possession. Annual limit reduced to two fish.

2022

- Effective July 7, bag and possession limits for fish over 20” reduced to one per day, one in possession. Annual limit reduced to two fish.
- Effective July 13, retention of all king salmon and the use of bait prohibited.

Proposed Management Actions

Action #1: Status Quo. Inseason sport fishery bag limits reductions and/or prohibitions on retention of Nushagak River drainage king salmon, as in many recent years, are the most restrictive management actions taken by the department. The department will continue to use its EO authority based on the management plan to manage the Nushagak/Mulchatna king salmon stock to achieve the escapement goal and rebuild from the recent period of low productivity.

Specific Action: No board action required, future actions taken would be using existing EO authority to restrict bag limits or methods and means in the Nushagak/Mulchatna king salmon sport fishery, as needed, inseason.

Background: The Nushagak/Mulchatna king salmon sport fishery is open to fishing from May 1 – July 31 in the lower river and from May 1 – July 24 above the confluence of Iowithla River while the upper Nushagak River above the confluence with Harris Creek is closed to fishing for king salmon year-round. The king salmon bag and possession limit for fish over 20” in length is two per day with two in possession, only one of which may be over 28”. After taking a bag limit of king salmon 20” or longer you may only use unbaited, single-hook, artificial lures or flies. There is an annual limit of four fish over 20” in length taken from the entire Nushagak River drainage. All harvested king salmon over 20” in length must be recorded. The bag and possession limit for king salmon less than 20” in length is five per day, five in possession.

Benefits: The benefits of providing the department the flexibility to manage Nushagak River king salmon stocks inseason with EO authority are timely and meaningful management actions based on current run strength. The department has, and has used, EO authority to manage the sport fishery to achieve established escapement goals. As the Nushagak River king salmon run rebuilds, the department would have the ability to return to more liberal bag limits and provide angler opportunity prior to the next board meeting.

Detriments: Since inseason actions are based on current data that changes the run projection daily and are implemented in response to run strength, there is less predictability for anglers on when particular management actions may be used, or which actions may be taken. Most anglers traveling to the Nushagak River are with a guide service and are coming from out of the area and plan their trips up to 18 months in advance.

Action #2: Reduce bag limit. Adopt regulation that would reduce bag and possession limits for fish over 20” in length and or reduce the annual limit for fish over 20”.

Specific Action: Take board action to create new regulations for the Nushagak River drainage king salmon sport fishery and define under what condition(s) sport fishing regulations could be liberalized.

Background: The Nushagak/Mulchatna king salmon sport fishery is open to fishing from May 1 – July 31 in the lower river and from May 1 – July 24 above the confluence of Iowithla River while the upper Nushagak River above the confluence with Harris Creek is closed to fishing for king salmon year-round. The king salmon bag and possession limit for fish over 20” in length is two per day with two in possession, only one of which may be over 28”. After taking a bag limit of king salmon 20” or longer you may only use unbaited, single-hook, artificial lures or flies. There is an annual limit of four fish over 20” in length taken from the entire Nushagak River drainage. All harvested king salmon over 20” in length must be recorded. The bag and possession limit for king salmon less than 20” in length is five per day, five in possession.

Benefits: Sport fishery restrictions in regulation would provide the most stable situation for anglers, most of whom are traveling from out of the area to the Nushagak River with a guide service, nearly all of which plan their trips 6 – 18 months in advance. Anglers traveling to the Nushagak expect to harvest king salmon and a reduced bag and annual limit would still provide this opportunity.

Detriments: Restricting the fishery by regulation could limit the department’s ability to react to run strength inseason in order to liberalize the fishery if inseason run strength was better than anticipated and could not be addressed until the next scheduled Bristol Bay board meeting.

Action #3: Adopt a regulation that would create a Nushagak River drainage king salmon nonretention (catch-and-release) fishery and prohibit the use of bait.

Specific Action: Take board action to create new regulations for the Nushagak River king salmon sport fishery and define under what condition(s) the retention of king salmon and use of bait in the sport fishery would be allowed.

Background: The Nushagak/Mulchatna king salmon sport fishery is open to fishing from May 1 – July 31 in the lower river and from May 1 – July 24 above the confluence of Iowithla River while the upper Nushagak River above the confluence with Harris Creek is closed to fishing for king salmon year-round. The king salmon bag and possession limit for fish over 20” in length is

two per day with two in possession, only one of which may be over 28". After taking a bag limit of king salmon 20" or longer you may only use unbaited, single-hook, artificial lures or flies. There is an annual limit of four fish over 20" in length taken from the entire Nushagak River drainage. All harvested king salmon over 20" in length must be recorded. The bag and possession limit for king salmon less than 20" in length is five per day, five in possession.

Benefits: Sport fishery restrictions in regulation would provide the most stable situation for anglers, most of whom are traveling from out of the area to the Nushagak River with a guide service, nearly all of which plan their trips 6 – 18 months in advance. Many anglers traveling to the Nushagak River expect to harvest king salmon. A nonretention fishery would eliminate harvest opportunity while still providing catch-and-release fishing opportunity with minimal impact to the run.

Detriments: Restricting the fishery by regulation could limit the department's ability to react to run strength inseason in order to liberalize the fishery if inseason run strength was better than anticipated and could not be addressed until the next scheduled Bristol Bay board meeting.

Action #4: Adopt a regulation that would restrict time and area for king salmon sport fishing in the Nushagak River Drainage.

Specific Action: Take board action to create new regulations for the Nushagak River king salmon sport fishery restricting open season dates, days of the week open to fishing, specific area closures, or any combination of these actions and define under what condition(s) these measures would be allowed to be liberalized.

Background: The Nushagak/Mulchatna king salmon sport fishery is open to fishing from May 1 – July 31 in the lower river and from May 1 – July 24 above the confluence of Iowithla River while the upper Nushagak River above the confluence with Harris Creek is closed to fishing for king salmon year-round. The king salmon bag and possession limit for fish over 20" in length is two per day with two in possession, only one of which may be over 28". After taking a bag limit of king salmon 20" or longer you may only use unbaited, single-hook, artificial lures or flies. There is an annual limit of four fish over 20" in length taken from the entire Nushagak River drainage. All harvested king salmon over 20" in length must be recorded. The bag and possession limit for king salmon less than 20" in length is five per day, five in possession.

Benefits: Sport fishery restrictions in regulation would provide the most stable situation for anglers, most of whom are traveling from out of the area to the Nushagak River with a guide service, nearly all of which plan their trips 6 – 18 months in advance. Time and area restrictions in regulation would provide predictable restrictive measures that anglers and operators could plan for and adapt to.

Detriments: Restricting the fishery by regulation could limit the department’s ability to react to run strength inseason in order to liberalize the fishery if inseason run strength was better than anticipated and could not be addressed until the next scheduled Bristol Bay board meeting.

Action #5: Adopt a regulation that would close the king salmon sport fishery in the Nushagak River drainage and prohibit the use of bait in the drainage.

Specific Action: Take board action to create new regulations closing the Nushagak River king salmon sport fishery and prohibiting the use of bait. The board would also need to define under what condition(s) the sport fishery could be opened and to what extent, as well as whether to allow for use of bait in the sport fishery.

