Inseason Harvest and Effort Estimates for the 2023 Kuskokwim River Subsistence Salmon Fisheries During Block Openings

by

William R. Bechtol[1], Terese Vicente[2], Andrew Magel[2],
Aaron Moses[3], and Alissa Nadine Rogers[4]

[1]Bechtol Research, PO Box 3426, Homer, AK 99603, bechtolresearch@hughes.net

[2]Kuskokwim River Inter-Tribal Fish Commission, P.O. Box 190, Bethel, AK, 99559,
terese@kritfc.org

[3]Yukon Delta National Wildlife Refuge, P.O Box 346 Bethel, Alaska 99559

[4]Orutsararmiut Native Council, P.O. Box 928, Bethel, AK 99559

February 2024

Cite report as: Bechtol, W.R., T. Vicente, A. Magel, A. Moses, and A. Nadine Rogers. 2024. Inseason harvest and effort estimates for the 2023 Kuskokwim River subsistence salmon fisheries during block openings., 59 + vi p.

TABLE OF CONTENTS

Page

LIST OF TABLES iv
LIST OF FIGURES v
ABSTRACT 1
INTRODUCTION 1
METHODS 4
Aerial Net Counts 4
Completed Trip Interviews 5
Analytical Methods 5
RESULTS 6
6/3/23 Opening (Set Gillnet Only) 6
6/6/23 Opening (Set Gillnet Only) 7
6/9/23 Opening (Set Gillnet Only) 7
6/12/23 Opening (Drift and Set Gillnet) 7
6/17/23 Opening (Drift and Set Gillnet) 8
6/23/23 Opening (Drift and Set Gillnet) 8
7/4/23 Opening (Set Gillnet Only) 9
7/7/23-7/8/23 Opening (Set Gillnet Only) 10
7/11/23 Opening (Drift and Set Gillnet) 10
7/17/23 Opening (Set Gillnet Only) 10
7/19/23 Opening (Set Gillnet Only) 10
7/24/23 Opening (Set Gillnet Only) 11
7/26/23 Opening (Set Gillnet Only) 11
8/3/23 Opening (Drift and Set Gillnet) 11
8/9/23 Opening (Drift and Set Gillnet) 11
8/12/23 Opening (Drift and Set Gillnet) 12
Total Harvest across Openings 12
Synthesis of Key Information on 6/12 Openings 13
DISCUSSION 14
Overall Summary 14
Reliability of Assumptions 15
Other Harvest Not Monitored or Accounted For 16
Sensitivity of Harvest Estimates 17

TABLE OF CONTENTS (Continued)

Page
Technical Review of Harvest Estimates 17
Scalability of the Model 17
ACKNOWLEDGMENTS 18
REFERENCES 19

LIST OF TABLES

Page

Table 1. Raw set gillnet counts by geographic stratum for dates on which aerial net counts occurred, 2023. 20

Table 2. Raw drift gillnet counts by geographic stratum for dates on which aerial net counts occurred, 2023. 21

Table 3. Estimated drift and set gillnet trips by date and geographic stratum, 2023. These quantities were derived from the raw counts presented in Tables 1 and 2. 22

Table 4. Salmon harvests from set gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits. 24

Table 5. Estimated minimum salmon harvests for drift gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits. 29

Table 6. Salmon harvests from both drift and set gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits. 31

Table 7. Minimum annual harvest estimates by salmon species from the Kuskokwim River inseason harvest estimation program, 2016–2023. 35

Table 8. Key harvest characteristics of 12-hour openings on June 12 in all years where inseason harvest was rigorously monitored. These numbers correspond only to the mainstem Kuskokwim River from Eek to Akiak. 35

LIST OF FIGURES

Page

Figure 1. Map of the Yukon Delta National Wildlife Refuge waters that compose the survey area with geographic strata noted (A – E). Dashed lines indicate strata boundaries. 36

Figure 2. The (*left*) total estimated setnet trips by opening and (*right*) proportion of all estimated setnet trips that occurred in each geographic stratum by opening. 37

Figure 3. Total (*left*) estimated driftnet trips by opening and *(right)* proportion of all estimated trips that occurred in each geographic stratum by opening. 38

Figure 4. Estimated salmon harvest by species in the openings for which data were collected; estimates include both driftnet and setnet harvests. 39

Figure 5. Total number (*left*) of interviews used to inform the harvest estimates from each opening and (*right*) proportion of all interviews that came from each source by opening. 40

Figure 6. Distribution of relevant quantities from completed setnet trip interviews during the 6/3/2023 opening, with means for all available interviews and by data source. 41

Figure 7. Distribution of relevant quantities from completed setnet trip interviews during the 6/6/2023 opening, with means for all available interviews and by data source. 42

Figure 8. Distribution of relevant quantities from completed setnet trip interviews during the 6/9/2023 opening, with means for all available interviews and by data source. 43

Figure 9. Distribution of relevant quantities from completed driftnet trip interviews for the 6/12/2023 opening, with means for all available interviews and by data source. 44

Figure 10. Distribution of relevant quantities from completed driftnet trip interviews for the 6/17/2022 opening, with means for all available interviews and by data source. 45

Figure 11. Distribution of relevant quantities from completed driftnet trip interviews for the 6/23/2023 opening, with means for all available interviews and by data source. 46

Figure 12. Distribution of relevant quantities from completed setnet trip interviews during the 6/30/23 opening, with means for all available interviews and by data source. 47

Figure 13. Distribution of relevant quantities from completed setnet trip interviews during the 7/4/23 opening, with means for all available interviews and by data source. 48

LIST OF FIGURES (Continued)

Page

Figure 14. Distribution of relevant quantities from completed setnet trip interviews during the 7/5/23 opening, with means for all available interviews and by data source. 49

Figure 15. Distribution of relevant quantities from completed setnet trip interviews during the 7/7/23 opening, with means for all available interviews and by data source. 50

Figure 16. Distribution of relevant quantities from completed driftnet trip interviews during the 7/11/23 opening, with means for all available interviews and by data source. 51

Figure 17. Distribution of relevant quantities from completed setnet trip interviews during the 7/17/23 opening, with means for all available interviews and by data source. 52

Figure 18. Distribution of relevant quantities from completed setnet trip interviews during the 7/19/23 opening, with means for all available interviews and by data source. 53

Figure 19. Distribution of relevant quantities from completed setnet trip interviews during the 7/24/23 opening, with means for all available interviews and by data source. 54

Figure 20. Distribution of relevant quantities from completed setnet trip interviews during the 7/26/23 opening, with means for all available interviews and by data source. 55

Figure 21. Distribution of relevant quantities from completed driftnet trip interviews during the 8/3/23 opening, with means for all available interviews and by data source. 56

Figure 22. Distribution of relevant quantities from completed setnet trip interviews during the 8/9/23 opening, with means for all available interviews and by data source. 57

Figure 23. Distribution of relevant quantities from completed setnet trip interviews during the 8/12/23 opening, with means for all available interviews and by data source. 58

Figure 24. Total 2023 salmon harvest by species across all openers for which harvest estimates were produced including both driftnets and setnets. 59

Figure 25. Total 2023 salmon harvest by species and strata across all openings for which harvest estimates were produced, including both driftnets and setnets. 59

ABSTRACT

Management of subsistence fisheries for salmon (*Oncorhynchus* spp.) in the Kuskokwim River has historically been conducted with minimal inseason harvest information. Due to this lack of information, managers have faced challenges making well-supported and defensible inseason decisions regarding fishing opportunities that simultaneously achieve conservation and subsistence harvest objectives, particularly during years of weak Chinook Salmon (*O. tshawytscha*) runs. In response to conservation concerns for the 2023 Kuskokwim River Chinook and Chum (*O. keta*) salmon runs, as well as for Coho Salmon (*O. kisutch*) following weak returns in 2022, the Kuskokwim River Inter-Tribal Fish Commission (KRITFC), in collaboration with the United States Fish and Wildlife Service–Yukon Delta National Wildlife Refuge, the Orutsararmiut Native Council (ONC), and independent contractors collected and processed data to produce inseason subsistence salmon harvest estimates from the mainstem Kuskokwim River within the boundaries of the Yukon Delta National Wildlife Refuge, between and including the villages of Eek and Tuluksak. Input data included: drift and set gillnet counts from aerial surveys; subsistence harvester interviews by ONC at the Bethel boat harbor, and Bethel, Oscarville, and Napaskiak area fish camps, and by USFWS and KRITFC at the Bethel boat harbor; and subsistence harvester interviews by KRITFC community-based harvest monitors from the Lower Kuskokwim River villages of Eek, Tuntutuliak, Napakiak, Napaskiak, Kwethluk, Akiachak, Akiak, and Tuluksak. Using methods developed and refined during 2016–2018, the best minimum estimate of total subsistence salmon harvest in the study area was 69,350 (95% confidence limits [CL]: 64,350–74,800) during 18 fishing opportunities with data collection between June 1 and August 12, 2023. Most salmon harvested were Sockeye Salmon (*O. nerka;* 28,940; 25,500–32,760), followed by Chinook Salmon (21,050; 95% CL: 19,240–23,040), Chum Salmon (11,930; 10,770–13,230), and Coho Salmon (7,420; 6,660–8,240). These estimates do not include harvests that (a) occurred in tributaries of the lower Kuskokwim River, (b) occurred downriver of the lower river boundary of Eek Island or upriver of Bogus Creek, (c) arose from non-gillnet capture methods, or (d) occurred during fishing opportunities on July 1, 5, 6, 7, 8, 21 and 26. While the sampling and analytical methods remained standardized and generally consistent with previous years, harvest and effort estimation for the 2023 season, similar to 2022, was facilitated by a customized software package (termed 'KuskoHarvEst') for program R that provides an intuitive, menu-driven workflow. This allowed the coauthors to independently execute the estimation model and confer on results. This software will be useful for future seasons in which inseason harvest and effort estimates are desired for the lower Kuskokwim River subsistence salmon fishery and during which similar sampling occurs.

INTRODUCTION

Inseason management of Kuskokwim River salmon fisheries is undertaken in the face of a severe lack of information, due in a large part to the size and remoteness of the river system and limited funds to monitor inseason harvests. Fully-informed management would require continuous and accurate information on run timing, harvest, and escapement for each return year (Staton and Catalano 2019). With knowledge on these three components, it would be

possible to know how much of the run is yet to come, how much escapement potential remains, and how many more fish may be harvested. Inseason management of Kuskokwim River salmon has historically been conducted with little of this information and has instead relied largely on a single and highly uncertain index (the Bethel Test Fishery[1] [BTF]) of run abundance, run timing, and species composition to inform decision-making. Western science has developed methods to obtain more detailed information on run timing (Staton et al. 2017) and relative run size (e.g., a recent new mainstem sonar project[2], and a Bayesian approach to update run size forecasts with inseason data on a daily basis; Staton and Catalano 2019), and delivering this information to managers and stakeholders in a timely manner for decision-making. Local and Indigenous Knowledge shared by Kuskokwim River harvesters and Tribal inseason managers during Federal-Tribal and public management meetings provides additional information on salmon return strength and timing. Based on observations of non-salmon species migrations, weather patterns, year-round climate, run timing information, and other natural indicators, this Local and Indigenous Knowledge complements Western scientific tools used to predict salmon run characteristics.

However, even with perfect holistic information on these run characteristics, the number of fish harvested drainagewide inseason is unknown, despite its critical importance for structuring inseason fishing opportunities and ensuring adequate salmon escapement. Some harvest data have been collected from the Bethel area by the Orutsararmiut Native Council (ONC) since the 1990s (A. Nadine Rogers, ONC, per, com.), although inseason harvest estimates were not produced. Timely inseason subsistence harvest estimates have only been available relatively recently in the Kuskokwim River (2016–2022) to inform inseason management and remain a critical information source necessary to successfully manage weak salmon runs. This report follows previous documentation of inseason salmon harvest estimates from short-duration Kuskokwim River subsistence fishing opportunities to estimate inseason harvest during the 2023 season (Staton and Coggins 2016, 2017; Staton 2018; Decossas 2019a, 2020; Russell et al. 2021; Bechtol and Schomogyi 2022).

In response to multi-year conservation concerns for the Kuskokwim River Chinook Salmon (*Oncorhynchus tshawytscha*) season (Larson 2023), and expectations of weak Chum Salmon (*O. keta*) and Coho Salmon (*O. kisutch*) returns in 2023, the Refuge Manager of the Yukon Delta National Wildlife Refuge (YDNWR), through action by the Federal Subsistence Board, assumed primary management authority of Kuskokwim River subsistence salmon fisheries within the boundaries of the YDNWR on June 1, 2023 (Figure 1). This area is also commonly referred to as federal waters of the Kuskokwim River or the lower Kuskokwim River.

The Refuge Manager, in consultation with the Kuskokwim River Inter-Tribal Fish Commission (KRITFC) Tribal In-Season Managers as YDNWR's collaborative management partners, decided that the use of restricted fishing time, area closures, and gear restrictions would provide adequate measures to manage the fishery. The restricted fishing time, or "block openings," provided focused harvest opportunities with closed periods between openings to allow some Chinook, Chum, and Coho salmon to pass through areas of high fishing effort, thereby protecting significant amounts of returning salmon for spawner escapement and also for harvesters residing

[1] **https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareakuskokwim.btf**
[2] **https://www.adfg.alaska.gov/index.cfm?adfg=commercialbyareakuskokwim.emihd**

above YDNWR boundaries. Block openings also provided specific windows to gather data for inseason harvest estimation and gave decisionmakers time in between openings to consider potential future fishing opportunities. Additionally, both the Refuge Manager and KRITFC managers agreed that several block opening fishing opportunities should be announced prior to the beginning of the Chinook Salmon season so people could plan for fishing, which provides greater certainty for subsistence harvesters and reduces complexity of inseason management. The Refuge Manager and KRITFC also agreed that 6-inch set gillnet opportunities should be provided to Federally-Qualified Subsistence Users in order to provide a "taste of salmon" during June 3 to June 9.

On May 18, 2023, the Refuge Manager published a Temporary Special Action (TSA)[3]. The issuance of a TSA differs from the Emergency Special Actions (ESAs) issued in previous years in that a TSA may be applied for a longer time frame, up to 90 days, an aspect that was warranted given the low Coho Salmon return in 2022 and the potential need for conservation measures later in the 2023 summer. Effective June 1, 2023, FSA-YD-23-01[3] announced that unless reopened by the YDNWR Refuge Manager, fishing for salmon with gillnets was closed in the following Federal public waters of the Kuskokwim River within and adjacent to the exterior boundaries of the YDNWR; (1) the Kuskokwim River mainstem within YDNWR boundaries; (2) the Eek, Kwethluk, Kasigluk, Kisaralik, Tuluksak, and Aniak rivers, and the Aniak Box, with fishing in rivers not listed restricted to fishing at least 100 yards upriver from the confluence with the Kuskokwim River mainstem. However, Federally Qualified Subsistence Users fishing with dip nets, beach seines, fish wheels, and rod and reel were permitted to retain Chinook, Chum and Coho salmon in all YDNWR waters. The Refuge Manager subsequently announced the fishing opportunities shown below. The approach of announcing a limited number of fisheries openings was intended to provide subsistence harvest opportunities without risking Chinook and Chum salmon escapement until additional data became available. Because of conservation concerns for salmon populations, these subsistence opportunities were limited to Federally Qualified Subsistence Users, which include all residents of the Kuskokwim River drainage per regulations written in Title VIII of the Alaska National Interest Lands Conservation Act (ANILCA).

The Refuge Manager expected relatively few Chinook and Chum salmon would be harvested during the early opportunities because of past low numbers of salmon in the river during the front-end closure, plus the net length and operational restrictions for set gillnets during this time. Harvests from non-gillnet methods are not included in this report. In addition, estimates were not made for harvests that occurred in non-spawning tributaries, downstream of YDNWR boundaries, or upstream of area D2 (Figure 1). These harvest areas were excluded because aerial surveys do not monitor these areas, interview data coverage was variable, and harvests were generally thought to be small relative to mainstem harvests with gillnets.

There were 18 subsistence fishery opportunities announced from June 3 to August 12, 2023, in the YDNWR boundaries[3]:

1. 6/3/23 6:00 am – 10:00 pm; 16 hours; set gillnet only
2. 6/6/23 6:00 am – 10:00 pm; 16 hours; set gillnet only
3. 6/9/23 6:00 am – 10:00 pm; 16 hours; set gillnet only

[3] **https://www.kuskosalmon.org/2023-fishing-info**

4. 6/12/23 07:00 am – 07:00 pm; 12 hours; drift or set gillnet
5. 6/17/23 07:00 am – 07:00 pm; 12 hours drift or set gillnet
6. 6/23/2023 07:00 am – 07:00 pm; 12 hours drift or set gillnet
7. 6/30/23 09:00 am – 7/1/23 09:00 am; 24 hours; set gillnet only
8. 7/4/23 09:00 am – 7/6/23 09:00 am; 48 hours; set gillnet only
9. 7/7/23 05:00 pm – 7/8/23 05:00 pm; 24 hours; set gillnet only
10. 7/11/23 09:00 am – 03:00 pm; 6 hours; drift or set gillnet
11. 7/17/23 10:00 am – 10:00 pm; 12 hours; set gillnet only
12. 7/19/23, 10:00 am – 10:00 pm; 12 hours; set gillnet only
13. 7/21/23, 10:00 am – 10:00 pm; 12 hours; set gillnet only
14. 7/24/23 10:00 am – 04:00 pm; 6 hours; set gillnet only
15. 7/26/23 10:00 am – 04:00 pm; 6 hours; set gillnet only
16. 8/3/23 09:00 am – 09:00 pm; 12 hours; drift or set gillnet
17. 8/9/23 09:00 am – 09:00 pm; 12 hours; drift or set gillnet
18. 8/12/23 09:00 am – 09:00 pm; 12 hours; drift or set gillnet

Federal restrictions to the harvest of salmon were rescinded on August 13, 2023, per the Refuge Manager's FSA-YD-23-02[3].

METHODS

The inseason harvest estimation framework that was developed and applied to the 2016–2023 Kuskokwim River salmon seasons required two primary types of information: (1) an estimate of the total number of fishing trips each day (termed "effort"); and (2) completed trip interview data from subsistence harvesters to document fishing trip gear and catch characteristics, including: total trip time, net-in-water time, general fishing location, and catch by species (Staton and Coggins 2016, 2017; Staton 2018; Decossas 2019, 2020; Russell et al. 2021; Bechtol and Schomogyi 2022). For a complete description of analytical and sampling methods, see Staton (2018).

Aerial Net Counts

For each harvest opportunity or block opening (duration of 6 to 48 hours depending on date and legal gear), USFWS conducted one to two flights between the river mouth by Eek Island and Bogus Creek near the community of Tuluksak, depending on factors such as expected effort, weather, and budget considerations (Tables 1 and 2; Figure 1). Based on YDNWR staff and USFWS pilot availability, some flights were also conducted with KRITFC or ONC observers and on flights chartered by KRITFC or ONC. Flights were scheduled to document net counts between low and high tides when the tides were moving the strongest (which are the most popular times to fish), and flights were spaced across openings. Individual flights lasted around 1½ to 2½ hours (Tables 1 and 2). The analytical method for converting aerial counts to estimates of total effort includes estimates of trips that were likely to have been counted on multiple flights, and trips that were unlikely to have been counted on any flight, and is described in Staton (2018). Net counts upriver from Bethel are treated as the maximum observed between upriver

and downriver flights. But based on input from the YDNWR staff, the approach beginning in 2022 is to sum set gillnet counts on flight legs below Bethel because many set gillnet locations are only visible on either the downriver or upriver passes. (Bechtol and Schomogyi 2022; A. Moses, USFWS, pers. com.).

Completed Trip Interviews

Information from harvester trips was obtained from three sources: (1) the Bethel boat harbor, (2) Bethel, Napaskiak, and Oscarville area fish camps, and (3) eight lower Kuskokwim River villages other than Bethel. Interview data from sources (1) and (2) were collected by ONC using methods similar to those used since the 1988 (A. Nadine Rogers, ONC, per. com.), although beginning in mid-July YDNWR and KRITFC staff conducted the interviews at the Bethel Boat Harbor and ONC ceased collecting area fish camp interviews. Data from lower Kuskokwim River villages other than Bethel were collected by KRITFC community harvest monitors with the same methods adopted in 2017 as part of a community-based harvest monitoring (CBM) project designed to provide interview data from areas of the YDNWR other than the Bethel area. In 2023, a total of 14 KRITFC community harvest monitors were located in the villages of Eek, Tuntutuliak, Napakiak, Napaskiak, Kwethluk, Akiachak, Akiak, and Tuluksak.

Staffs from KRITFC, ONC, and USFWS met in person or by Zoom on April 25, 2023, to discuss the inseason harvest estimation project. These staffs then met with ONC and KRITFC interviewers in Bethel, AK on May 22, 2023, for a day of training on interview techniques, including Principles for Conducting Research in the Arctic[4], and collection of ASL otolith, and ichthyophonus samples.

During the 2023 season, data from all sources were generally compiled in a timely manner (by 12 to 24 hours following an opening) to be included in harvest estimates. However, interview data for a small number of cases were received too late for inclusion in the inseason harvest reports. These interview data are included in this final report and had little effect on harvest estimates, but note that catch and effort estimates on an individual date in this report may differ slightly from inseason harvest estimates. In total, 1,418 inseason harvest interviews were conducted among the three sources: 735 (52%) from the Bethel boat harbor as sampled by ONC, KRITFC, and USFWS; 558 (39%) from KRITFC community-based harvest monitors; and 125 (9%) from fish camps sampled by ONC.

Analytical Methods

Analytical methods in 2023 were similar to previous years as described in Staton (2018) except for: (1) extension of the area included to stratum D2 (Figure 1) based on expanded aerial flight coverage and interviews from Tuluksak; (2) inclusion of Coho harvest data in the assessment due to concerns over poor Coho Salmon returns in recent years; and (3) extension of harvest estimation period into August to better identify Coho Salmon harvests. Note that some interviews were available from fishing efforts in reporting strata O (i.e., downriver of the

[4] **https://www.iarpccollaborations.org/principles.html**

YDNWR boundary or in non-spawning tributaries) and in strata D3 (Figure 1), but are not included in these harvest estimates because there was no aerial survey coverage for these areas.

Harvest estimates were made through a custom software package for program R entitled 'KuskoHarvEst' (Staton 2021). 'KuskoHarvEst' aims to: (1) facilitate installation of software needed to perform estimation and generate reports, (2) remove software editing needed for each harvest opportunity, and (3) enforce consistency and remove subjectivity in data quality checking and censoring. The package accomplishes these tasks by being self-contained, easily downloadable, and providing an intuitive menu-driven workflow for all data processing and estimation steps. Routines in the R package are automated for conducting calculations developed in the 2016–2018 seasons (Staton and Coggins 2016, 2017; Staton 2018). Following the conclusion of the 2021 season, software development continued based on feedback from the 2021 experience with the first version, largely to improve the ability to detect and handle data formatting issues (B. Staton, Quantitative Ecological Services, pers. com.). Note that the software as currently configured does not accommodate interviews from harvesters that fished across multiple days (i.e., for a fishing trip that started on one day and ended on the subsequent day). For the June 30 to July 1 openings in 2023, data on fishing and aerial flight times were reduced by six hours to make the trip "appear" as having happened on a single day. In a small number of other cases for which fishing trips spanned more than a single day, reported harvest was apportioned between adjacent days according to hours of the fishing trip reported for those adjacent days. Due to weather or staffing issues, or an insufficient number of interviews, harvest estimates were not made for the July 1, 5, 6, 7, 8, 21 and 26 fishing days.

Minor edits to the harvest estimation program continued in 2022 as issues were resolved. Coauthors reviewed the updated software prior to the 2023 season and had the opportunity to independently use the software inseason to produce the estimates for each harvest opportunity. Results were consistent among coauthors, with the biggest issue being data formatting errors that were often, but not always, identified by the interface computer code.

Note that harvest estimates across species or across strata may differ slightly from the total sum of individual estimates catches as shown in the tables due to small rounding differences.

RESULTS

6/3/23 Opening (Set Gillnet Only)

An estimated total of 60 set gillnet trips occurred in the study area during the 16-hour opening on June 3 (Table 3; Figure 2). The estimated total salmon harvest was 356 (95% CL: 164-591). Most (99%) of the harvested salmon were Chinook Salmon (352; 95% CL: 160-587), followed by Chum Salmon at 1% of the harvest (4; 95% CL: 0-14) (Tables 4 and 6; Figure 4). Harvest estimates were produced from 25 trip interviews, of which 11 (44%) came from community harvest monitors, 9 (36%) from the Bethel boat harbor, and 5 (20%) from the ONC area fish camps (Figure 5). For the June 3 opening, trip duration averaged 8.4 hours, and soak time averaged 7.3 hours among all interviews (Figure 6).

6/6/23 Opening (Set Gillnet Only)

An estimated total of 82 setnet trips occurred in the study area during the 16-hour opening on June 6 (Table 3; Figure 2). The estimated total salmon harvest was 220 (95% CL: 144–296). Over 99% of the salmon harvest was Chinook Salmon (219; 95% CL: 143-294), followed by Chum Salmon at 0.5% of the harvest (1; 95% CL: 0–6) (Tables 4 and 6; Figure 4). Harvest estimates were produced from 44 trip interviews, of which 19 (43%) came from community harvest monitors, 17 (39%) from the Bethel boat harbor, and 8 (18%) from the ONC area fish camps (Figure 5). For the June 6 opening, trip duration averaged 9.9 hours, and soak time averaged 9.0 hours among all interviews (Figure 7).

6/9/23 Opening (Set Gillnet Only)

An estimated total of 129 setnet trips occurred in the study area during the 16-hour opening on June 9 (Table 3; Figure 2). The estimated total salmon harvest was 1,293 (95% CL: 874–1,873). Most (87%) of the harvest was Chinook Salmon (1,131; 95% CL: 729–1,659), followed by Sockeye Salmon at 10% of the harvest (135; 95% CL: 85–193), and Chum Salmon at 2% of the harvest (26; 95% CL: 6–56) (Tables 4 and 6; Figure 4). Harvest estimates were produced from 74 trip interviews, of which 39 (53%) came from community harvest monitors, 18 (24%) from the Bethel boat harbor, and 17 (23%) from the ONC area fish camps (Figure 5). For the June 9 opening, trip duration averaged 9.5 hours and soak time averaged 8.1 hours among all interviews (Figure 8).

6/12/23 Opening (Drift and Set Gillnet)

An estimated total of 201 drift boat trips and 31 setnet trips occurred in the study area during the 12-hour opening on June 12 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 1,524 (95% CL: 1,278–1,787). The majority of the harvest (65%) was Chinook Salmon (1,001; 95% CL: 803–1,217), followed by Sockeye Salmon at 27% of the harvest (416; 95% CL: 303–569) and Chum Salmon at 7% of the harvest (108; 95% CL: 76–147) (Tables 4–6; Figure 4). Harvest estimates were produced from 177 trip interviews, of which 79 (45%) came from the Bethel boat harbor, 76 (43%) from community harvest monitors, and 22 (12%) from the ONC area fish camps (Figure 5). Five interviews were from setnet harvesters with the remaining 172 interviews from driftnet users.

Based on the distribution of relevant driftnet interview quantities from the June 12 opening (Figure 9), trip duration averaged 6.9 hours and driftnet soak time averaged 5.5 hours among drift net users. Salmon catch per driftnet trip during the June 12 opening averaged 4.4 for Chinook, 1.5 for Sockeye, and 0.8 for Chum salmon (Figure 9). As in recent years, the average harvesters interviewed by community harvest monitors spent more time fishing and had higher catches/trip than reported at Bethel area fish camps or the Bethel boat harbor.

6/17/23 Opening (Drift and Set Gillnet)

An estimated total of 474 drift boat trips and 36 setnet trips occurred within the study area during the 12-hour opening on June 17 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 19,481 (95% CL: 16,777–22,588). A majority (54%) of the harvest was Chinook Salmon (10,503; 95% CL: 9,163–12,029), followed by Sockeye Salmon at 31% of the harvest (6,049; 95% CL: 4,474–7,859), and Chum Salmon at 15% of the harvest (2,929; 95% CL: 2,306–3,683) (Tables 4–6; Figure 4).

Harvest estimates were produced from 269 completed trip interviews, of which 144 (53%) came from the Bethel boat harbor, 101 (38%) came from community harvest monitors, and 24 (9%) came from ONC area fish camps (Figure 5). Of these interviews, 5% were from setnet harvesters and the remaining 95% were from driftnet harvesters.

Based on the distribution of relevant driftnet interview quantities from this opening (Figure 10), trip durations (average 7.0 hours) and soak durations (average 5.1 hours) were similar to the June 12 opening. Salmon catch per driftnet trip increased substantially over the June 12 opening for Chinook (average 15.3), Sockeye (average 7.5), and Chum (average 3.9) salmon (Figures 9 and 10).

6/23/23 Opening (Drift and Set Gillnet)

An estimated total of 446 drift boat trips and 33 setnet trips occurred in the study area during the 12-hour opening on June 23 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 21,231 (95% CL: 18,656–24,030). Sockeye Salmon were the most numerous fish harvested at 45.1% of the harvest (9,584; 95% CL: 8,356–11,060). Chinook Salmon comprised 32.9% of the salmon harvest (6,987; 95% CL: 5,915–8,203), followed by Chum Salmon at 22.0% of the harvest (4,661; 95% CL: 3,967–5,461) (Tables 4–6; Figure 4).