Background: The Nushagak-Mulchatna king salmon sport fishery is open to fishing from May 1 – July 31 in the lower river and from May 1 – July 24 above the confluence of Iowithla River while the upper Nushagak River above the confluence with Harris Creek is closed to fishing for king salmon year-round. The king salmon bag and possession limit for fish over 20” in length is two per day with two in possession, only one of which may be over 28”. After taking a bag limit of king salmon 20” or longer you may only use unbaited, single-hook, artificial lures or flies. There is an annual limit of four fish over 20” in length taken from the entire Nushagak River drainage. All harvested king salmon over 20” in length must be recorded. The bag and possession limit for king salmon less than 20” in length is five per day, five in possession.

Benefits: A fishery closure in regulation would eliminate anglers targeting king salmon in the Nushagak River and reduce catch-and-release mortality of king salmon.

Detriments: Closing the fishery by regulation would limit the department’s ability to provide king salmon sport fishing opportunity if king salmon escapement goals were achieved and there was harvestable surplus and could not be addressed until the next scheduled Bristol Bay board meeting. It is unknown what reduction of hooking mortality would occur from a complete king salmon fishery closure in the Nushagak River since sport fishing effort on the river is primarily focused on king salmon and may drop dramatically as a result of closure. Effort targeting other species may or may not result in incidental catch-and-release of king salmon, however the level to which this may occur is unknown since effort for other species is often a result of king salmon anglers switching focus after king salmon bag limits have been reached. In the absence of king salmon anglers this type of effort would be eliminated, and it is unknown how many anglers would travel to the Nushagak River to target other species in the absence of opportunity to fish for king salmon.

Summary Table of Sport Fishery actions.

| Fishery/Action # | Summary | Specific Action |
|-------------------------|----------------------------------|------------------------|
| SF/#1 | Status quo. EO authority. | No Action. |
| SF/#2 | Reduce bag and possession limit. | Board action needed. |
| SF/#3 | Create a nonretention fishery. | Board action needed. |

| | | |
|-------|--|----------------------|
| SF/#4 | Create new time and area regulations. | Board action needed. |
| SF/#5 | Close the king salmon fishery and prohibit bait. | Board action needed. |

PAST SUBSISTENCE FISHERY MANAGEMENT

There are no limits on subsistence harvest of king salmon in the Nushagak District. There were no management actions taken to reduce subsistence harvest of king salmon between 2017 and 2022. Subsistence harvest is the highest priority use and is not restricted until the sport fishery has been closed. Because the sport fishery was not closed, the subsistence fishery was not restricted.

SUBSISTENCE FISHERIES

Alaska subsistence statute 16.05.258 states that if the harvestable portion of the stock is sufficient to provide for subsistence uses, but no other consumptive uses, the board shall adopt regulations that eliminate other consumptive uses in order to provide a reasonable opportunity for subsistence uses.

The board made a positive customary and traditional use finding (C&T) for all salmon in Bristol Bay with an amount reasonably necessary (ANS) for subsistence of 157,000–172,171, including 55,000–65,000 sockeye salmon in the Kvichak River drainage. The board has not made a specific ANS finding for king salmon in the Nushagak River drainage or elsewhere in Bristol Bay (5 AAC 01.336(b)(1)).

The ANS for Bristol Bay, established by the board through an administrative finding in 1993, has not been met since 1994. The separate ANS finding for sockeye salmon in the Kvichak River drainage was imbedded into the Bristol Bay ANS in 2001 when the board classified that stock as a stock of concern. Alaska’s subsistence statute provides that the boards “determine the amount of the harvestable portion [of the stock or population] that is reasonably necessary for subsistence uses.” Furthermore, the boards are to “adopt regulations that provide a reasonable opportunity for subsistence uses.” “Reasonable opportunity” is defined as “an opportunity, as determined by the appropriate board, that allows a subsistence user to participate in a subsistence hunt or fishery that provides a normally diligent participant with a reasonable expectation of success of taking of fish or game” (AS 16.05.258(f)).

The ANS is one guideline used by the board to evaluate if reasonable opportunity is being provided under existing regulations and to assist them in the allocation of harvest between subsistence and nonsubsistence uses of fish. It is typically presented as a range based on historical harvest and is developed with public input. The ANS is intended to reflect customary and traditional levels of harvests as documented by the best available information. The ANS is neither a guarantee of harvest, a quota, or a cap; nor is it an inseason management tool. ANS determinations are made for a fish stock or assemblage of stocks; they are not community-specific.

If the board recommends developing a Bristol Bay king salmon- specific or a Nushagak River king salmon-specific ANS, the department will develop ANS options for consideration by the board for the next Bristol Bay board meeting.

Under the existing *Nushagak-Mulchatna King Salmon Management Plan*, the commissioner shall establish, by emergency order, fishing periods during which the time or area is reduced for the inriver king salmon subsistence fishery in the Nushagak River (5 AAC 06.361(e)(3)).

In 2019, a total of 1,106 subsistence permits were issued for the Bristol Bay Management Area; of those, 860 (78%) were returned. The largest number of permits were issued for the Nushagak drainage (620 permits). Bristol Bay king salmon harvest totals were 11,488 with the largest harvest from the Nushagak drainage, including the bay, of 10,129 king salmon (Table 1).

In Bristol Bay, the overall subsistence king salmon harvest represents 12% of the salmon harvest. While small relative to sockeye (78%), Nushagak River king salmon are a well-documented and important part of subsistence in in Bristol Bay.

The following actions include potential reductions to subsistence harvest of Nushagak River king salmon. If the board chooses to take action to reduce the subsistence harvest, it may wish to consider prioritizing actions in the subsistence fishery after actions taken in the other consumptive uses of Nushagak River king salmon.

The following action items are contingent on closures for other consumptive uses due to poor king salmon runs as described earlier in this document.

Proposed Management Actions

Action #1: Status Quo

Specific action: Current regulations. No action in the subsistence fishery until sport fishery is closed.

Background: There are no limits on subsistence harvest of king salmon in the Nushagak District and fishing is open 24 hours per day 7 days per week in the defined subsistence areas.

Benefits: Subsistence harvest consistent with current regulations provides clarity and consistency to subsistence harvesters. It does not increase cost or user conflict.

Detriments: No change to harvest may contribute to further king salmon decline by an unknown, but likely minimal, amount.

Action #2: A harvest limit on Nushagak River king salmon in the subsistence fishery

Specific action: Limit the number of king salmon that can be harvested per permit holder that would meet management needs while providing some opportunity.

Background: Based on the most recent available subsistence harvest data (2015–2019), the average annual king salmon harvest for the Nushagak Drainage was 12,433 fish. The average number of permits issued was 601 per year and average number of king salmon harvested per permit ranged from 17-26 fish per year (Table 2). Household sizes vary and are not accounted

for in the calculation above, therefore allowing additional king salmon harvest per person residing with the permit holder can account for larger households.

Benefits: May increase the inriver abundance of king salmon.

Detriments: May not provide reasonable opportunity and may create additional harvest pressure on other natural resources.

Action #3: Reduce fishing time by one day increments in the subsistence fishery during king salmon season only.

Specific Action: Reduce fishing days in the Nushagak River drainage including Dillingham beaches and Wood River to Red Bluff and Nushagak Section of the commercial fishing district if conservation concerns warrant reduction of harvest.

Background: In 2018, the board voted to repeal limits to subsistence fishing periods in the Nushagak District and allow salmon to be taken at any time (5 AAC 01.310(d)).