Harvest estimates were produced from 278 trip interviews, of which 143 (51%) came from the Bethel boat harbor, 97 (35%) from community harvest monitors, and 38 (14%) from ONC area fish camps (Figure 5). Nine interviews were from setnet harvesters with the remaining 269 interviews from driftnet users.

Based on the distribution of relevant drift harvester interview quantities from this opening, trip duration among harvesters averaged 6.7 hours, and soak time averaged 4.5 hours (Figure 11). Catches rates for driftnet boats averaged 14.3 per trip for Sockeye, 10.5 for Chinook, and 7.7 for Chum salmon. Harvesters interviewed by community harvest monitors and at Bethel area fish camps on average had longer fishing trips and higher soak times and catch rates than most people interviewed at the Bethel boat harbor.

6/30/23-7/1/23 Opening (Set Gillnet Only)

An estimated total of 104 setnet trips occurred in the study area during the 24-hour opening from June 30 to July 1 (Table 3; Figure 2). The estimated total salmon harvest was 7,944 (95% CL: 5,609–11,587). The majority (82%) of the harvest was Sockeye Salmon (6,448; 95% CL: 4,316–9,793), followed by 13% Chum Salmon (1,070; 95% CL: 750–1,442), and 5% Chinook Salmon (426; 95% CL: 312–561) (Tables 4 and 6; Figure 4).

Harvest estimates were produced from 114 trip interviews, of which 54 (48%) came from the Bethel boat harbor, 37 (33%) from KRITFC community harvest monitors, and 21 (19%) from ONC area fish camps (Figure 5). Note that the number of interviews exceeded the estimated number of trips because some of the interview data were deemed as being unreliable.

Trip duration averaged 6.1 hours and soak times averaged 5.5 hours, with setnet catches rates averaging 32.7 per trip for Sockeye, 7.0 for Chum, and 2.7 for Chinook salmon (Figure 12). Trip duration, soak times, and average Sockeye Salmon catch/trip were greatest for Bethel area fish camps, whereas Chum and Chinook salmon catch/trip was greatest for community harvest monitors.

7/4/23 Opening (Set Gillnet Only)

This opening began on July 4 and lasted 48 hours, but only data from 9:00 am to 11:59 pm on July 4 could be used to produce a harvest estimate because an aerial survey to count nets did not occur on July 5. Additionally, staff were unable to conduct harvest interviews at the Bethel boat harbor on July 4, so data were only collected from ONC area fish camp and community harvest monitors.

An estimated total of 39 setnet trips occurred in the study area on July 4 (Table 3; Figure 2). The estimated total salmon harvest was 1,629 (95% CL: 1,076–2,239). The majority (76%) of the harvest was Sockeye Salmon (1,232; 95% CL: 805–1,739), followed by 17% Chum Salmon (280; 95% CL: 154–442), and 7% Chinook Salmon (117; 95% CL: 47-212) (Tables 4 and 6; Figure 4).

Harvest estimates were produced from 22 trip interviews, of which 17 (77%) came from community harvest monitors and 5 (23%) came from Bethel area fish camps (Figure 5). Trip duration averaged 6.5 hours and soak time averaged 5.9 hours (Figure 13). While trip duration and soak times were highest for Bethel area fish camps, catches/trip for Chinook, Chum, and Sockeye salmon were highest for interviews by community harvest monitors. While some interview data are available for 7/5/23 (Figure 14), aerial surveys counts were not available to produce harvest estimates.

7/7/23-7/8/23 Opening (Set Gillnet Only)

No harvest estimate was produced for the 24-hour set gillnet opener from 9:00 am on July 7 to 9:00 am on July 8. Limited interview data are available, but bad weather prevented aerial net surveys from being conducted (Figure 15).

7/11/23 Opening (Drift and Set Gillnet)

An estimated total of 120 driftnet and 16 setnet trips occurred in the study area during the 6-hour drift and set gillnet opening on July 11 (Table 3; Figures 2 and 3). Estimated total salmon harvest was 6,709 (95% CL: 5,768–7, 754). The majority (67%) of the harvest was Sockeye Salmon (4,478; 95% CL: 3,805–5,215), followed by 28% Chum Salmon (1,916; 95% CL: 1,456–2,461), 4% Chinook Salmon (264; 95% CL: 210–326), and 1% Coho Salmon (15; 95% CL: 8–124) (Table 6; Figure 4).

Harvest estimates were produced from 66 trip interviews, of which 49 (74%) came from the Bethel boat harbor, and 17 (26%) from community harvest monitors (Figure 5). Based on the distribution of relevant drift harvester interview quantities from this opening (Figure 12), trip duration (average 3.5 hours) increased but soak time (average 1.7 hours) decreased compared to recent openings (Figure 16).

7/17/23 Opening (Set Gillnet Only)

An estimated total of 14 setnet trips occurred in the study area during the 12-hour set gillnet opening on July 17 (Table 3; Figure 2). The estimated total salmon harvest was 309 (95% CL: 175–463). The majority (58%) of the harvest was Sockeye Salmon (180; 95% CL: 104–267), followed by 35% Chum Salmon (108; 95% CL: 42–189), 6% Chinook Salmon (17; 95% CL: 4–34), and 1% Coho Salmon (4; 95% CL: 0–10) (Tables 4 and 6; Figure 4).

Harvest estimates were produced from 14 trip interviews, of which eight (57%) came from the Bethel boat harbor, and six (43%) from community harvest monitors (Figure 5). Trip duration averaged 4.3 hours and soak time averaged 3.6 hours (Figure 17), with both measures being increases over previous recent opening.

7/19/23 Opening (Set Gillnet Only)

An estimated total of 17 setnet trips occurred in the study area during the 12-hour set gillnet opening on July 19 (Table 3; Figure 2). The estimated total salmon harvest was 314 (95% CL: 178–474). The majority (51%) of the harvest was Chum Salmon (159; 95% CL: 76–261), followed by 43% Sockeye Salmon (136; 95% CL: 76–205), 4% Chinook Salmon (13; 95% CL: 1–28), and 2% Coho Salmon (6; 95% CL: 1–11) (Tables 4 and 6; Figure 4).

Harvest estimates were produced from 17 trip interviews, of which 10 (59%) came from the Bethel boat harbor, and seven (41%) from community harvest monitors (Figure 5). Trip duration averaged 4.4 hours and soak time averaged 3.3 hours (Figure 18).

7/24/23 Opening (Set Gillnet Only)

An estimated total of 7 setnet trips occurred in the study area during the 6-hour set gillnet opening on July 24 (Table 3; Figure 2). The estimated total salmon harvest was 164 (95% CL: 97–214). The largest component (40%) of the harvest was Chum Salmon (65; 95% CL: 35–85), followed by 34% Sockeye Salmon (56; 95% CL: 34–70), 18% Coho Salmon (30; 95% CL: 15–42), and 8% Chinook Salmon (13; 95% CL: 1–27) (Tables 4 and 6; Figure 4).

Harvest estimates were produced from 7 trip interviews, of which 4 (57%) came from community harvest monitors and 3 (43%) from the Bethel boat harbor (Figure 5). Trip duration averaged 3.4 hours and soak time averaged 2.9 hours (Figure 19).

7/26/23 Opening (Set Gillnet Only)

No harvest estimate was produced for the 6-hour set gillnet opener on July 26. Limited interview data are available (Figure 20).

8/3/23 Opening (Drift and Set Gillnet)

An estimated total of 129 driftnet trips and 6 setnet trips occurred in the study area during the 12-hour drift and set gillnet opening on August 3 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 4,752 (95% CL: 4,049–5,568). The majority (84%) of the harvest was Coho Salmon (4,019; 95% CL: 3,389–4,755), followed by 11% Chum Salmon (514; 95% CL: 3318–737), 4% Sockeye Salmon (185; 95% CL: 119–278), and 1% Chinook Salmon (35; 95% CL: 8–75) (Table 6; Figure 4).

Harvest estimates were produced from 85 trip interviews, of which 68 (80%) came from the Bethel boat harbor, and 17 (20%) from community harvest monitors (Figure 5). Driftnet trip duration averaged 3.5 hours and soak time averaged 1.8 hours (Figure 21).

8/9/23 Opening (Drift and Set Gillnet)

An estimated total of 41 driftnet trips and 1 setnet trip occurred in the study area during the 12-hour drift and set gillnet opening on August 9 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 1,285 (95% CL: 1,101–1,486). The majority (95%) of the harvest was Coho Salmon (1,225; 95% CL: 1,050-1,422), followed by 3% Sockeye Salmon (33; 95% CL: 18–-52), and 2% Chum Salmon (27; 95% CL: 16–40) (Table 6; Figure 4). No Chinook Salmon harvests were reported.

Harvest estimates were produced from 62 trip interviews, of which 40 (65%) came from the Bethel boat harbor, and 22 (35%) from community harvest monitors (Figure 5). However, the number of nets counted during the aerial survey substantially exceeded the number of nets reported to be fishing at the time of the survey based on interviews, and the estimation model adjusted the net counts accordingly. Driftnet trip duration averaged 3.6 hours and soak time averaged 1.5 hours (Figure 22).

8/12/23 Opening (Drift and Set Gillnet)

An estimated total of 61 driftnet trips and 9 setnet trips occurred in the study area during the 12-hour drift and set gillnet opening on August 12 (Table 3; Figures 2 and 3). The estimated total salmon harvest was 2,203 (95% CL: 1,906–2,528). The majority (95%) of the harvest was Coho Salmon (2,097; 95% CL: 1,799–2,417), followed by 3% Chum Salmon (72; 95% CL: 46–103), and 2% Sockeye Salmon (34; 95% CL: 16–57) (Table 6; Figure 4). Although 1 Chinook Salmon was reported as harvested, the estimated catch is zero after adjusting for fishing gear and time (0; 95% CL: 0–2).

Harvest estimates were produced from 53 trip interviews, of which 43 (81%) came from the Bethel boat harbor, and 10 (19%) from KRITFC community harvest monitors (Figure 5). Driftnet trip duration averaged 3.6 hours and soak time averaged 1.5 hours (Figure 23).

Total Harvest across Openings

Insufficient or no data were available to make harvest estimates for July 1, 5, 6, 7, 8, 21 and 26. In addition, 66 interviews of harvesters fishing stratum O (primarily non-spawning tributaries and below Eek Island) and above Bogus Creek (above stratum D2) had no aerial survey counts of nets (Figure 1). Therefore, interview data were not expanded to total estimates for these areas, and total harvest estimates reported here should be considered as minimum estimates.

Across all openings, an estimated total of 69,346 (95% CL: 64,355–74,803) salmon was harvested (Table 6; Figure 24). This estimate does not include harvests that (a) occurred in tributaries of the lower Kuskokwim River; (b) occurred above Bogus Creek; (c) were from non-gillnet capture methods; or (d) occurred during fishing opportunities on dates identified above for which no or insufficient data were available to make harvest estimates. This total harvest was 6% larger than the average annual harvest of all salmon from 2016–2022 (Table 7).

Sockeye Salmon was the largest contributor (42% of the total) to the 2023 inseason harvest estimate with a total of 28,936 fish (95% CL: 25,504–32,761; Table 6; Figure 24). The 2023 harvest of Sockeye Salmon was the largest inseason amount since 2016 and 43% larger than the average Sockeye Salmon harvest during 2016–2022 (Table 7).

The harvest of 21,055 Chinook Salmon (95% CL: 19,241–23,038) comprised 30% of the total 2023 inseason salmon harvest estimate (Table 6; Figure 24). The 2023 Chinook Salmon harvest was 15% less than the 2016–2022 average harvest (Table 7).

The total inseason estimate of 11,929 (95% CL: 10,773–13,226) Chum Salmon harvested in 2023 comprised 17% of the estimate for all salmon (Table 16; Figure 24). This was the largest inseason estimate of Chum Salmon harvest since 2019, but still 43% less than the average harvest during 2016–2022 (Table 7).

The harvest of 7,425 Coho Salmon (95% CL: 6,658–8,243) comprised 11% of the total 2023 inseason salmon harvest estimate (Table 6; Figure 24). Because this was the first year to estimate inseason harvests of Coho Salmon, other years are not available for comparison (Table 7).

However, note that the 2023 inseason estimates also include harvests reported for stratum D2 (Akiak to Bogus Creek) and also Coho Salmon harvests, which were not part of the summaries. in previous years.

In 2023, harvesters in geographic stratum C (Napaskiak to Akiachak; Table 6; Figures 1 and 25) caught the most total salmon, accounting for 45% of all salmon harvest, followed by stratum A (Eek Island to Johnson River; 24%), stratum B (Johnson River to Napaskiak; 18%), and stratum D1 (Akiachak to Akiak;8%) and stratum D2 (Akiak to Bogus Creek; 5%) (Table 6). Driftnet effort in 2023 peaked on the June 17 opening, whereas maximum setnet effort occurred on June 9 (Table 3).

Synthesis of Key Information on 6/12 Openings

June 12 is a key opening date, following June 1 to June 11 restrictions to allow early returning Chinook Salmon to migrate upstream (Smith and Gray 2022). But it remains important to continue synthesizing information on the 12-hour openings that have been implemented on June 12 from 2016 to 2023. There are several notable findings from June 12 fishing opportunities during 2016–2023. The number of driftnet and setnet trips from Eek to Bogus Creek peaked at 584 trips in 2017, steadily declined to 409 trips in 2021, increased to 477 trips in 2022, then fell dramatically in 2023 to 212 trips, a level of effort 57% less than the 2016–2022 average (Table 8). Notably, the weather on June 12, 2023, was marginal for fishing with rain and high winds, which likely deterred many harvesters from fishing; and the river was unusually high with lots of debris, which may have prevented the harvest of Chinook Salmon that were reported to be present in deep channels.

In terms of total harvest, this first combined 12-hour drift and set gillnet opening in 2023 resulted in an estimated total salmon harvest that was 76% less than the average June 12 harvest during 2016–2022 (Table 8). Note that these data consider effort and harvest only for strata A to D1 to allow comparison to historical data (stratum D2 was first included in 2023). The estimated 908 Chinook Salmon harvested in this opening was the lowest for this date since 2016 and 80% less than the 2016–2022 average. The estimate of 96 Chum Salmon harvested in this opening was more than in 2021 and 2022, but 88% less than the longer-term average. In contrast, the June 12

Sockeye Salmon harvest was 9% higher than the 2016–2022 average. The species ratio (Chum+Sockeye/Chinook) in 2023 (0.5) was the highest observed since 2016, indicating more Chum and Sockeye relative to Chinook (Table 8).

DISCUSSION

Overall Summary

For the 2023 season, an inseason estimated total of 69,346 (95% CL: 64,355–74,803) salmon was harvested in strata A to D2 (Figure 1; Tables 6 and 8). This estimate was 6% larger than the average during 2016–2022, the years for which the current inseason harvest estimation program has been implemented. The largest catch component (42%) in 2023 was the Sockeye Salmon harvest of 28,936 fish (95% CL: 25,504–32,761), representing the largest inseason harvest estimate for Sockeye Salmon since 2016. Chinook Salmon was the second largest contributor (30%) to the 2023 inseason harvest estimate with a total of 21,055 fish (95% CL: 19,241–23,038). The 2023 harvest of Chinook Salmon was 15% less than the average harvest during 2016–2022. Chum Salmon comprised 17% of the total 2023 inseason harvest estimate, and the harvest of 11,929 (95% CL: 10,773–13,226) Chum Salmon was the largest catch since 2019, but still only 43% of the average harvest during 2016–2022. The harvest of 7,425 Coho Salmon (95% CL: 6,658–8,243) was 11% of the total 2023 inseason salmon harvest estimate; 2023 was the first year that Coho Salmon have been included in the inseason harvest estimates.

As noted previously, the 2023 estimates do not include harvests: from July 1, 5, 6, 7, 8, 21 and 26 openings; from non-salmon spawning tributaries; from areas outside the YDNWR boundaries; or from areas upriver of Bogus Creek (Figure 1). Reasons for excluding data for certain dates is typically related to: (1) a lack of aerial surveys to count nets; or (2) an insufficient number of interviews. In total, 1,418 inseason harvest interviews were conducted among the three sources: 735 (52%) from the Bethel boat harbor as sampled by ONC, KRITFC, and USFWS; 558 (39%) from KRITFC community-based harvest monitors; and 125 (9%) from fish camps sampled by ONC.

For set gillnets fished over midnight between days (e.g., 09:00 am on July 4 to 09:00 am on July 6), it was necessary to divide the catch across days for accommodation by the harvest estimation code. This likely resulted in an overestimation of the number of nets fished across multi-day openings, although the total catch estimate should still be fairly accurate. If one of the days over which the catch is divided is excluded from consideration due to one of the reasons listed above, the estimate is only made for the day with adequate data. Revision of the estimation code to consider fishing across multiple days is a future consideration.

Note that the 2023 fishing season differed from 2016–2022 in several aspects. For one, the period of federal fishery management on the Lower Kuskokwim River extended from June 1 to August 13, a longer period than in previous years. The original assumption of fishery management by USFWS under the provisions of ANILCA Title VIII was tied to a dramatic decline of Chinook Salmon stocks returning to the Kuskokwim River after a record low return in

2012. That decline was followed in recent years by an equally dramatic decline in Chum Salmon stocks. Then, following poor Coho Salmon returns with a record low return in 2022, concerns emerged over the potential status of Coho Salmon in 2023 and federal management continued until August 13, when it became apparent that the Coho Salmon return was stronger than observed in 2022 and stronger than projected for 2023. The 2023 inseason management program continued through the period of federal management to provide fishery managers with inseason harvest information into the early portion of the Coho Salmon return.

A second difference for the 2023 season was to modify the harvest estimation computer code to allow inclusion of Coho Salmon (B. Staton, B. Staton, Quantitative Ecological Services, pers. com.). Harvests of Coho Salmon reported in interviews is now a selected option when estimating harvests.

Finally, the computer code was modified to allow interviews and survey data from stratum D2 (Figure 1; B. Staton, Quantitative Ecological Services, pers. com.). Interview and aerial survey data were first available from stratum D2 in 2022, but it wasn't until 2023 that the computer code was modified to allow harvest estimation for stratum D2.

Given the above caveats, the estimates provided in this report should be considered minimum subsistence harvest estimates that will be revised through the Alaska Department of Fish and Game household surveys conducted postseason (e.g., McDevitt and Koster 2022).

It should also be noted that data presented in this report may differ slightly from harvest summaries provided inseason following individual openings. Substantial effort is made to receive the interview and flight data by about 12 hours after an opening, and process that data into a harvest estimate that can be distributed in 1-2 days after an opening. However, in several instances, and for a variety of reasons, interview data were not received until an initial harvest summary was distributed. These late data have been included in this report but did not have a substantial effect on harvest estimates, but did improve the precision of the estimates.

Reliability of Assumptions

All reported analyses assumed the interview information to be random samples from the population of harvesters during the openings (Bernard et al. 1998). This assumption is not unique to this analysis, or creel surveys in general, but is made in every statistical analysis where samples are used to make inferences on a population. We must highlight that sampling for the completed trip interviews was not implemented as truly random, but was opportunistic. The potential for non-randomness could raise questions about the harvest estimates in terms of accuracy and precision. If data were systematically biased (e.g., some people interviewed fished longer and had higher catch rates than non-sampled harvesters), then the resulting estimates would also be biased. While surveys had both high and low catches, we believe these estimates thoroughly represent the available harvest results and efforts. In addition, the software was recently revised to exclude interview data that exceeding three standard deviations from the mean (B. Staton, Quantitative Ecological Services, pers. com).

We believe the samples, although gathered opportunistically, provide a good representation of the lower Kuskokwim River subsistence fishery during block openings. Fishing opportunities in the 2023 season were relatively short in duration, ranging from 6 to 48 hours, meaning that surveyor coverage at interview locations could sample a representation of harvesters returning to these locations, leading us to believe temporal representation was high (i.e., the samples should identify variability due to the time of day that different trips occurred). However, due to the size of the study area and the number of communities involved, spatial representation is more difficult to guarantee. The lower Kuskokwim River can be generally separated into three major sections based on river morphology, harvester behavior, and harvester density: (1) upriver from Bethel, (2) around Bethel, and (3) downriver from Bethel. A majority of the surveys collected were from around Bethel, primarily through the Bethel boat harbor surveys conducted by ONC, and later in the season by KRITFC and USFWS. While most of the population of subsistence harvesters is based in and around Bethel, catch rates outside of Bethel can differ substantially from Bethel area harvests. For example, the villages of Napaskiak and Napakiak are relatively short boat rides (about 6 and 10 river miles, respectively) from Bethel, but exhibit different effort and harvest characteristics from Bethel.

Overall, interviews by ONC at the Bethel area fish camps, including at Oscarville, and Napaskiak, and at the Bethel boat harbor by ONC, KRITFC, and USFWS provided a respectable representation of the subsistence fishery in the Bethel area. Concurrently, KRITFC provided coverage through community-based harvest monitors based below Bethel in the villages of Eek, Tuntutuliak, Napakiak, and Napaskiak, and above Bethel in the villages of Kwethluk, Akiachak, Akiak, and Tuluksak. Given this broad geographic coverage within the study area, we believe data collected through the monitoring program are representative of the lower river subsistence fishery.

Other Harvest Not Monitored or Accounted For

Harvest estimates in this document for salmon within the study area are believed to be accurate for river areas represented by interviews and aerial net counts, but are undoubtedly biased low as an estimate for all of 2023. For example, gillnet harvests occurred in areas designated as non-spawning tributaries that were still part of the Kuskokwim River drainage. Harvest in these areas is poorly documented (Decossas 2019b). The 2023 interviews collected some information from subsistence users who fished in the non-salmon spawning tributaries (i.e., Johnson River, Tuntutuliak River, and Pailleq Slough). This aspect is further amplified because data from non-salmon spawning tributaries are often collected only when the mainstem fishery is open for fishing, whereas non-salmon spawning tributaries are open throughout the salmon season with fewer gear restrictions (e.g., gillnets with ≥ 6” mesh are allowed). No data collected from non-salmon spawning tributaries were included in these 2023 harvest estimates. Harvest estimates were not generated for these locations, similar to previous years, because subsistence harvest interviews are generally collected only for announced fishing openings, and aerial surveys do not typically cover these areas. Similarly, harvest interviews were conducted with harvesters fishing just outside the YDNWR boundary near Eek Island and also from stratum D3, but these data are not included in the harvest estimates. While harvests in these locations are not believed to be

detrimental to meeting escapement needs, the magnitude of salmon harvests in these locations remains unknown.

Additionally, Federally Qualified Subsistence Users were also able to harvest Chinook Salmon before June 1 with up to 6" mesh size gillnets. During this time period, harvest and effort are not monitored, although the number of Chinook Salmon in the Kuskokwim River is believed to have been minimal.

Finally, the coauthors would like to note that inseason harvest monitoring in 2023 encompassed the majority of the Chinook, Chum, and Sockeye salmon returns, but only the early portion of the Coho Salmon run. The extent to which inseason harvest during the Coho Salmon return is monitored in future years will likely depend on future trends of this stock.

Sensitivity of Harvest Estimates

Sensitivity of the estimates to assumption violations was investigated by producing effort and harvest estimates using data from smaller subsets of all of the available interviews (e.g., removing Bethel boat harbor interviews). Results of these analyses showed that the estimates were generally robust to leaving out information (i.e., making the information used presumably less representative), and the results ranged from small changes (<5%) in point estimates to larger changes (~15%). Typically, harvest estimates increased when Bethel boat harbor data were removed and decreased when the CBM interviews were removed. In most cases, the point estimate of the analysis with left-out data fell within the 95% CL of the original estimate and the qualitative conclusion did not change.

Again, one aspect that needs clarification is that some table values, if summed across date, location, or species, might not add up exactly to the displayed total. This is due to rounding of values and is an aspect considered for future resolution.

Technical Review of Harvest Estimates

During 2023, the harvest estimation model was run independently by two or more of the coauthors, or a coauthor and KRITFC staff, and the resulting estimates were resolved. Output differences were usually tied to data entry or formatting errors. After resolving data issues, harvest estimates were sent to an open email list that included USFWS-KRITFC inseason managers and researchers, the Kuskokwim River Salmon Management Working Group, Alaska Department of Fish and Game, and interested stakeholders.

Scalability of the Model

The current methods for estimating inseason salmon harvests are effective when applied to most fishery conditions that have occurred since 2016 (i.e., relatively few opportunities, each relatively short in duration). However, if the frequency and duration of fishing opportunities

were to increase, a more carefully designed random sampling program may be needed to produce reliable harvest estimates. This is because longer openings make it more difficult to justify the assumption of random sampling at existing locations with interview coverage. Currently, interviewers are focused toward the end or just after the end of an opening. But as the duration of an opening increases, decisions need to be made about the most appropriate time and place to conduct interviews to ensure interviews are a representative sample of the fishery. Interviews by phone have aided the interview process, but it is still uncertain how interviews might be randomized over a longer duration opening.

ACKNOWLEDGMENTS

The KRITFC Community-Based Harvest Monitoring program was funded in 2023 through grants from the Fisheries Resource Monitoring Program under the USFWS Office of Subsistence Management (FRMP 22-354) and through a Bureau of Indian Affairs Cooperative Management Program award. The ONC inseason interview harvest monitoring program was funded by a grant from the Fisheries Resource Monitoring Program (F19AS00022 and F22ACO1433-01) and Alaska Department of Fish and Game Spatio-temporal Variations of Chinook Salmon in AYK (AC-2104 E) under the USFWS Office of Subsistence Management.

The authors would like to thank USFWS staff Boyd Blihovde, Spencer Rearden, Kyra Neal, Mike Wade, and USFWS pilots for their collaboration and collection of data by flights, without which this analysis would not have been possible. Special appreciation is extended to individuals conducting interviews including: KRITFC monitors James Heakin, Sherrie Heakin, Brianna Pavila, Isaiah Pavila, Peter Nelson, Kimberly Nicholai, Wesley Nicholai, Alfred Epchook, Elizabeth Phillip, Kyra Phillip, Moselle Alexie, Kathleen Lake, Carl Napoka, Jr., and Wilfred Waska; and ONC interviewers Alissa Nadine Rogers, Nia Long, Briana Henry, Kara Domnick, Grace Kugler, Canaar Charlie, Delen Hooper, Orianne Reich, and Elenore Whitney. Interviewers often worked late hours to conduct interviews and submit data through a customized phone app. We also thank LaMont Albertson, Avery Hoffman, Nikki Pollock, Justin Leon, Joe Spaeder, Karen Gillis, and Kevin Whitworth for their contributions in initiating and furthering the community-based monitoring work, with special thanks to Ben Staton (Quantitative Ecological Services) for his guidance, and development and revisions as needed, of the ‘KuskoHarvEst’ software package used to produce harvest estimates. Finally, our greatest appreciation goes to the subsistence harvesters in the lower Kuskokwim River for their willingness to participate in the interviews, without which these analyses could not be conducted. Quyana, Tsen’ahn, thank you for sharing your time and knowledge to support the protection of Kuskokwim River salmon and traditional ways of life.

REFERENCES

Bechtol, W.R., and T. Schomogyi. 2022. Inseason harvest and effort estimates for the 2022 Kuskokwim River subsistence salmon fisheries during block openings. Kuskokwim River Inter-Tribal Fish Commission, 39 + iv p.

Bernard, D.R., A.E. Bingham, and M. Alexanderdottir. 1998. The mechanics of onsite creel surveys in Alaska. Alaska Department of Fish and Game Division of Sport Fish Special Publication Number 98-1. Anchorage, AK.

Decossas, G., 2019a. In-season harvest and effort estimates for the 2019 Kuskokwim River subsistence salmon fisheries during block openers. U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Decossas, G., 2019b. Estimation of subsistence gillnet effort and Chinook Salmon harvest in non-salmon spawning tributaries of the Lower Kuskokwim River U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Decossas, G., 2020. In-season harvest and effort estimates for the 2020 Kuskokwim River subsistence salmon fisheries during block openers. U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Larson, S. 2023. 2022 Kuskokwim River Chinook salmon run reconstruction and 2023 forecast. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report No. 3A23-02, Anchorage.

McDevitt, C. and D. Koster. 2022. Subsistence Fisheries Harvest Monitoring Report, Kuskokwim Fisheries Management Area, Alaska, 2021. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 489, Fairbanks.

Russell, K., K. Whitworth, W.R. Bechtol, and B,A, Staton. 2021. Inseason harvest and effort estimates for the 2021 Kuskokwim River subsistence salmon fisheries during block openers, Kuskokwim River Inter-Tribal Fish Commission.

Smith, N., and B.P. Gray. 2022. 2021 Kuskokwim management area annual management report. Alaska Department of Fish and Game, Fishery Management Report No. 22-26, Anchorage.

Staton, B.A, 2018. In-season harvest and effort estimates for the 2018 Kuskokwim River subsistence salmon fisheries during block openers. U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Staton, B. 2021. 'KuskoHarvEst': Tools for producing in-season estimates of salmon harvest and effort occurring in short-duration subsistence harvest opportunities in the Lower Kuskokwim River. R package version 1.1.0. **https://www.github.com/bstaton1/KuskoHarvEst**

Staton, B.A., and M.J. Catalano, 2019. Bayesian information updating procedures for Pacific salmon run size indicators: evaluation in the presence and absence of auxiliary migration timing information. Canadian Journal of Fisheries and Aquatic Sciences. 76:1719–1727.

Staton, B.A., M.J. Catalano, T.M. Farmer, A. Abebe, and F.S. Dobson, 2017. Development and evaluation of a migration timing forecast model for Kuskokwim River Chinook salmon. Fisheries Research. 194:9–21.