Prior to 2018, the regulations were as follows:

- Seasons: Except as follows, fishing is open at any time
 - In areas open to commercial fishing: from May 1–31 and October 1–31, from 9:00 a.m. Monday to 9:00 a.m. Friday; from June 1–September 30, during open commercial fishing period
 - In the area of the Nushagak District generally called the “Dillingham beaches” from July 2–July 17, three 24-hour periods per week (from 9:00 a.m. Monday to 9:00 a.m. Tuesday, 9:00 a.m. Wednesday to 9:00 a.m. Thursday, and 9:00 a.m. Saturday to 9:00 a.m. Sunday). This area is defined as all waters upstream of a line between a department regulatory marker located two statute miles south of Bradford Point and a department regulatory marker located on Nushagak Point to a department regulatory marker located at Red Bluff on the west shore of the Wood River, and to a department regulatory marker located at Lewis Point on the north shore of the Nushagak River.

Benefits: May increase the inriver abundance of king salmon.

Detriments: Reducing days limits reasonable opportunity for subsistence. This action may also be confusing to subsistence users . For example, with limited time harvesters may be unable to fish because of work schedules and other time-related conflicts.

Action #4: Reduce area open in the subsistence fishery.

Specific action: Inseason, certain areas as determined by the area manager may be closed to subsistence.

Background: (a) In the Nushagak District, the commissioner, by emergency order, shall also provide for subsistence salmon fishing during periods of extended closures. During these emergency order openings,

- (1) set gillnets may not be more than 10 fathoms in length; and
- (2) no set gillnet may be set or operated within 450 feet of another set gillnet;
- (3) repealed 5/15/93.

(c) Repealed 5/31/98.

(d) In all waters upstream of a line from a point approximately two miles south of Bradford Point at 58_ 58.63' N. lat., 158_ 33.62' W. long., to Nushagak Point at 58_ 56.79' N. lat., 158_ 29.53' W. long., to a point at Red Bluff on the west shore of the Wood River at 59_ 09.58' N. lat., 158_ 32.36' W. long., and to Lewis Point on the north shore on the Nushagak River at 58_ 59.46' N. lat., 158_ 05.57' W. long., salmon may be taken at any time.

(e) Repealed 4/16/2016.

(f) Under conditions set out in 5 AAC 06.361(e) the commissioner may, by emergency order, reduce time or area for the Nushagak River king salmon subsistence fishery.

Benefits: May increase the inriver abundance of king salmon.

Detriments: This action may be confusing, create conflict, and limit subsistence opportunity. If Dillingham beach closures occur, this may restrict access for harvesters lacking boat access. If other areas are closed and beaches remain open, user conflict may occur, especially given the existing setback regulation.

Summary Table of Subsistence Fishery actions.

| Fishery/Action #1 | Summary | Specific Action |
|--------------------------|--|--|
| Subsistence #1 | Status quo. Maintain current EO management for subsistence harvest. | Continue using EO authority as needed. |
| Subsistence #2 | A harvest limit on Nushagak River king salmon in the subsistence fishery | Limit the number of king salmon that can be harvested per permit holder that would meet management needs while providing some opportunity. Board Action Required. |
| Subsistence #3 | Reduce fishing time by one day increments in the subsistence fishery during king salmon season only. | Reduce fishing days in the Nushagak River drainage including Dillingham beaches and Wood River to Red Bluff and Nushagak Section of the commercial fishing district if |

| | | |
|----------------|---|---|
| | | conservation concerns warrant reduction of harvest. EO/Board action needed. |
| Subsistence #4 | Reduce area open in the subsistence fishery. | Inseason, certain areas as determined by the area manager may be closed to subsistence. EO/Board action needed. |

RESEARCH AND MONITORING PLAN

CURRENT MONITORING PROJECTS

Current inseason monitoring consists of indexing the daily king salmon run using the sonar counts combined with species apportionment netting at the Portage Creek sonar site. As noted earlier, this sonar site was developed for sockeye salmon assessment and has shortcomings; it does not account for all king salmon migrating upriver each year (Maxwell *et al.* 2020), and the proportion of king salmon counted by the sonar project varies each year (Head and Hamazaki 2022). Counts are especially uncertain in years of high sockeye salmon abundance, when large numbers of sockeye make king salmon apportionment more difficult and king salmon migration is pushed offshore, out of range of sonar and netting. Currently, this is the only source of inseason data used to project king salmon inriver abundance and make management decisions.

Postseason monitoring consists of final sonar counts, harvest estimates from subsistence and sport fisheries, and a renewed aerial survey program. Sonar counts provide a final end-of-season inriver abundance index, which is used as the starting point for estimating final escapement. Sport and subsistence harvests upstream of the sonar site are estimated then subtracted from the sonar index to calculate final escapement. Harvest data are not available until well after the run is over, however, which means the final escapement estimate is not only just an index but is also not usually available until into the next calendar year. Aerial surveys have been conducted in early August each year since 2019, to generate an escapement index independent of the sonar project and to be used as inputs for future run reconstructions. These surveys have been operated annually from 2019 through 2022 during the peak of king salmon spawning. These aerial surveys are scheduled to continue in future years.

KING SALMON MONITORING PROJECT HISTORY

Shortcomings of the king salmon component of the Portage Creek sonar project have been recognized and investigated over the life of the project. Maxwell et al. (2020) found that annually, an average of 57% of the king salmon run migrated outside the sonar beam at Portage Creek each year from 2011 through 2014 and were therefore not counted (annual range = 47% – 65% uncounted). Similarly, a tagging study was conducted from 2014 through 2016 to produce a sonar independent population estimate using mark-recapture methods; this tagging study indicated the Portage Creek sonar project did not count 19% - 24% the adult king salmon passing the sonar (data on file with Central Region Research Group, ADF&G, Division of Commercial

Fisheries, Soldotna). These studies prompted the department to develop a model to combine and weight available information about Nushagak River king salmon abundance (Head and Hamazaki 2022) to produce a scientifically defensible estimate of total run size and escapement rather than the relatively unreliable sonar index count. This model was completed in 2020 but a model-based escapement goal has yet to be developed and therefore Nushagak River king salmon are still being assessed by the sonar assessment project. Therefore, inriver estimates provided here are an index known to have undercounted fish from 19% to 65% annually in recent years.

POTENTIAL FUTURE MONITORING

Inseason information currently unavailable, but that could help with king salmon conservation, would be (1) information on king salmon migration pathways through the fishery to help with area closures, and (2) daily monitoring of sport fishery performance and commercial harvests to provide a qualitative run strength validation of the sonar data. Both would require new monitoring initiatives.

Postseason information that could be useful for king conservation, would be (1) an estimate of king salmon abundance independent of sonar counts and apportionment; (2) an improvement to the sonar and/or (3) an improved method to estimate the fraction of king salmon counted by the sonar, and (4) run reconstruction models to generate better estimates of past and future total run size. All of these would all help improve total run estimates generated to develop escapement goals.

Many of these have been discussed at various times. In 2022, the department released a report outlining the construction of a total run model that incorporates all available data and the uncertainty surrounding each survey methodology to produce scientifically defensible estimates of total run and escapement for Nushagak River king salmon (Head and Hamazaki 2022). In this report the authors put forth recommendations on how to improve model performance and accuracy. The department is investigating the utility of an escapement goal based on the run reconstruction model's estimates of total run and escapement and test this framework as a proof of concept. Pending results, the department may recommend going to a run reconstruction model-based goal at the 2025 board meeting.

Additionally, the department has been communicating with collaborators, mainly the Bristol Bay Science and Research Institute (BBSRI) about ways to improve both inseason and postseason assessments of Nushagak River king salmon. Preliminary research and monitoring ideas include generating independent estimates of total abundance, improving age, sex, and length (ASL) datasets from both harvest and escapement, improving the sonar apportionment program, and generating inseason estimates of harvest.