Staton, B.A., and L.G. Coggins. 2016. In-season harvest and effort estimates for 2016 Kuskokwim River subsistence salmon fisheries during block openers. U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Staton, B.A., and L.G. Coggins. 2017. In-season harvest and effort estimates for the 2017 Kuskokwim River subsistence salmon fisheries during block openers. U.S. Department of Interior, Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, Bethel, AK.

Table 1. Raw set gillnet counts by geographic stratum for dates on which aerial net counts occurred, 2023.

Opening	Date	Flight Times[1]		Geographic Stratum[2]					Total
		Start	Stop	A	B	C	D1	D2	
1	6/3/23	14:00	16:20	1	10	41	5	3	60
2	6/6/23	14:10	16:20	1	9	57	4	11	82
3	6/9/23	13:00	15:30	1	28	68	20	12	129
4	6/12/23	16:00	18:00	0	9	17	2	3	31
5	6/17/23	10:00	11:35	0	0	8	2	3	13
5	6/17/23	14:15	16:15	2	8	16	4	6	36
6	6/23/23	10:15	12:10	0	2	22	0	3	27
6	6/23/23	16:11	17:50	1	0	3	5	1	10
7	6/30/23	17:05	18:39	8	7	54	14	7	90
8	7/4/23	15:47	17:28	0	3	30	4	2	39
8	7/5/23	ND	ND	ND	ND	ND	ND	ND	ND
9	7/7/23	ND	ND	ND	ND	ND	ND	ND	ND
10	7/11/23	12:30	14:26	0	0	12	4	0	16
11	7/17/23	17:00	18:30	0	0	8	0	1	9
12	7/19/23	13:55	15:10	1	0	4	1	1	7
13	7/21/23	ND	ND	ND	ND	ND	ND	ND	ND
14	7/24/23	13:00	15:00	1	2	1	1	1	6
15	7/26/23	ND	ND	ND	ND	ND	ND	ND	ND
16	8/3/23	16:00	17:34	0	0	2	1	1	4
17	8/9/23	15:30	17:30	0	0	1	0	0	1
18	8/12/23	10:58	13:28	0	0	7	2	0	9

[1]ND = No data

[2]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, D2 = Akiak to Bogus Creek

Table 2. Raw drift gillnet counts by geographic stratum for dates on which aerial net counts occurred, 2023.

Opening	Date	Flight Times[1]		Geographic Stratum[2]					Total
		Start	Stop	A	B	C	D1	D2	
1	6/3/23	14:00	16:20	0	0	0	0	0	0
2	6/6/23	14:10	16:20	0	0	0	0	0	0
3	6/9/23	13:00	15:30	0	0	0	0	0	0
4	6/12/23	16:00	18:00	3	13	72	8	9	105
5	6/17/23	10:00	11:35	83	50	199	22	18	372
5	6/17/23	14:15	16:15	148	78	159	33	24	442
6	6/23/23	10:15	12:10	54	85	192	20	20	371
6	6/23/23	16:11	17:50	46	41	104	25	13	229
7	6/30/23	17:05	18:39	0	0	0	0	0	0
8	7/4/23	15:47	17:28	2	0	0	0	0	0
8	7/5/23	ND	ND	ND	ND	ND	ND	ND	ND
9	7/7/23	ND	ND	ND	ND	ND	ND	ND	ND
10	7/11/23	12:30	14:26	24	19	36	10	10	99
11	7/17/23	17:00	18:30	0	0	0	0	0	0
12	7/19/23	13:55	15:10	0	0	0	0	0	0
13	7/21/23	ND	ND	ND	ND	ND	ND	ND	ND
14	7/24/23	13:00	15:00	0	0	0	0	0	0
15	7/26/23	ND	ND	ND	ND	ND	ND	ND	ND
16	8/3/23	16:00	17:34	2	8	44	3	2	59
17	8/9/23	15:30	17:30	2	3	11	8	0	24
18	8/12/23	10:58	13:28	4	12	21	0	3	40

[1]ND = No data

[2]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, D2 = Akiak to Bogus Creek

Table 3. Estimated drift and set gillnet trips by date and geographic stratum, 2023. These quantities were derived from the raw counts presented in Tables 1 and 2.

Gear	Opening	Date	Duration[2]	Geographic Stratum[1]					Total
				A	B	C	D1	D2	
Driftnet	1	6/3/23	16	NA	NA	NA	NA	NA	NA
	2	6/6/23	16	NA	NA	NA	NA	NA	NA
	3	6/9/23	16	NA	NA	NA	NA	NA	NA
	4	6/12/23	12	6	25	138	15	17	201
	5	6/17/23	12	132	74	212	32	24	474
	6	6/23/23	12	77	91	217	36	25	446
	7	6/30/23	24	NA	NA	NA	NA	NA	NA
	8	7/4/23	48	NA	NA	NA	NA	NA	NA
	9	7/7/23	24	NA	NA	NA	NA	NA	NA
	10	7/11/23	6	NA	NA	NA	NA	NA	NA
	11	7/17/23	12	29	23	44	12	12	120
	12	7/19/23	12	NA	NA	NA	NA	NA	NA
	13	7/21/23	12	NA	NA	NA	NA	NA	NA
	14	7/24/23	6	NA	NA	NA	NA	NA	NA
	15	7/26/23	6	NA	NA	NA	NA	NA	NA
	16	8/3/23	12	4	18	96	7	4	129
	17	8/9/23	12	3	5	19	14	0	41
	18	8/12/23	12	6	18	32	0	5	61

-continued-

Table 3 (Page 2 pf 2).

Gear	Opening	Date	Duration[2]	Geographic Stratum[1]					Total
				A	B	C	D1	D2	
Set Gillnet	1	6/3/23	16	1	10	41	5	3	60
	2	6/6/23	16	1	9	57	4	11	82
	3	6/9/23	16	1	28	68	20	12	129
	4	6/12/23	12	0	9	17	2	3	31
	5	6/17/23	12	1	4	19	5	7	36
	6	6/23/23	12	2	1	18	8	4	33
	7	6/30/23	24	9	8	63	16	8	104
	8	7/4/23	48	0	3	30	4	2	39
	8	7/5/23	“	ND	ND	ND	ND	ND	ND
	9	7/7/23	24	ND	ND	ND	ND	ND	ND
	10	7/11/23	6	0	0	12	4	0	16
	11	7/17/23	12	0	0	12	0	2	14
	12	7/19/23	12	2	0	10	2	3	17
	13	7/21/23	12	ND	ND	ND	ND	ND	ND
	14	7/24/23	6	1	3	1	1	1	7
	15	7/26/23	6	ND	ND	ND	ND	ND	ND
	16	8/3/23	12	0	0	3	1	2	6
	17	8/9/23	12	0	0	1	0	0	1
	18	8/12/23	12	0	0	7	2	0	9

[1]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, D2 – Akiak to Bogus Creek
[2]Duration is the number of hours in the opening.
NA = not applicable; e.g., drift gillnet closed on set-only opportunity
ND = No data or insufficient data,.

Table 4. Salmon harvests from set gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits.

		Geographic Stratum[1]					
Opening	Species	A	B	C	D1	D2	Total
6/3/23	Chinook	6 (3-10)	59 (27-98)	240 (109-401)	29 (13-49)	18 (8-29)	352 (160-587)
	Chum	0 (0-0)	1 (0-2)	3 (0-10)	0 (0-1)	0 (0-1)	4 (0-14)
	Sockeye	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	6 (3-10)	59 (27-99)	243 (112-404)	30 (14-49)	18 (8-29)	356 (164-591)
6/6/23	Chinook	3 (2-4)	24 (16-32)	152 (99-205)	11 (7-14)	29 (19-39)	219 (143-294)
	Chum	0 (0-0)	0 (0-1)	1 (0-4)	0 (0-0)	0 (0-1)	1 (0-6)
	Sockeye	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	3 (2-4)	24 (16-32)	153 (100-206)	11 (7-14)	29 (19-40)	220 (144-296)
6/9/23	Chinook	9 (6-13)	245 (158-360)	596 (384-875)	175 (113-257)	105 (68-154)	1,131 (729-1,659)
	Chum	0 (0-0)	6 (1-12)	14 (3-30)	4 (1-9)	2 (1-5)	26 (6-56)
	Sockeye	1 (1-1)	29 (18-42)	71 (45-102)	21 (13-30)	13 (8-18)	135 (85-193)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	10 (7-14)	281 (189-407)	681 (461-988)	200 (135-290)	120 (81-174)	1,293 (874-1,873)
6/12/23	Chinook	0 (0-0)	3 (0-10)	6 (0-19)	1 (0-2)	1 (0-3)	11 (0-34)
	Chum	0 (0-0)	1 (0-4)	2 (0-8)	0 (0-1)	0 (0-1)	4 (0-14)
	Sockeye	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	0 (0-0)	4 (0-13)	8 (0-24)	1 (0-3)	1 (0-5)	14 (0-44)

-continued-

Table 4 (Page 2 of 5).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
6/17/23	Chinook	6 (3-9)	22 (11-37)	106 (52-175)	28 (14-46)	39 (19-64)	201 (99-331)
	Chum	0 (0-1)	2 (0-4)	9 (2-21)	2 (1-5)	3 (1-8)	17 (4-39)
	Sockeye	2 (0-5)	8 (2-19)	39 (9-88)	10 (2-23)	14 (3-32)	74 (16-167)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	8 (4-13)	32 (17-53)	154 (82-252)	41 (21-66)	57 (30-93)	292 (155-476)
6/23/23	Chinook	9 (4-17)	5 (2-8)	83 (36-149)	37 (16-66)	18 (8-33)	152 (66-273)
	Chum	4 (0-10)	2 (0-5)	35 (4-92)	16 (2-41)	8 (1-21)	65 (7-169)
	Sockeye	41 (9-83)	21 (4-41)	371 (79-745)	165 (35-331)	82 (18-165)	680 (145-1,365)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	54 (18-106)	27 (9-52)	489 (161-943)	217 (72-418)	109 (36-209)	897 (296-1,728)
6/30/23	Chinook	37 (27-49)	33 (24-43)	258 (189-340)	66 (48-86)	33 (24-43)	426 (312-561)
	Chum	93 (65-125)	82 (58-111)	648 (454-873)	165 (115-222)	82 (58-111)	1,070 (750-1,442)
	Sockeye	558 (374-847)	496 (332-753)	3,906 (2,614-5,932)	992 (664-1,507)	496 (332-753)	6,448 (4,316-9,793)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	687 (485-1,003)	611 (432-891)	4,812 (3,398-7,018)	1,222 (863-1,783)	611 (432-891)	7,944 (5,609-11,587)
7/4/23	Chinook	0 (0-0)	9 (4-16)	90 (36-163)	12 (5-22)	6 (2-11)	117 (47-212)
	Chum	0 (0-0)	22 (12-34)	215 (118-340)	29 (16-45)	14 (8-23)	280 (154-442)
	Sockeye	0 (0-0)	95 (62-134)	948 (619-1,338)	126 (83-178)	63 (41-89)	1,232 (805-1,739)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	0 (0-0)	125 (83-172)	1,253 (827-1,722)	167 (111-230)	84 (55-115)	1,629 (1,076-2,239)
7/5/23	Total	ND	ND	ND	ND	ND	ND

-continued-

Table 4 (Page 3 of 5).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
7/7/23	Total	ND	ND	**ND**	**ND**	**ND**	**ND**
7/11/23	Chinook	0 (0-0)	0 (0-0)	21 (0-48)	7 (0-16)	0 (0-0)	28 (0-64)
	Chum	0 (0-0)	0 (0-0)	81 (12-180)	27 (4-60)	0 (0-0)	108 (16-240)
	Sockeye	0 (0-0)	0 (0-0)	179 (0-300)	60 (0-100)	0 (0-0)	238 (0-400)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	0 (0-0)	0 (0-0)	281 (24-427)	94 (8-143)	0 (0-0)	375 (32-570)
7/17/23	Chinook	0 (0-0)	0 (0-0)	14 (3-29)	0 (0-0)	2 (1-5)	17 (4-34)
	Chum	0 (0-0)	0 (0-0)	93 (36-162)	0 (0-0)	15 (6-27)	108 (42-189)
	Sockeye	0 (0-0)	0 (0-0)	154 (89-229)	0 (0-0)	26 (15-38)	180 (104-267)
	Coho	0 (0-0)	0 (0-0)	4 (0-9)	0 (0-0)	1 (0-1)	4 (0-10)
	Total	0 (0-0)	0 (0-0)	265 (150-397)	0 (0-0)	44 (25-66)	309 (175-463)
7/19/23	Chinook	2 (0-3)	0 (0-0)	8 (1-17)	2 (0-3)	2 (0-5)	13 (1-28)
	Chum	19 (9-31)	0 (0-0)	93 (45-153)	19 (9-31)	28 (13-46)	159 (76-261)
	Sockeye	16 (9-24)	0 (0-0)	80 (45-121)	16 (9-24)	24 (13-36)	136 (76-205)
	Coho	1 (0-1)	0 (0-0)	3 (1-7)	1 (0-1)	1 (0-2)	6 (1-11)
	Total	37 (21-56)	0 (0-0)	185 (105-279)	37 (21-56)	55 (31-83)	314 (178-474)
7/21/23	Total	ND	ND	ND	ND	ND	ND

-continued-

Table 4 (Page 4 of 5).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
7/24/23	Chinook	2 (0-4)	6 (1-11)	2 (0-4)	2 (0-4)	2 (0-4)	13 (1-27)
	Chum	9 (5-12)	28 (15-37)	9 (5-12)	9 (5-12)	9 (5-12)	65 (35-85)
	Sockeye	8 (5-10)	24 (14-30)	8 (5-10)	8 (5-10)	8 (5-10)	56 (34-70)
	Coho	4 (2-6)	13 (7-18)	4 (2-6)	4 (2-6)	4 (2-6)	30 (15-42)
	Total	23 (14-31)	70 (41-91)	23 (14-31)	23 (14-31)	23 (14-31)	164 (97-214)
7/26/23	ND	ND	ND	ND	ND	ND	ND
8/3/23	Chinook	1 (0-2)	3 (0-9)	28 (3-67)	2 (0-5)	1 (0-3)	35 (8-75)
	Chum	15 (3-33)	74 (16-154)	363 (191-563)	27 (15-41)	15 (8-24)	495 (321-709)
	Sockeye	8 (2-15)	38 (12-72)	94 (54-148)	7 (4-11)	4 (2-6)	152 (98-217)
	Coho	208 (154-267)	826 (614-1,054)	2,530 (1,977-3,169)	185 (143-232)	106 (83-132)	3,855 (3,243-4,570)
	Total	232 (175-296)	942 (707-1,217)	3,016 (2,396-3,679)	220 (175-269)	127 (100-155)	4,536 (3,886-5,287)
8/9/23	Chinook	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Chum	3 (1-6)	4 (1-10)	11 (4-21)	9 (4-18)	0 (0-0)	27 (16-40)
	Sockeye	3 (1-6)	5 (2-9)	8 (2-15)	17 (5-33)	0 (0-0)	33 (18-52)
	Coho	77 (59-94)	128 (102-156)	579 (433-740)	441 (337-554)	0 (0-0)	1,225 (1,050-1,422)
	Total	83 (64-101)	138 (109-168)	597 (449-761)	467 (359-582)	0 (0-0)	1,285 (1,101-1,486)

-continued-

Table 4 (Page 5 of 5).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
8/12/23	Chinook	0 (0-0)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-0)	0 (0-2)
	Chum	2 (0-7)	22 (10-39)	41 (20-69)	0 (0-0)	6 (3-11)	72 (46-103)
	Sockeye	3 (0-11)	10 (3-21)	18 (4-41)	0 (0-0)	3 (1-6)	34 (16-57)
	Coho	161 (97-205)	612 (478-760)	1,078 (848-1,314)	0 (0-0)	168 (134-209)	2,019 (1,739-2,285)
	Total	167 (97-209)	644 (514-787)	1,137 (925-1,366)	0 (0-0)	177 (144-217)	2,126 (1,848-2,394)
Total	Chinook	6,563 (5,123-8,209)	2,812 (2,379-3,247)	6,960 (6,142-7,811)	1,181 (873-1,530)	864 (774-955)	18,380 (16,671-20,339)
	Chum	3,252 (2,493-4,156)	2,336 (1,864-2,860)	3,328 (2,770-4,080)	636 (493-792)	451 (366-559)	10,003 (8,869-11,256)
	Sockeye	5,298 (3,723-7,045)	4,267 (3,591-5,019)	7,787 (6,815-8,964)	1,250 (1,068-1,463)	1,131 (972-1,320)	19,733 (17,645-22,013)
	Coho	446 (365-522)	1,564 (1,314-1,849)	4,217 (3,551-4,903)	634 (518-757)	283 (234-333)	7,144 (6,418-7,923)
	Total	15,558 (12,616-18,823)	10,979 (9,888-12,262)	22,292 (20,313-24,620)	3,700 (3,224-4,209)	2,730 (2,475-3,016)	55,260 (51,475-59,649)

[1]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, D2 – Akiak to Bogus Creek

ND – No data or insufficient data to make an estimate.

Table 5. Estimated minimum salmon harvests for drift gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits.

		Geographic Stratum[1]					
Opening	Species	A	B	C	D1	D2	Total
6/12/23	Chinook	27 (19-36)	112 (76-150)	681 (500-887)	78 (60-99)	92 (69-119)	990 (793-1,211)
	Chum	5 (2-9)	22 (8-41)	57 (32-88)	8 (5-13)	11 (6-17)	104 (74-141)
	Sockeye	18 (10-29)	75 (42-118)	260 (155-407)	29 (18-43)	34 (21-51)	416 (303-569)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	51 (36-67)	209 (146-277)	998 (770-1,241)	115 (91-143)	136 (107-169)	1,509 (1,274-1,769)
6/17/23	Chinook	4,032 (2,944-5,321)	1,577 (1,229-1,966)	3,633 (3,093-4,289)	623 (329-960)	437 (375-501)	10,302 (8,979-11,840)
	Chum	1,508 (921-2,187)	507 (393-634)	653 (481-834)	162 (70-257)	81 (62-105)	2,912 (2,294-3,664)
	Sockeye	2,613 (1,207-4,322)	1,163 (819-1,548)	1,876 (1,446-2,380)	108 (51-177)	215 (166-273)	5,975 (4,422-7,746)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	8,153 (5,663-11,051)	3,248 (2,689-3,825)	6,162 (5,269-7,132)	893 (552-1,228)	733 (629-837)	19,189 (16,485-22,367)
6/23/23	Chinook	2,446 (1,578-3,468)	1,071 (860-1,300)	2,550 (2,055-3,102)	455 (369-550)	312 (254-370)	6,834 (5,795-8,054)
	Chum	1,144 (777-1,588)	1,255 (891-1,698)	1,697 (1,266-2,236)	297 (223-390)	203 (154-260)	4,596 (3,891-5,399)
	Sockeye	1,605 (1,092-2,245)	2,159 (1,633-2,746)	4,002 (3,221-4,976)	676 (550-828)	462 (375-566)	8,904 (7,794-10,232)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	5,195 (3,704-6,846)	4,486 (3,639-5,495)	8,248 (6,821-10,163)	1,428 (1,174-1,719)	977 (806-1,173)	20,334 (18,067-23,015)
7/11/23	Chinook	64 (40-96)	51 (29-76)	75 (46-117)	23 (13-35)	23 (14-34)	237 (189-290)
	Chum	577 (313-923)	453 (236-729)	510 (262-873)	133 (67-230)	135 (69-229)	1,807 (1,347-2,335)
	Sockeye	1,052 (702-1,428)	820 (526-1,144)	1,538 (1,132-2,074)	415 (305-557)	415 (305-563)	4,240 (3,581-4,959)
	Coho	0 (0-0)	0 (0-0)	34 (0-100)	9 (0-27)	9 (0-27)	51 (8-124)
	Total	1,693 (1,159-2,396)	1,323 (894-1,861)	2,156 (1,623-2,795)	580 (436-753)	582 (437-753)	6,335 (5,378-7,385)

-continued-

Table 5 (Page 2 of 2).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
8/3/23	Chinook	1 (0-2)	3 (0-9)	28 (3-67)	2 (0-5)	1 (0-3)	35 (8-75)
	Chum	15 (3-33)	74 (16-154)	363 (191-563)	27 (15-41)	15 (8-24)	495 (321-709)
	Sockeye	8 (2-15)	38 (12-72)	94 (54-148)	7 (4-11)	4 (2-6)	152 (98-217)
	Coho	208 (154-267)	826 (614-1,054)	2,530 (1,977-3,169)	185 (143-232)	106 (83-132)	3,855 (3,243-4,570)
	Total	232 (175-296)	942 (707-1,217)	3,016 (2,396-3,679)	220 (175-269)	127 (100-155)	4,536 (3,886-5,287)
8/9/23	Chinook	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Chum	3 (1-6)	4 (1-10)	11 (4-21)	9 (4-18)	0 (0-0)	27 (16-40)
	Sockeye	3 (1-6)	5 (2-9)	8 (2-15)	17 (5-33)	0 (0-0)	33 (18-52)
	Coho	77 (59-94)	128 (102-156)	579 (433-740)	441 (337-554)	0 (0-0)	1,225 (1,050-1,422)
	Total	83 (64-101)	138 (109-168)	597 (449-761)	467 (359-582)	0 (0-0)	1,285 (1,101-1,486)
8/12/23	Chinook	0 (0-0)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-0)	0 (0-2)
	Chum	2 (0-7)	22 (10-39)	41 (20-69)	0 (0-0)	6 (3-11)	72 (46-103)
	Sockeye	3 (0-11)	10 (3-21)	18 (4-41)	0 (0-0)	3 (1-6)	34 (16-57)
	Coho	161 (97-205)	612 (478-760)	1,078 (848-1,314)	0 (0-0)	168 (134-209)	2,019 (1,739-2,285)
	Total	167 (97-209)	644 (514-787)	1,137 (925-1,366)	0 (0-0)	177 (144-217)	2,126 (1,848-2,394)
All Openings	Chinook	6,563 (5,123-8,209)	2,812 (2,379-3,247)	6,960 (6,142-7,811)	1,181 (873-1,530)	864 (774-955)	18,380 (16,671-20,339)
	Chum	3,252 (2,493-4,156)	2,336 (1,864-2,860)	3,328 (2,770-4,080)	636 (493-792)	451 (366-559)	10,003 (8,869-11,256)
	Sockeye	5,298 (3,723-7,045)	4,267 (3,591-5,019)	7,787 (6,815-8,964)	1,250 (1,068-1,463)	1,131 (972-1,320)	19,733 (17,645-22,013)
	Coho	446 (365-522)	1,564 (1,314-1,849)	4,217 (3,551-4,903)	634 (518-757)	283 (234-333)	7,144 (6,418-7,923)
	Total	15,558 (12,616-18,823)	10,979 (9,888-12,262)	22,292 (20,313-24,620)	3,700 (3,224-4,209)	2,730 (2,475-3,016)	55,260 (51,475-59,649)

[1]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, , D2 = Akiak to Bogus Creek

Table 6. Salmon harvests from both drift and set gillnets by subsistence opening, species, and geographic stratum, 2023. Numbers within parentheses are 95% confidence limits.

		Geographic Stratum[1]					
Opening	Species	A	B	C	D**1**	**D2**	Total
6/3/23	Chinook	6 (3-10)	59 (27-98)	240 (109-401)	29 (13-49)	18 (8-29)	352 (160-587)
	Chum	0 (0-0)	1 (0-2)	3 (0-10)	0 (0-1)	0 (0-1)	4 (0-14)
	Sockeye	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	6 (3-10)	59 (27-99)	243 (112-404)	30 (14-49)	18 (8-29)	356 (164-591)
6/6/23	Chinook	3 (2-4)	24 (16-32)	152 (99-205)	11 (7-14)	29 (19-39)	219 (143-294)
	Chum	0 (0-0)	0 (0-1)	1 (0-4)	0 (0-0)	0 (0-1)	1 (0-6)
	Sockeye	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	3 (2-4)	24 (16-32)	153 (100-206)	11 (7-14)	29 (19-40)	220 (144-296)
6/9/23	Chinook	9 (6-13)	245 (158-360)	596 (384-875)	175 (113-257)	105 (68-154)	1,131 (729-1,659)
	Chum	0 (0-0)	6 (1-12)	14 (3-30)	4 (1-9)	2 (1-5)	26 (6-56)
	Sockeye	1 (1-1)	29 (18-42)	71 (45-102)	21 (13-30)	13 (8-18)	135 (85-193)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	10 (7-14)	281 (189-407)	681 (461-988)	200 (135-290)	120 (81-174)	1,293 (874-1,873)
6/12/23	Chinook	27 (19-36)	115 (79-153)	687 (504-891)	79 (60-100)	93 (70-119)	1,001 (803-1,217)
	Chum	5 (2-9)	23 (9-42)	59 (34-92)	9 (5-13)	11 (6-17)	108 (76-147)
	Sockeye	18 (10-29)	75 (42-118)	260 (155-407)	29 (18-43)	34 (21-51)	416 (303-569)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	51 (36-67)	214 (151-286)	1,006 (775-1,248)	116 (92-144)	138 (108-170)	1,524 (1,278-1,787)

-continued-

Table 6 (Page 2 of 4).

Opening	Species	Geographic Stratum[1] A	B	C	D**1**	**D2**	Total
6/17/23	Chinook	4,038 (2,947-5,328)	1,600 (1,254-1,994)	3,739 (3,178-4,418)	651 (353-996)	476 (411-545)	10,503 (9,163-12,029)
	Chum	1,509 (921-2,187)	509 (395-636)	663 (491-843)	164 (74-260)	84 (65-108)	2,929 (2,306-3,683)
	Sockeye	2,615 (1,211-4,324)	1,172 (828-1,559)	1,915 (1,479-2,430)	119 (60-190)	230 (179-291)	6,049 (4,474-7,859)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	8,161 (5,670-11,061)	3,281 (2,715-3,868)	6,316 (5,428-7,284)	934 (591-1,268)	790 (677-899)	19,481 (16,777-22,588)
6/23/23	Chinook	2,455 (1,586-3,480)	1,076 (864-1,306)	2,633 (2,117-3,180)	492 (400-591)	331 (270-392)	6,987 (5,915-8,203)
	Chum	1,148 (778-1,591)	1,257 (895-1,699)	1,732 (1,302-2,262)	313 (234-409)	211 (163-270)	4,661 (3,967-5,461)
	Sockeye	1,646 (1,122-2,292)	2,180 (1,657-2,785)	4,372 (3,516-5,399)	841 (663-1,064)	544 (435-668)	9,584 (8,356-11,060)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	5,249 (3,758-6,897)	4,513 (3,682-5,527)	8,737 (7,215-10,671)	1,646 (1,361-1,980)	1,086 (903-1,292)	21,231 (18,863-24,030)
6/30/23	Chinook	37 (27-49)	33 (24-43)	258 (189-340)	66 (48-86)	33 (24-43)	426 (312-561)
	Chum	93 (65-125)	82 (58-111)	648 (454-873)	165 (115-222)	82 (58-111)	1,070 (750-1,442)
	Sockeye	558 (374-847)	496 (332-753)	3,906 (2,614-5,932)	992 (664-1,507)	496 (332-753)	6,448 (4,316-9,793)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	687 (485-1,003)	611 (432-891)	4,812 (3,398-7,018)	1,222 (863-1,783)	611 (432-891)	7,944 (5,609-11,587)
7/4/23	Chinook	0 (0-0)	9 (4-16)	90 (36-163)	12 (5-22)	6 (2-11)	117 (47-212)
	Chum	0 (0-0)	22 (12-34)	215 (118-340)	29 (16-45)	14 (8-23)	280 (154-442)
	Sockeye	0 (0-0)	95 (62-134)	948 (619-1,338)	126 (83-178)	63 (41-89)	1,232 (805-1,739)
	Coho	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Total	0 (0-0)	125 (83-172)	1,253 (827-1,722)	167 (111-230)	84 (55-115)	1,629 (1,076-2,239)

-continued-

Table 6–(Page 3 of 4).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
7/11/23	Chinook	64 (40-96)	51 (29-76)	96 (59-142)	30 (18-44)	23 (14-34)	264 (210-326)
	Chum	577 (313-923)	453 (236-729)	591 (329-952)	160 (87-261)	135 (69-229)	1,916 (1,456-2,461)
	Sockeye	1,052 (702-1,428)	820 (526-1,144)	1,717 (1,291-2,255)	474 (345-625)	415 (305-563)	4,478 (3,805-5,215)
	Coho	0 (0-0)	0 (0-0)	34 (0-100)	9 (0-27)	9 (0-27)	51 (8-124)
	Total	1,693 (1,159-2,396)	1,323 (894-1,861)	2,437 (1,875-3,096)	674 (503-859)	582 (437-753)	6,709 (5,768-7,754)
7/17/23	Chinook	0 (0-0)	0 (0-0)	14 (3-29)	0 (0-0)	2 (1-5)	17 (4-34)
	Chum	0 (0-0)	0 (0-0)	93 (36-162)	0 (0-0)	15 (6-27)	108 (42-189)
	Sockeye	0 (0-0)	0 (0-0)	154 (89-229)	0 (0-0)	26 (15-38)	180 (104-267)
	Coho	0 (0-0)	0 (0-0)	4 (0-9)	0 (0-0)	1 (0-1)	4 (0-10)
	Total	0 (0-0)	0 (0-0)	265 (150-397)	0 (0-0)	44 (25-66)	309 (175-463)
7/19/23	Chinook	2 (0-3)	0 (0-0)	8 (1-17)	2 (0-3)	2 (0-5)	13 (1-28)
	Chum	19 (9-31)	0 (0-0)	93 (45-153)	19 (9-31)	28 (13-46)	159 (76-261)
	Sockeye	16 (9-24)	0 (0-0)	80 (45-121)	16 (9-24)	24 (13-36)	136 (76-205)
	Coho	1 (0-1)	0 (0-0)	3 (1-7)	1 (0-1)	1 (0-2)	6 (1-11)
	Total	37 (21-56)	0 (0-0)	185 (105-279)	37 (21-56)	55 (31-83)	314 (178-474)
7/24/23	**Chinook**	**2** (0-4)	**6** (1-11)	**2** (0-4)	**2** (0-4)	**2** (0-4)	**13** (1-27)
	Chum	9 (5-12)	28 (15-37)	9 (5-12)	9 (5-12)	9 (5-12)	65 (35-85)
	Sockeye	8 (5-10)	24 (14-30)	8 (5-10)	8 (5-10)	8 (5-10)	56 (34-70)
	Coho	4 (2-6)	13 (7-18)	4 (2-6)	4 (2-6)	4 (2-6)	30 (15-42)
	Total	23 (14-31)	70 (41-91)	23 (14-31)	23 (14-31)	23 (14-31)	164 (97-214)

-continued-

Table 6 (Page 4 of 4).