CONDITIONS FOR DELISTING A STOCK OF CONCERN

The *Policy for the Management of Sustainable Salmon Fisheries* defines “management concern” as “a concern arising from a chronic inability, despite the use of specific management measures, to maintain escapements for a salmon stock within the bounds of the SEG, BEG, OEG, or other specified management objectives for the fishery.” The stock of management concern for this

stock is unusual as it is based on ‘other specified management objective’ - the inriver goal and not the escapement goal. Inriver abundance and escapement are estimated from the sonar assessment. That assessment is known to have poor accuracy as a king salmon counting tool with 45-60% of king salmon migrating beyond the area of the river where sonar can reach. Because of that, there is low confidence in the accuracy of the king salmon inriver abundance estimate. Additionally, king salmon production levels have declined. King salmon productivity has declined to the point where the total king salmon run is less than the 95,000 fish inriver goal in four of the past 10 years. In those years even if there had been no harvest by any user groups the inriver goal would remain unattainable. However, the department does not have biological sustainability concerns for this stock because escapement levels have been at or near lower end of SEG given assessment uncertainty. The inriver goal of 95,000 was established during a period of higher king salmon productivity. The 95,000 inriver fish goal includes the 55,000 low end of the SEG and provides for reasonable opportunity for sport and subsistence fisheries with recent 10-year (2013–2022) average harvests of 11,000 subsistence and 6,000 sport king salmon harvest. The board may want to revisit the inriver goal to determine if it remains appropriate for current lower production regime and recognizing the uncertainty associated with the assessment. Because of these issues the department recommends using the lower bound of the escapement goal as the metric for getting out of stock of management concern status. This allows for static inriver subsistence and sport harvests and achieves the SEG but recognizes the lower productivity regime that currently exists.

1. Delisting - If the lower bound of the SEG is met or exceeded in three consecutive years and is expected to meet the goal range in the future years or is met in four out of six consecutive years and is expected to meet the goal range in future years, the department will recommend removing Nushagak River king salmon as a stock of management concern at the first Bristol Bay board meeting after this condition is met.
2. Restrictions - Management restrictions may be relaxed based on king salmon run timing and if catch and harvest data indicate restrictions are no longer needed to ensure the escapement goal is met.
3. Restrictions - If two consecutive years of escapement are near or above the upper bound of the escapement goal range, management restrictions may be relaxed or set aside using EO authority.

Stock status, action plan performance (including information on harvest rate, distribution, and timing in fisheries), and the results of the escapement goal review will be updated in a report to the board at the 2025 Bristol Bay meeting.

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TABLES AND FIGURES

Table 1.—Nushagak River King salmon harvest and escapement, above and below the sonar site, 1966–2022.^a

| Year | Harvests Below Sonar | | | | Harvests Above Sonar | | | | Total Harvest |
|------|----------------------|------------|-------------|-------|------------------------|-------------|-------|----------------------|---------------|
| | Total Run | Commercial | Subsistence | Sport | Inriver Sonar Estimate | Subsistence | Sport | Spawning Escapement | |
| 1966 | 144,145 | 58,184 | 2,515 | 221 | 83,224 | 1,185 | 578 | 81,462 | 62,683 |
| 1967 | 234,216 | 96,240 | 2,515 | 221 | 135,240 | 1,185 | 578 | 133,477 | 100,739 |
| 1968 | 228,551 | 78,201 | 4,487 | 221 | 145,643 | 2,113 | 578 | 142,951 | 85,600 |
| 1969 | 158,672 | 80,803 | 4,826 | 221 | 72,821 | 2,274 | 578 | 69,970 | 88,702 |
| 1970 | 196,081 | 87,547 | 4,283 | 221 | 104,030 | 2,017 | 578 | 101,435 | 94,646 |
| 1971 | 169,206 | 82,769 | 2,991 | 221 | 83,224 | 1,409 | 578 | 81,237 | 87,968 |
| 1972 | 101,001 | 46,045 | 2,719 | 221 | 52,015 | 1,281 | 578 | 50,156 | 50,844 |
| 1973 | 107,999 | 30,470 | 4,487 | 221 | 72,821 | 2,113 | 578 | 70,130 | 37,869 |
| 1974 | 183,287 | 32,053 | 5,370 | 221 | 145,643 | 2,530 | 578 | 142,535 | 40,752 |
| 1975 | 172,144 | 21,454 | 4,826 | 221 | 145,643 | 2,274 | 578 | 142,791 | 29,353 |
| 1976 | 273,657 | 60,684 | 4,691 | 221 | 208,061 | 2,209 | 578 | 205,273 | 68,383 |
| 1977 | 224,104 | 85,074 | 3,535 | 256 | 135,240 | 1,665 | 667 | 132,907 | 91,197 |
| 1978 | 393,636 | 118,548 | 4,487 | 122 | 270,479 | 2,113 | 320 | 268,046 | 125,590 |
| 1979 | 361,210 | 157,321 | 6,050 | 181 | 197,658 | 2,850 | 473 | 194,335 | 166,875 |
| 1980 | 366,555 | 64,958 | 8,021 | 210 | 293,366 | 3,779 | 547 | 289,040 | 77,515 |
| 1981 | 513,708 | 193,461 | 7,818 | 338 | 312,091 | 3,682 | 882 | 307,527 | 206,181 |
| 1982 | 509,867 | 195,287 | 8,225 | 505 | 305,849 | 3,875 | 1,319 | 300,656 | 209,211 |
| 1983 | 482,196 | 137,123 | 8,021 | 555 | 336,497 | 3,779 | 1,448 | 331,270 | 150,926 |
| 1984 | 237,104 | 61,378 | 6,662 | 659 | 168,404 | 3,138 | 1,723 | 163,544 | 73,560 |
| 1985 | 314,434 | 67,783 | 5,370 | 513 | 240,768 | 2,530 | 1,339 | 236,899 | 77,535 |
| 1986 | 165,950 | 65,783 | 7,875 | 628 | 91,663 | 4,725 | 4,162 | 82,777 | 83,173 |
| 1987 | 231,453 | 45,983 | 8,770 | 1,286 | 175,414 | 2,680 | 3,173 | 169,562 | 61,891 |
| 1988 | 141,908 | 16,648 | 5,671 | 1,192 | 118,397 | 3,766 | 1,626 | 113,006 | 28,902 |
| 1989 | 187,644 | 17,637 | 5,688 | 1,404 | 162,916 | 2,155 | 2,210 | 158,551 | 29,093 |
| 1990 | 156,663 | 14,812 | 7,989 | 797 | 133,065 | 3,629 | 2,689 | 126,747 | 29,916 |
| 1991 | 246,718 | 19,718 | 8,093 | 1,793 | 217,114 | 3,010 | 3,758 | 210,346 | 36,372 |
| 1992 | 232,103 | 47,563 | 10,322 | 1,844 | 172,374 | 2,498 | 2,911 | 166,965 | 65,138 |
| 1993 | 283,393 | 62,979 | 14,498 | 2,408 | 203,508 | 2,919 | 3,492 | 197,098 | 86,295 |
| 1994 | 334,606 | 119,480 | 11,048 | 4,436 | 199,643 | 3,331 | 6,191 | 190,121 | 144,485 |
| 1995 | 271,127 | 79,943 | 10,800 | 2,238 | 178,146 | 2,419 | 2,713 | 173,014 | 98,113 |
| 1996 | 193,141 | 72,123 | 10,217 | 2,346 | 108,456 | 3,063 | 3,045 | 102,348 | 90,793 |
| 1997 | 247,327 | 64,390 | 11,397 | 931 | 170,610 | 2,981 | 2,567 | 165,062 ^b | 82,265 |
| 1998 | 371,638 | 117,820 | 7,717 | 1,640 | 244,461 | 4,429 | 4,188 | 235,845 | 135,793 |
| 1999 | 149,248 | 11,178 | 7,450 | 934 | 129,686 | 2,477 | 3,304 | 123,906 | 25,342 |