Opening	Species	Geographic Stratum[1] A	B	C	D1	D2	Total
8/3/23	Chinook	1 (0-2)	3 (0-9)	28 (3-67)	2 (0-5)	1 (0-3)	35 (8-75)
	Chum	15 (3-33)	74 (16-154)	373 (196-577)	30 (17-46)	22 (10-42)	514 (331-737)
	Sockeye	8 (2-15)	38 (12-72)	111 (64-172)	12 (6-23)	15 (3-35)	185 (119-278)
	Coho	208 (154-267)	826 (614-1,054)	2,612 (2,055-3,285)	212 (161-269)	161 (111-234)	4,019 (3,389-4,755)
	Total	232 (175-296)	942 (707-1,217)	3,124 (2,490-3,829)	256 (199-320)	199 (139-301)	4,752 (4,049-5,568)
8/9/23	Chinook	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)
	Chum	3 (1-6)	4 (1-10)	11 (4-21)	9 (4-18)	0 (0-0)	27 (16-40)
	Sockeye	3 (1-6)	5 (2-9)	8 (2-15)	17 (5-33)	0 (0-0)	33 (18-52)
	Coho	77 (59-94)	128 (102-156)	579 (433-740)	441 (337-554)	0 (0-0)	1,225 (1,050-1,422)
	Total	83 (64-101)	138 (109-168)	597 (449-761)	467 (359-582)	0 (0-0)	1,285 (1,101-1,486)
8/12/23	Chinook	0 (0-0)	0 (0-1)	0 (0-2)	0 (0-0)	0 (0-0)	0 (0-2)
	Chum	2 (0-7)	22 (10-39)	41 (20-69)	0 (0-0)	6 (3-11)	72 (46-103)
	Sockeye	3 (0-11)	10 (3-21)	18 (4-41)	0 (0-0)	3 (1-6)	34 (16-57)
	Coho	161 (97-205)	612 (478-760)	1,139 (884-1,420)	17 (0-68)	168 (134-209)	2,097 (1,799-2,417)
	Total	167 (97-209)	644 (514-787)	1,198 (948-1,464)	17 (0-68)	177 (144-217)	2,203 (1,906-2,528)
Total	Chinook	6,636 (5,187-8,278)	3,217 (2,766-3,686)	8,534 (7,740-9,437)	1,549 (1,220-1,917)	1,120 (1,016-1,224)	21,055 (19,241-23,038)
	Chum	3,377 (2,627-4,274)	2,479 (2,010-3,012)	4,542 (3,903-5,304)	911 (760-1,081)	621 (523-736)	11,929 (10,773-13,226)
	Sockeye	5,923 (4,322-7,676)	4,939 (4,193-5,726)	13,554 (11,670-15,863)	2,652 (2,213-3,215)	1,868 (1,606-2,196)	28,936 (25,504-32,761)
	Coho	451 (369-528)	1,577 (1,329-1,864)	4,371 (3,692-5,089)	683 (570-821)	344 (278-427)	7,425 (6,658-8,243)
	Total	16,386 (13,415-19,686)	12,213 (11,076-13,534)	31,000 (28,288-34,024)	5,794 (5,154-6,559)	3,952 (3,599-4,374)	69,346 (64,355-74,803)

[1]Geographic strata: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, D2 – Akiak to Bogus Creek

Table 7. Minimum annual harvest estimates by salmon species from the Kuskokwim River inseason harvest estimation program, 2016–2023.

	2016	2017	2018	2019	2020	2021	2022	2023	2016–2022 Average
Chinook Salmon	28,019	8,630	20,870	40,120	23,210	21,630	29,950	21,055	24,633
Chum Salmon	27,398	54,420	43,570	7,170	5,590	4,220	3,630	11,929	20,857
Sockeye Salmon	25,026	24,080	23,320	13,400	6,710	23,600	25,400	28,936	20,219
Coho Salmon	ND	ND	ND	ND	ND	ND	ND	7,425	ND
Total Salmon	80,443	87,130	87,750	60,710	35,500	49,440	58,980	69,346	65,708

Table 8. Key harvest characteristics of 12-hour openings on June 12 in all years where inseason harvest was rigorously monitored. These numbers correspond only to the mainstem Kuskokwim River from Eek to Akiak.

	2016	2017	2018	2019	2020	2021	2022	2023	2016-2022 Average
Drift and set effort	560	584	497	489	426	409	477	212	492
Total salmon harvest	5,290	5,620	7,250	8,650	3,820	3,680	5,800	1,387	5,730
Total salmon/net	9.4	9.6	14.5	17.7	9.0	9.0	12.1	6.5	11.6
Chinook harvest	4,460	2,400	5,230	8,040	3,240	3,260	5,300	908	4,277
Chinook/net	8.0	4.1	10.5	16.4	7.6	8.0	11.1	4.3	9.5
Chum harvest	610	2430	1770	310	460	70	60	96	942
Sockeye harvest	220	800	250	290	100	350	440	382	335
Chum/Sockeye total	830	3,230	2,020	600	590	420	500	478	1,252
Chum-Sockeye/net	1.5	5.5	4.1	1.2	1.4	1.0	1.0	2.3	2.7
Species ratio	0.2	1.3	0.4	0.1	0.2	0.1	0.1	0.53	0.4

Note: To allow comparisons to previous years, the 2023 data only include characteristics from strata A to D1, excluding stratum D2 that was included for the first time in 2023.

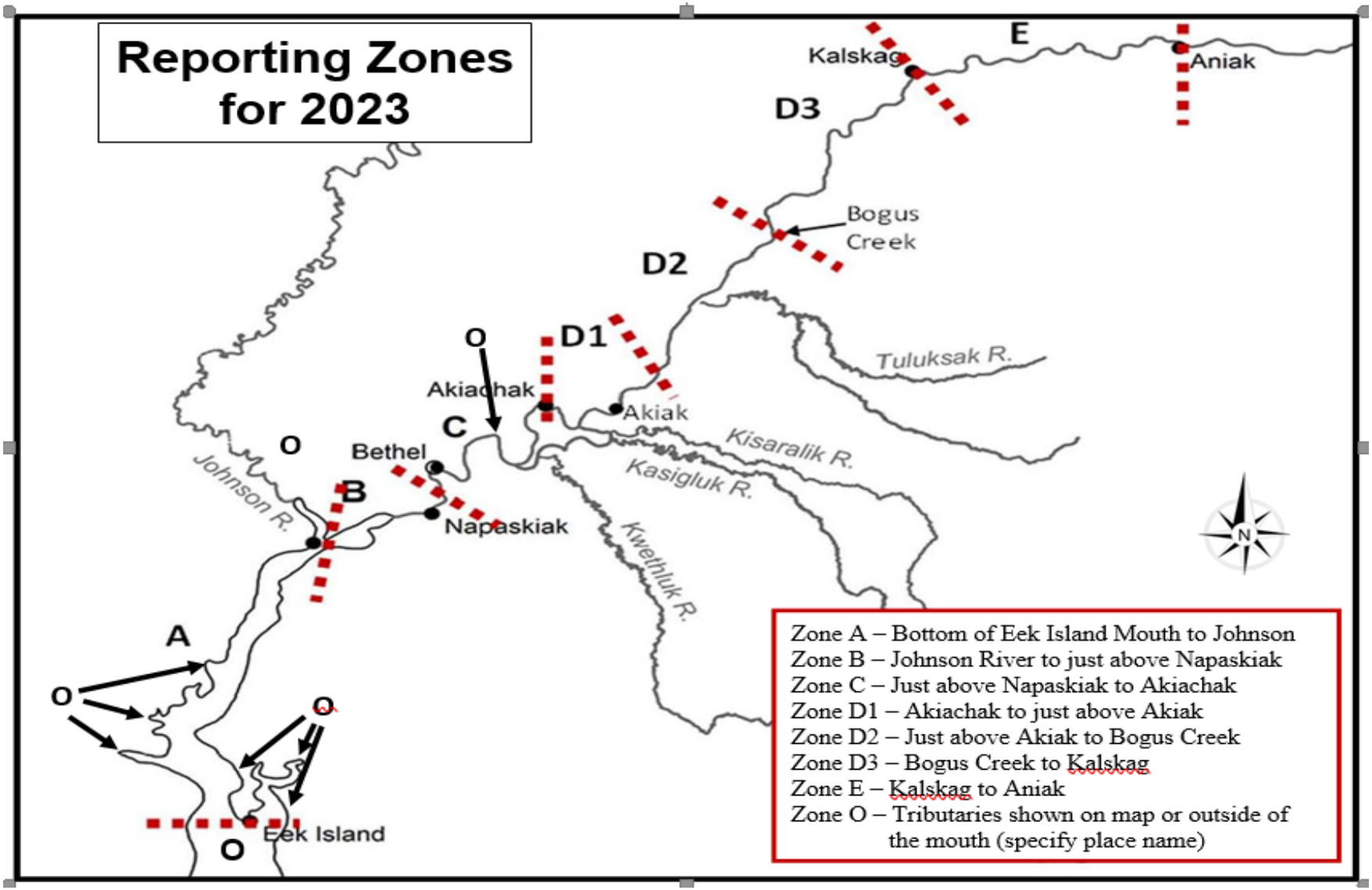

Figure 1. Map of the Yukon Delta National Wildlife Refuge waters that compose the survey area with geographic strata noted (A – E). Dashed lines indicate strata boundaries.

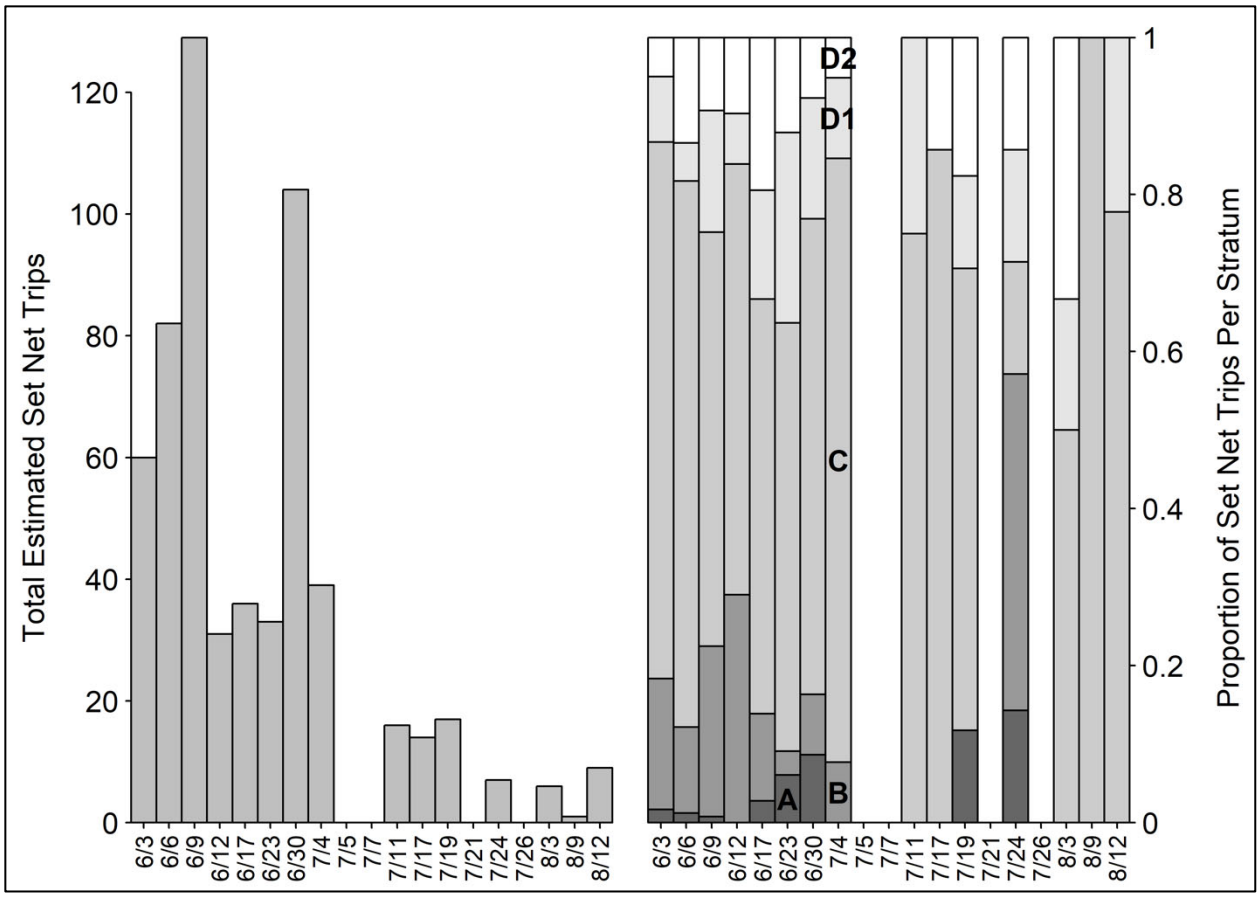

Figure 2. The (*left*) total estimated setnet trips by opening and (*right*) proportion of all estimated setnet trips that occurred in each geographic stratum by opening.
Note: Setnet effort not shown for dates with insufficient data.
Geographic strata are: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, D1 = Akiachak to Akiak, and D2 = Akiak to Bogus Creek.