-continued-

Table 1.– Page 2 of 2.

| Year | Harvests Below Sonar | | | | Harvests Above Sonar | | | | Total Harvest |
|---------------------|----------------------|------------|-------------|-------|------------------------|-------------|-------|---------------------|---------------|
| | Total Run | Commercial | Subsistence | Sport | Inriver Sonar Estimate | Subsistence | Sport | Spawning Escapement | |
| 2001 | 213,306 | 11,746 | 7,972 | 1,600 | 191,988 | 3,372 | 4,299 | 184,317 | 28,989 |
| 2002 | 229,485 | 40,039 | 6,946 | 1,193 | 181,307 | 4,103 | 2,500 | 174,704 | 54,781 |
| 2003 | 225,594 | 43,485 | 13,399 | 2,203 | 166,507 | 4,448 | 3,752 | 158,307 | 67,287 |
| 2004 | 356,240 | 100,846 | 10,644 | 2,567 | 242,183 | 4,422 | 4,339 | 233,422 | 122,818 |
| 2005 | 307,701 | 62,764 | 7,951 | 2,863 | 234,123 | 4,471 | 5,702 | 223,950 | 83,751 |
| 2006 | 218,861 | 84,881 | 6,131 | 3,166 | 124,683 | 3,012 | 4,307 | 117,364 | 101,497 |
| 2007 | 125,435 | 51,831 | 9,564 | 3,581 | 60,459 | 3,411 | 6,088 | 50,960 | 74,475 |
| 2008 | 128,752 | 18,968 | 9,149 | 3,305 | 97,330 | 2,571 | 3,395 | 91,364 | 37,388 |
| 2009 | 117,936 | 24,693 | 9,312 | 2,451 | 81,480 | 2,796 | 3,903 | 74,781 | 43,155 |
| 2010 | 94,245 | 26,056 | 6,345 | 1,659 | 60,185 | 1,845 | 2,248 | 56,092 | 38,153 |
| 2011 | 145,232 | 26,927 | 8,485 | 1,542 | 108,278 | 2,981 | 3,302 | 101,995 | 43,237 |
| 2012 | 195,106 | 11,952 | 7,236 | 1,833 | 174,085 | 2,398 | 4,098 | 167,589 | 27,517 |
| 2013 | 132,782 | 10,213 | 6,889 | 1,971 | 113,709 | 4,201 | 4,714 | 104,794 | 27,988 |
| 2014 | 96,639 | 11,868 | 11,942 | 2,369 | 70,460 | 3,890 | 3,891 | 62,679 | 33,960 |
| 2015 | 160,713 | 50,675 | 9,505 | 2,514 | 98,019 | 2,209 | 4,720 | 91,090 | 69,623 |
| 2016 | 167,540 | 24,937 | 14,182 | 3,053 | 125,368 | 1,933 | 5,358 | 118,077 | 49,463 |
| 2017 | 102,083 | 33,376 | 8,912 | 2,834 | 56,961 | 1,827 | 3,161 | 52,297 | 50,110 |
| 2018 | 147,742 | 36,626 | 10,427 | 3,450 | 97,239 | 1,408 | 4,742 | 91,354 | 56,653 |
| 2019 | 80,250 | 22,725 | 7,162 | 3,600 | 46,763 | 2,967 | 2,706 | 41,258 | 39,160 |
| 2020 | 57,968 | 7,452 | 5,988 | 1,496 | 43,032 | 2,265 | 454 | 40,313 | 17,655 |
| 2021 | 65,539 | 4,820 | 3,922 | 1,575 | 55,222 | 1,297 | 2,472 | 51,453 | 14,086 |
| 2022 | 59,738 | 5,431 | 7,282 | 2,591 | 44,434 | 1,953 | 2,707 | 39,774 | 19,964 |
| Average 1966–2021 | 217,343 | 58,515 | 7,482 | 1,463 | 149,883 | 2,798 | 2,568 | 144,530 | 72,826 |
| 20 Year (2002–2021) | 157,792 | 34,757 | 8,705 | 2,461 | 111,870 | 2,923 | 3,793 | 105,192 | 52,638 |
| 10 Year (2012–2021) | 120,636 | 21,464 | 8,617 | 2,470 | 88,086 | 2,440 | 3,632 | 82,090 | 38,622 |

Note: Subsistence harvest is a subset of the total Chinook salmon harvest in the Nushagak Bay reporting area and attempts to only account for Nushagak River bound Chinook salmon. Harvest within the Igushik, Snake, and Wood Rivers (Above Red Bluff) are not included in this table. As a result, Subsistence harvest numbers from this table may not match up with other subsistence harvest estimates for the area as a whole.

^a Source: 1992–2011 Buck et. al 2012, 2012–2022 Personal Communication Jordan Head (Data prepared for 2021 Escapement Goal Review).

^b Spawning escapement estimated from inriver sonar abundance less upriver harvest for all years except 1997. 1997 estimate based on aerial surveys that have been expanded to DIDSON Equivalents (Buck et al. 2012).

^c Commercial Harvest includes harvest of 4,087 Chinook salmon that were caught in General District 320-05 as they are most likely of Nushagak origin. (Buck et al 2012)

Table 2. Subsistence harvest of king salmon, Nushagak Drainage, 2015–2019.

| Year | Permits issued | King Salmon | Average per permit |
|-------------|----------------|-------------|--------------------|
| 2015 | 591 | 12,117 | 21 |
| 2016 | 649 | 16,576 | 26 |
| 2017 | 562 | 11,060 | 20 |
| 2018 | 589 | 12,206 | 21 |
| 2019 | 616 | 10,206 | 17 |
| 5-Year Avg. | 601 | 12,433 | 21 |

Note: 2019 is the most recent available published harvest data

Harvests extrapolated over areas based on permits returned.

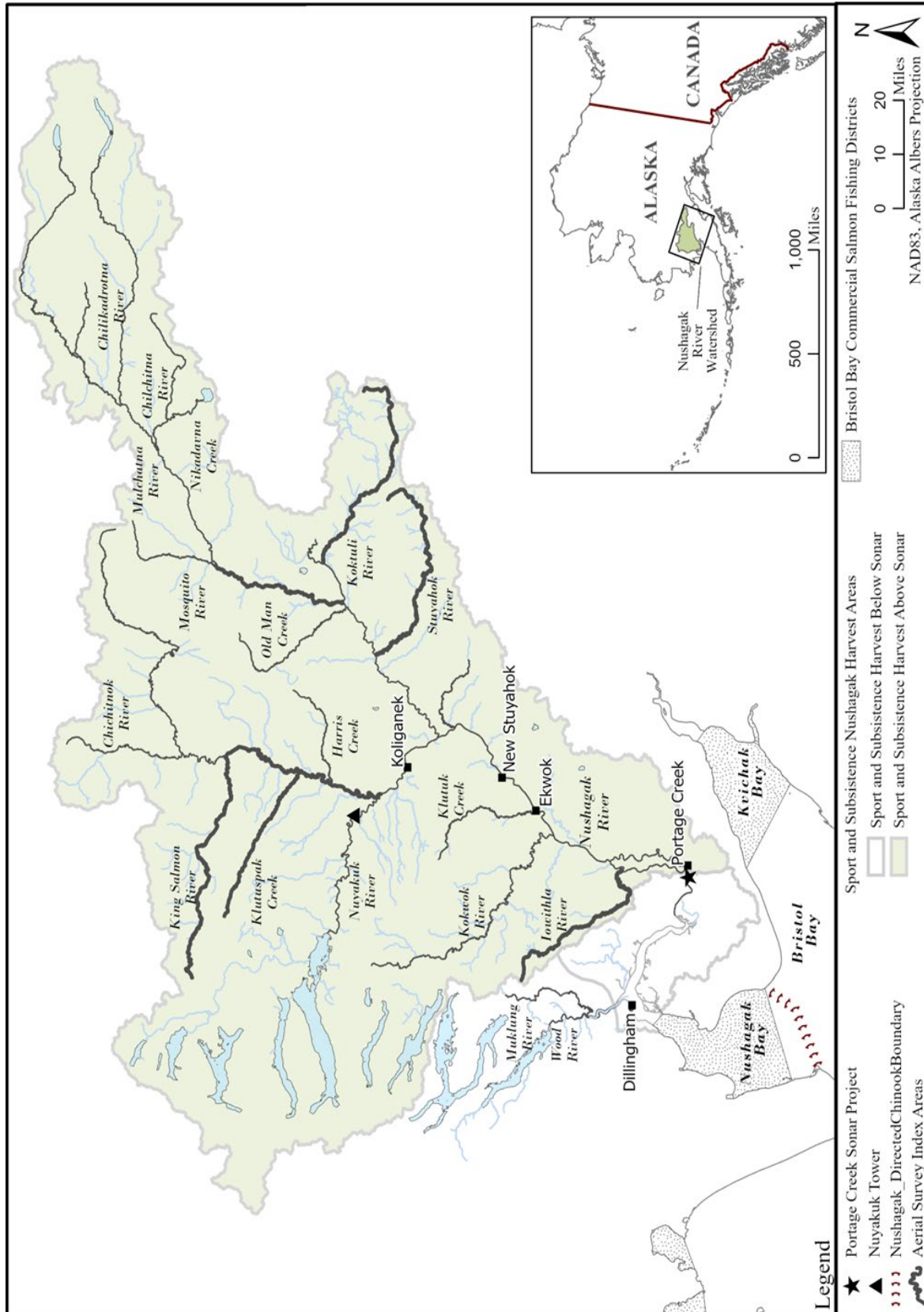


Figure 1.- Map of the Nushagak River Drainage, assessment projects, and harvest areas.

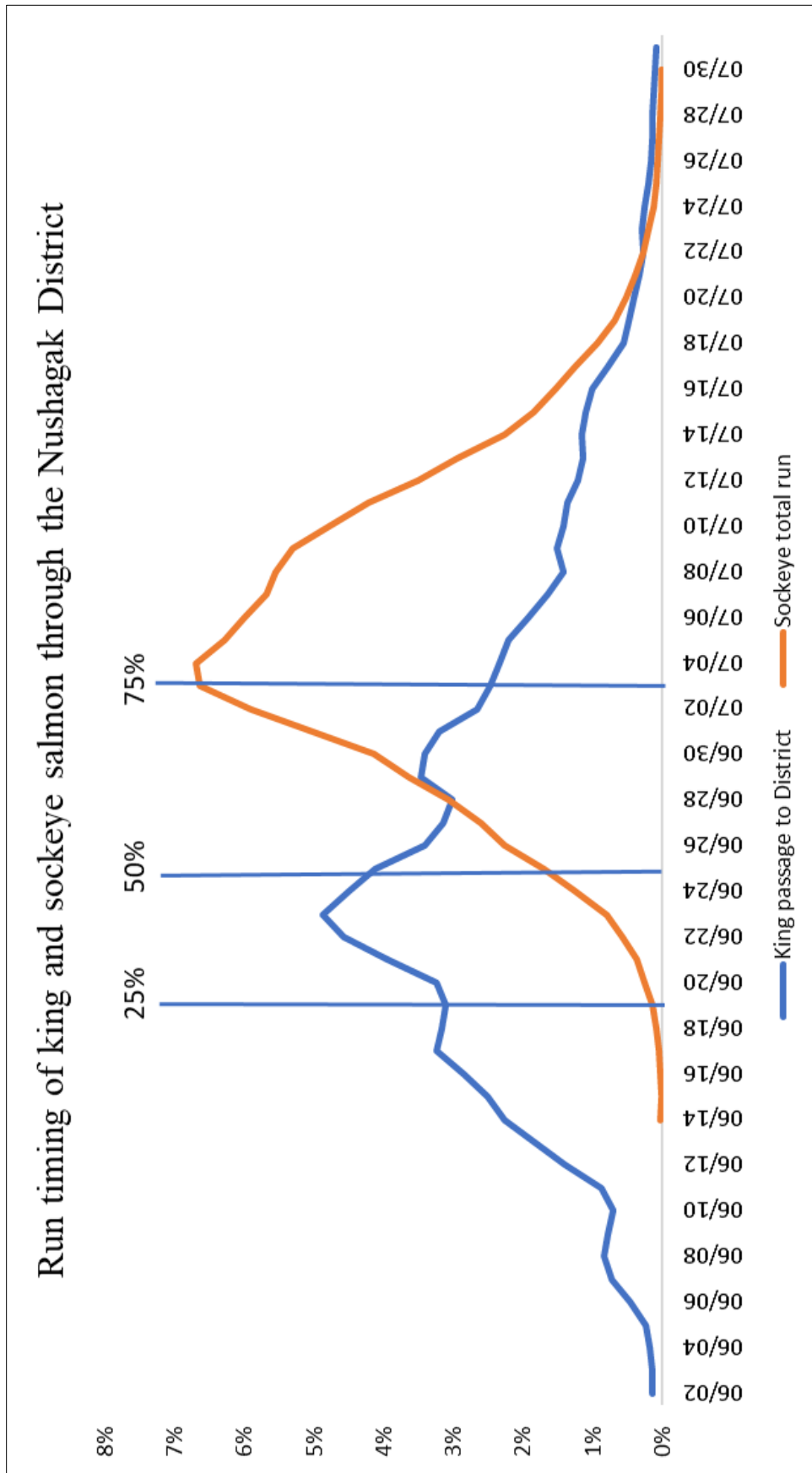


Figure 2.- King and sockeye salmon run timing to the Nushagak District, showing quartiles of king salmon run timing.

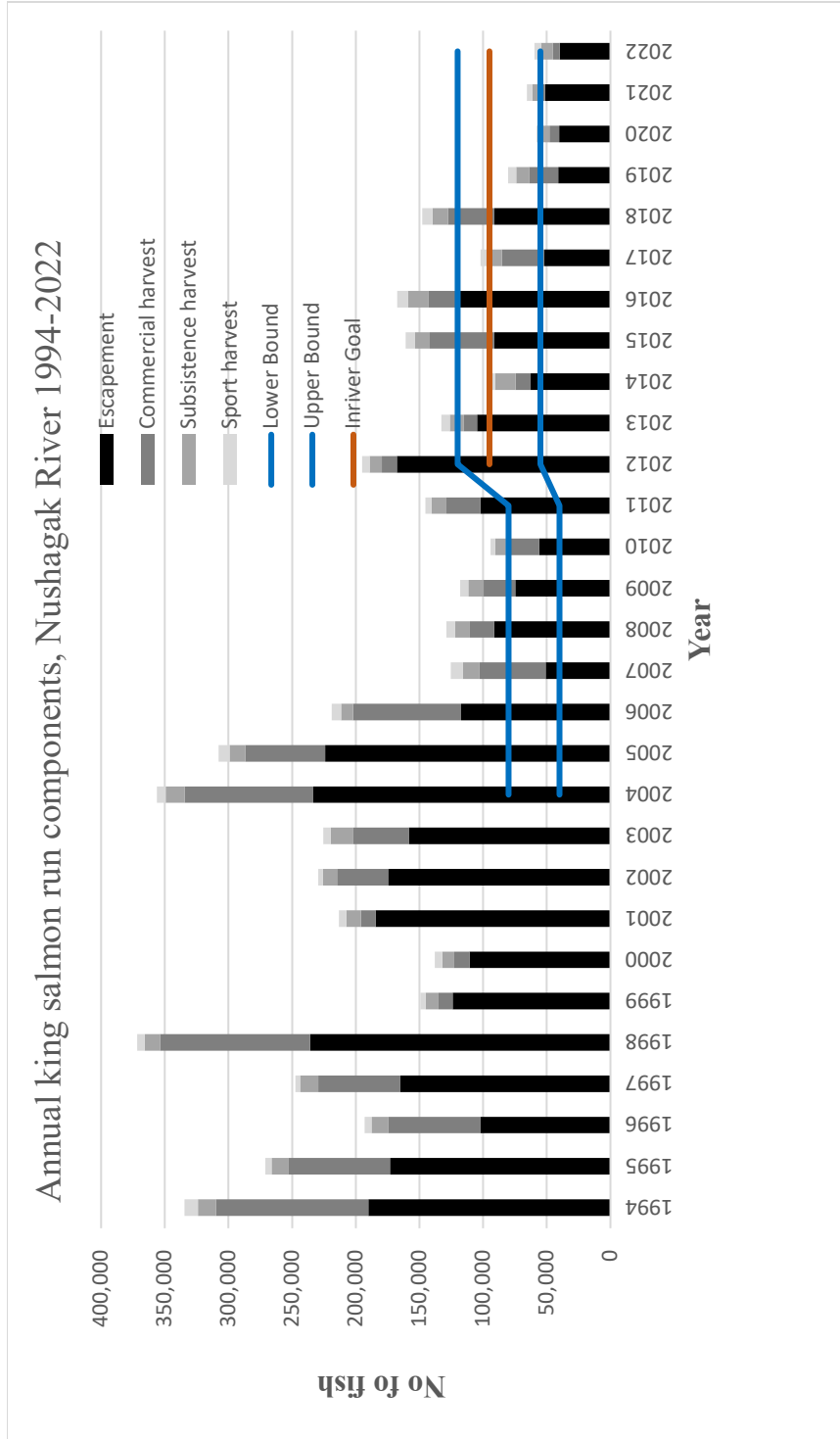


Figure 3. Escapement goals, inriver goal, and annual components of the king salmon run to the Nushagak River, 1994-2022.

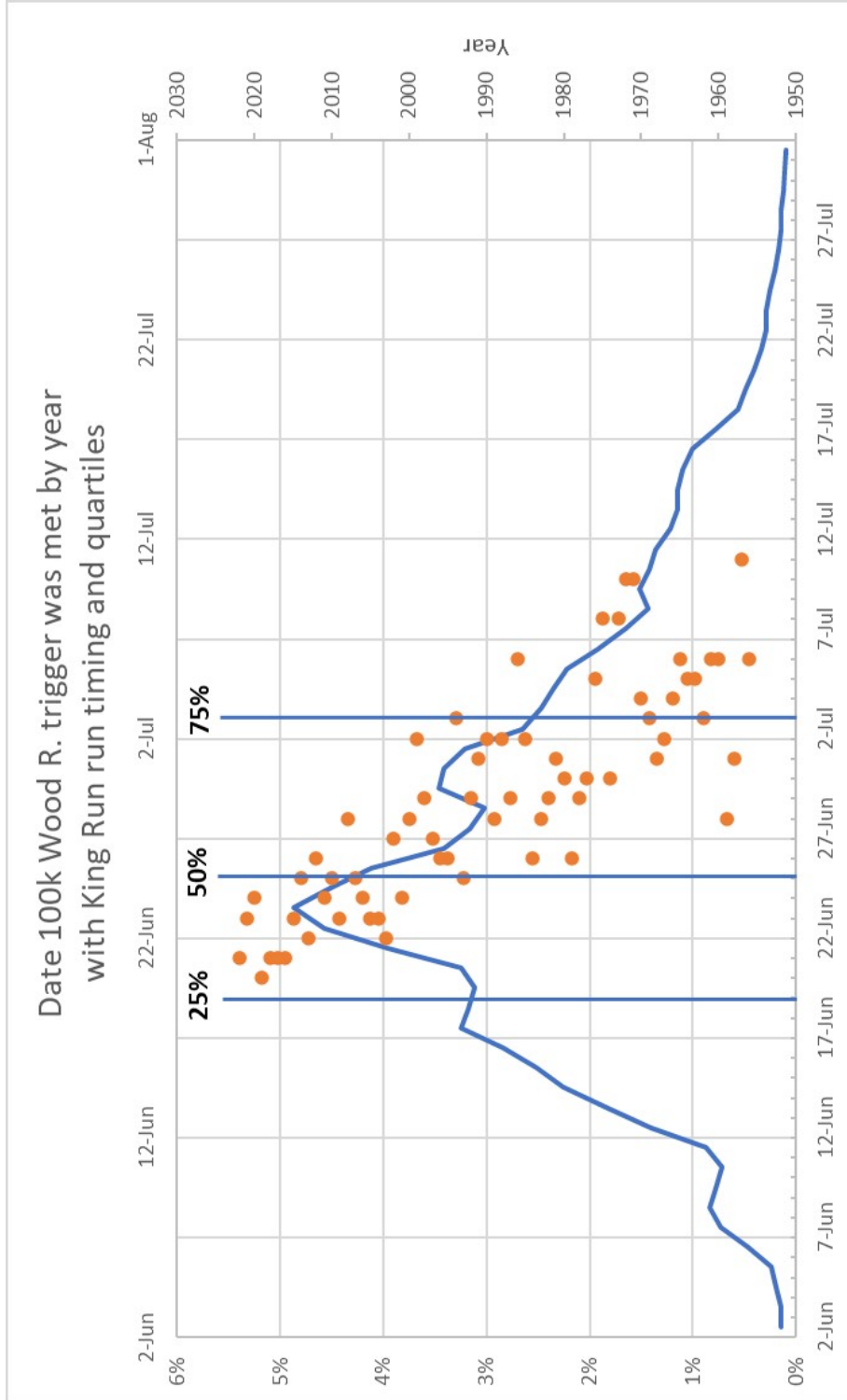


Figure 4. King run timing to the Nushagak District, showing quartiles of king salmon run timing (blue lines) with annual date at which Wood River 100,000 fish trigger is reached by year on secondary Y-axis (orange dots). Note that since 2010, almost all years trigger was reached before the 50% king salmon run timing.

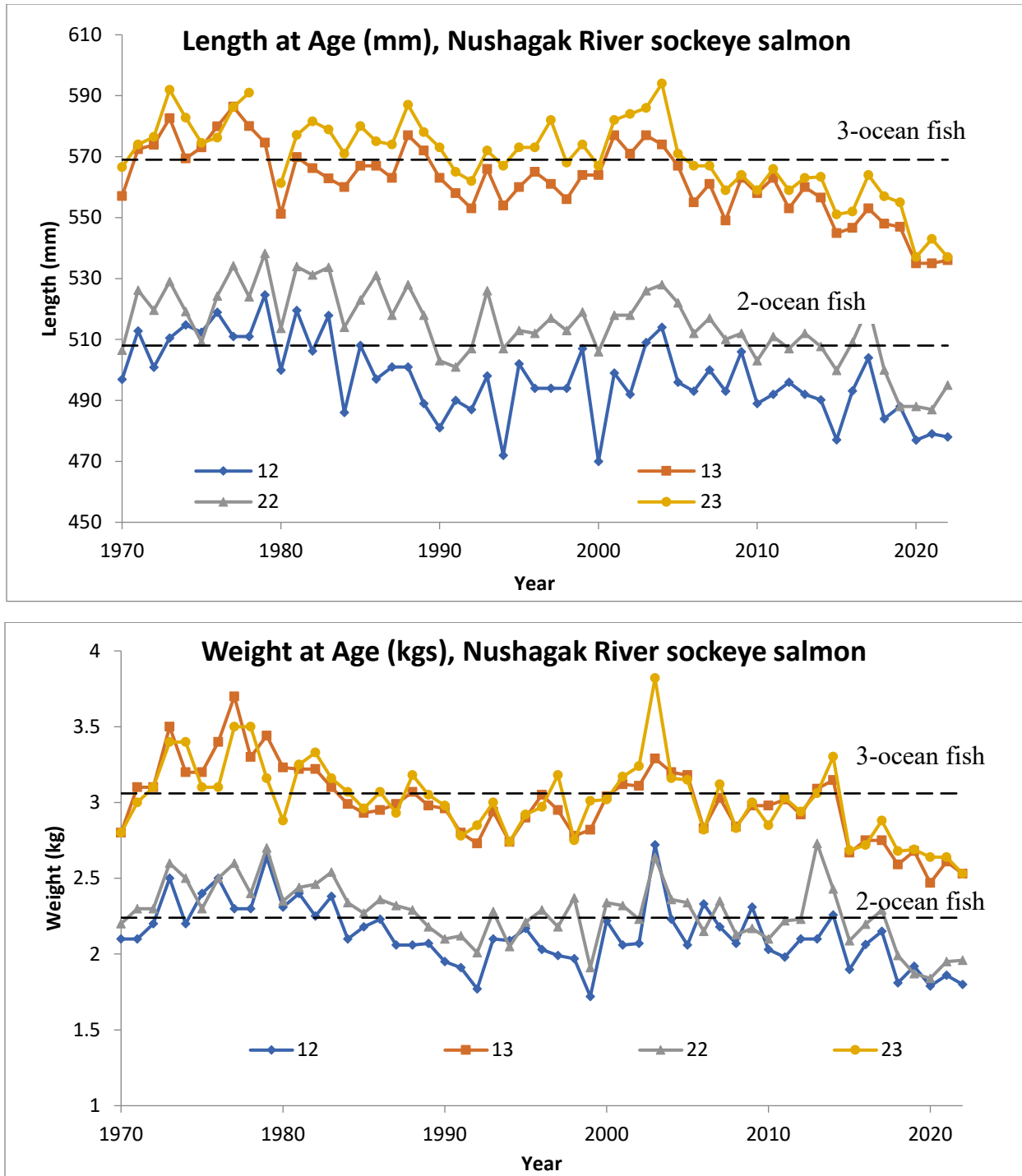


Figure 5. Length and weight of Nushagak River sockeye salmon harvested in the commercial salmon fishery, 1970 – 2022.

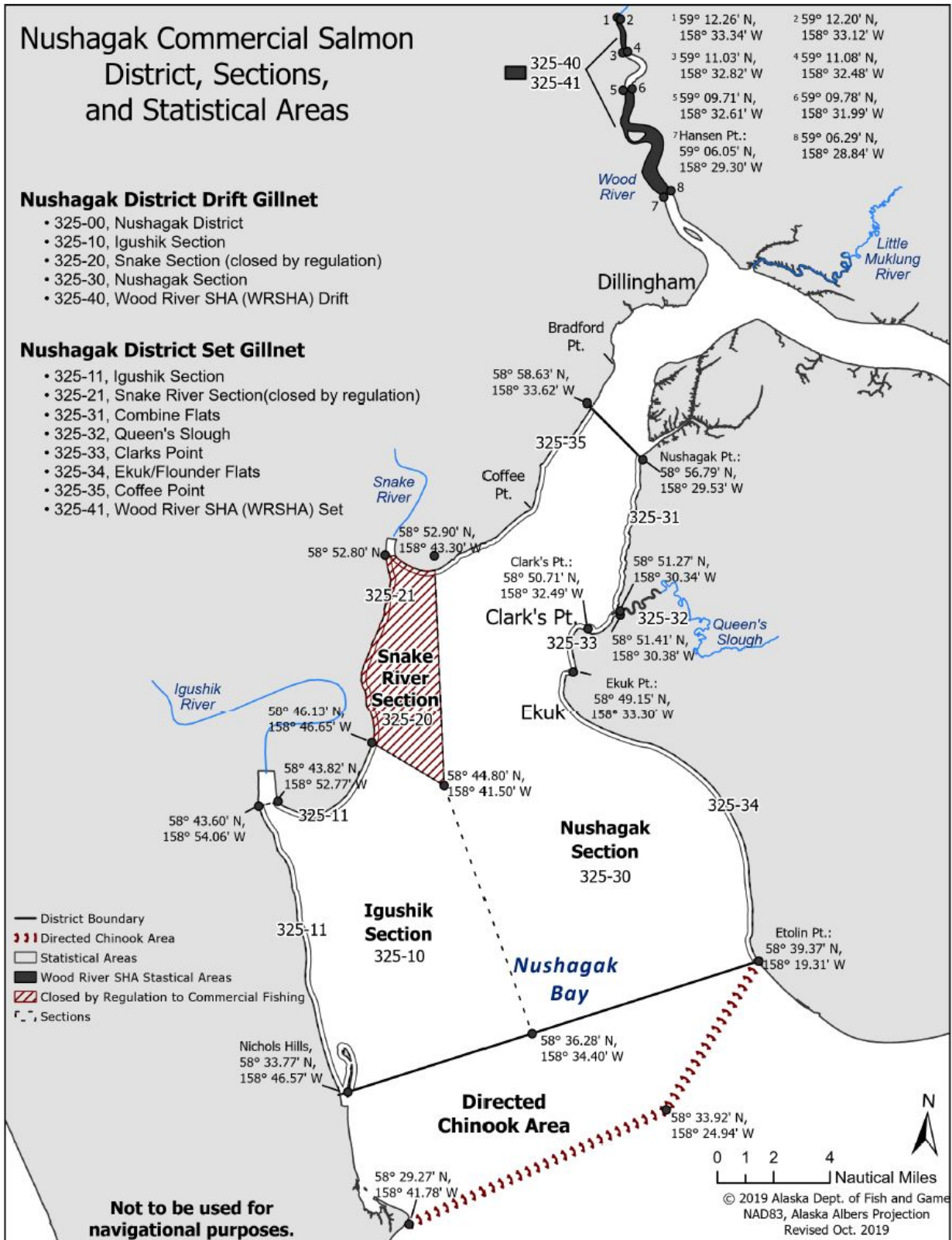


Figure 6.— Nushagak River commercial salmon districts, sections, and statistical area.