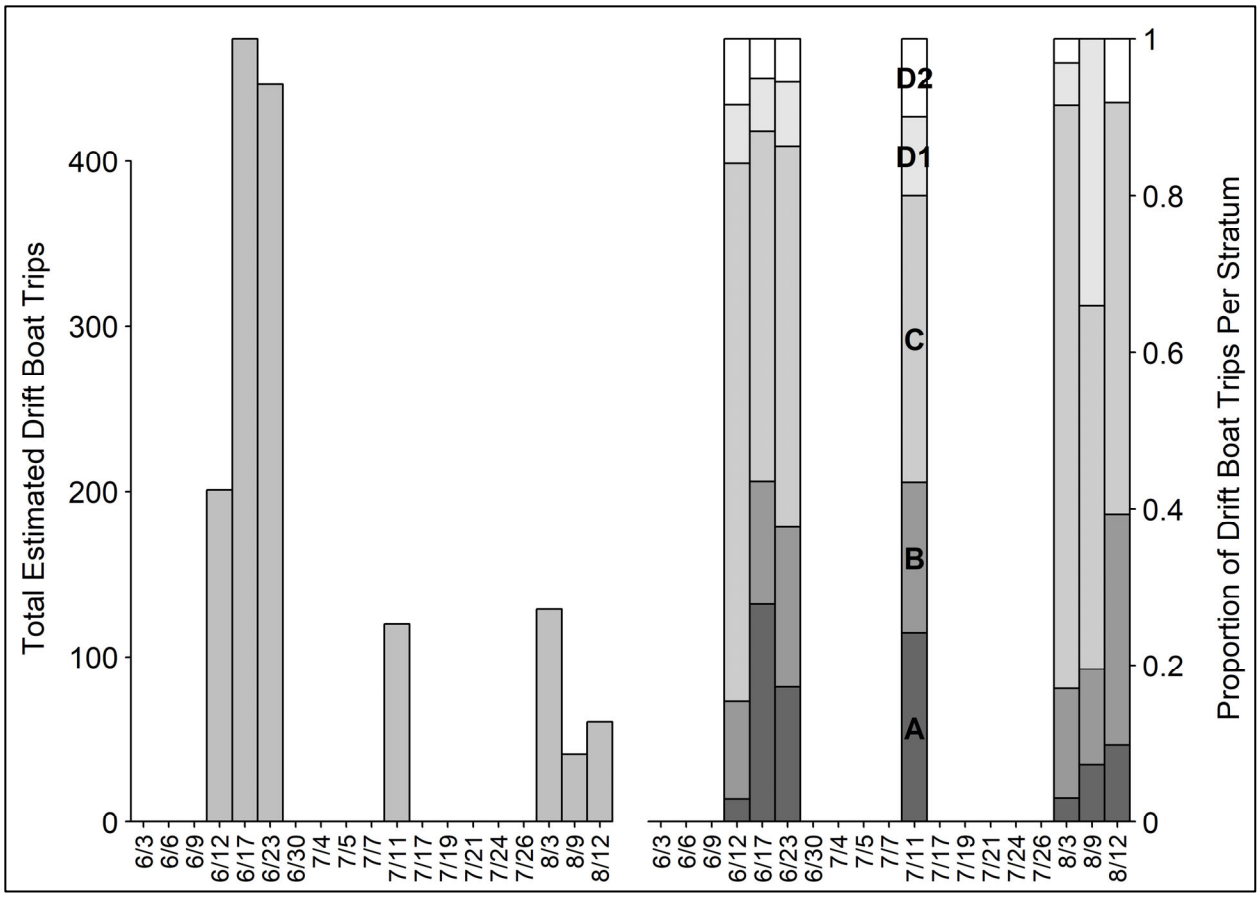

Figure 3. Total (*left*) estimated driftnet trips by opening and *(right)* proportion of all estimated trips that occurred in each geographic stratum by opening.
Note: Missing days were for setnets only.
Geographic strata are: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, and D = Akiachak to Akiak

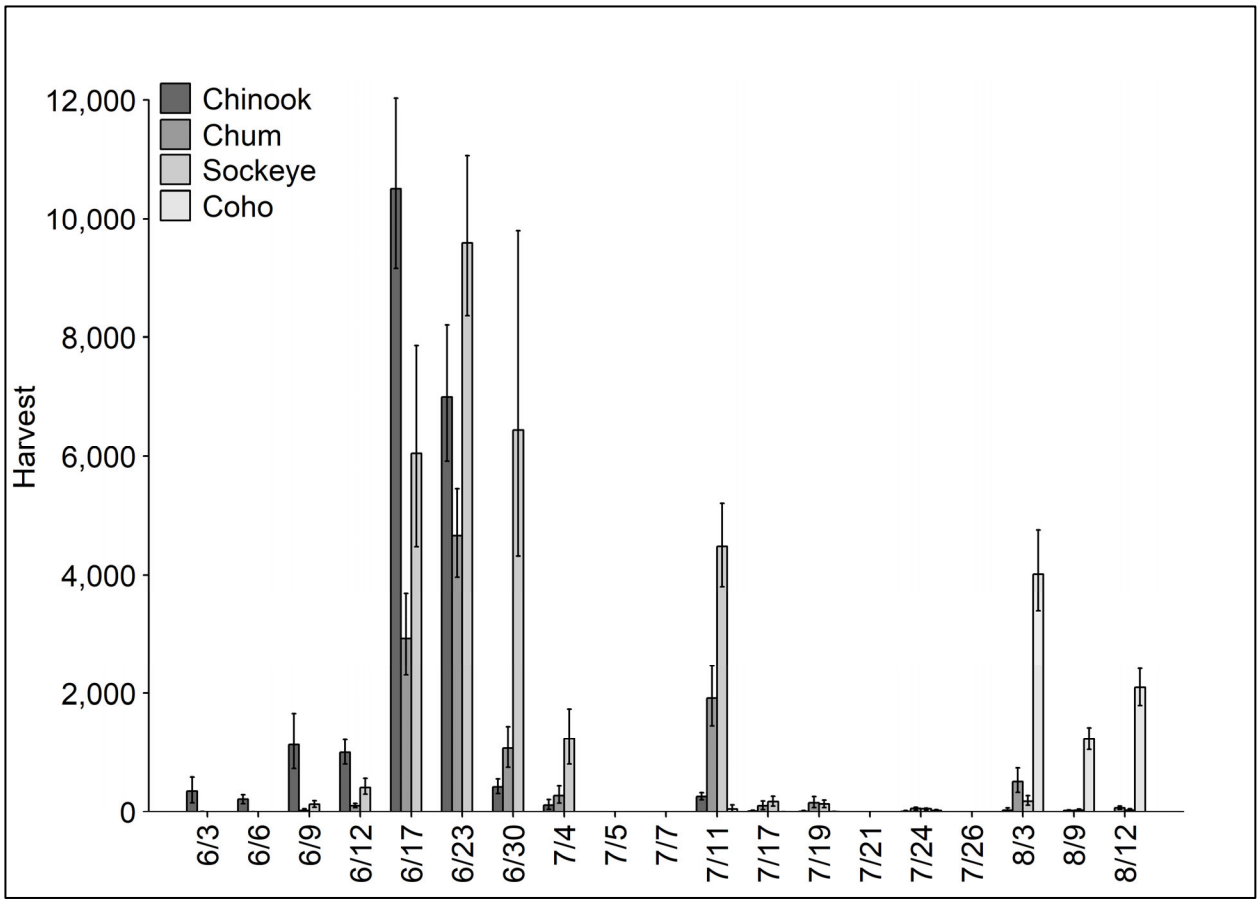

Figure 4. Estimated salmon harvest by species in the openings for which data were collected; estimates include both driftnet and setnet harvests.
Vertical lines are 95% CL bounds.

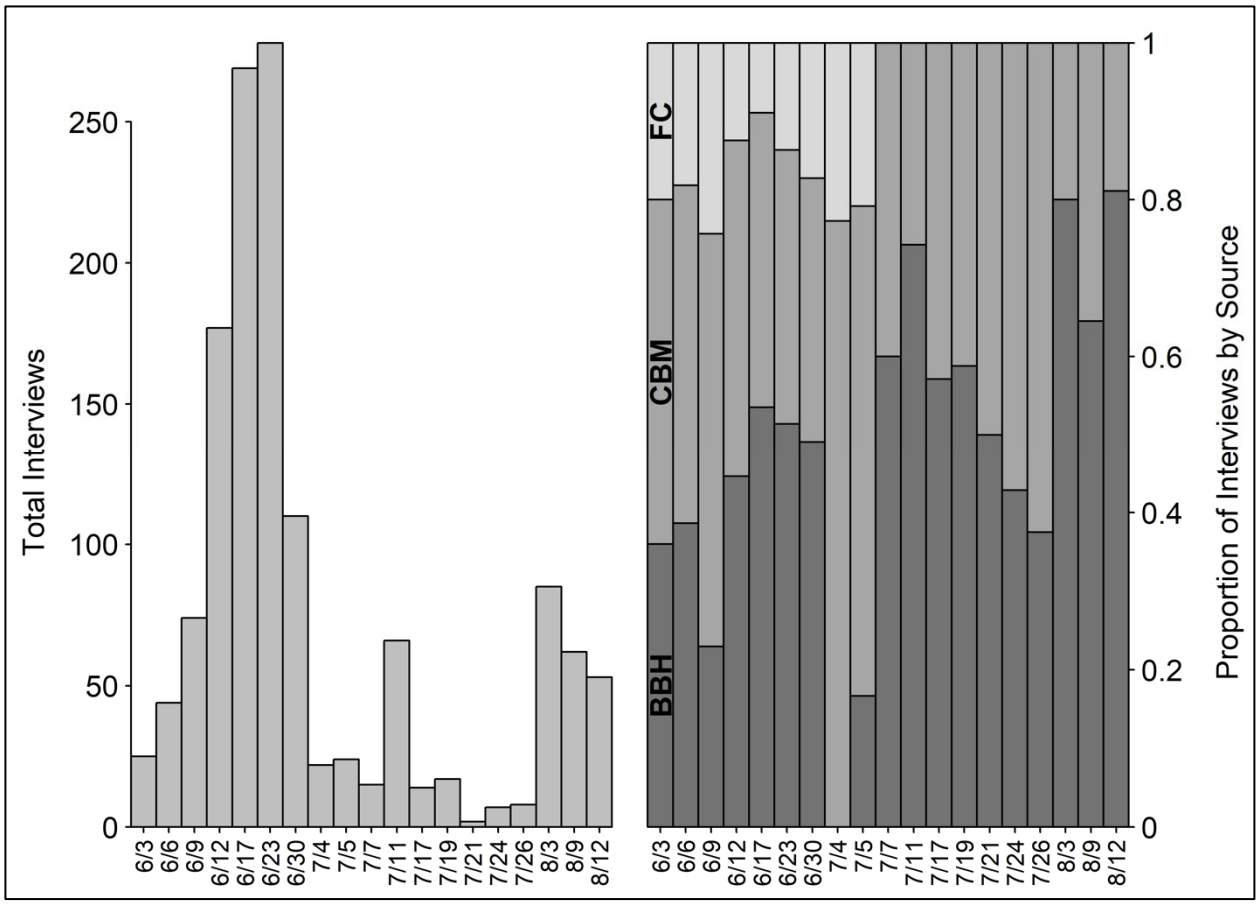

Figure 5. Total number (*left*) of interviews used to inform the harvest estimates from each opening and (*right*) proportion of all interviews that came from each source by opening.

Data sources were: BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

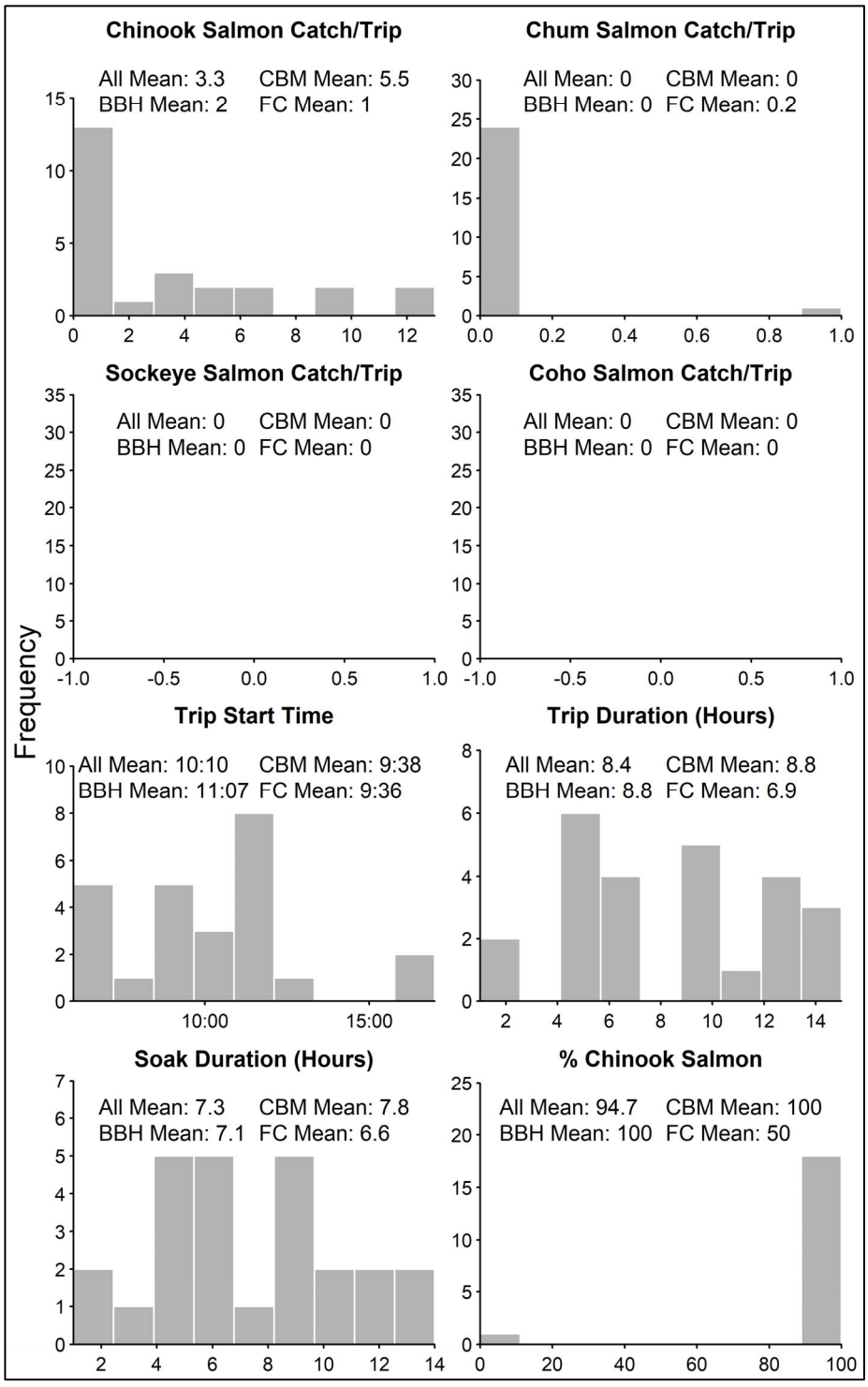

Figure 6. Distribution of relevant quantities from completed setnet trip interviews during the 6/3/2023 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

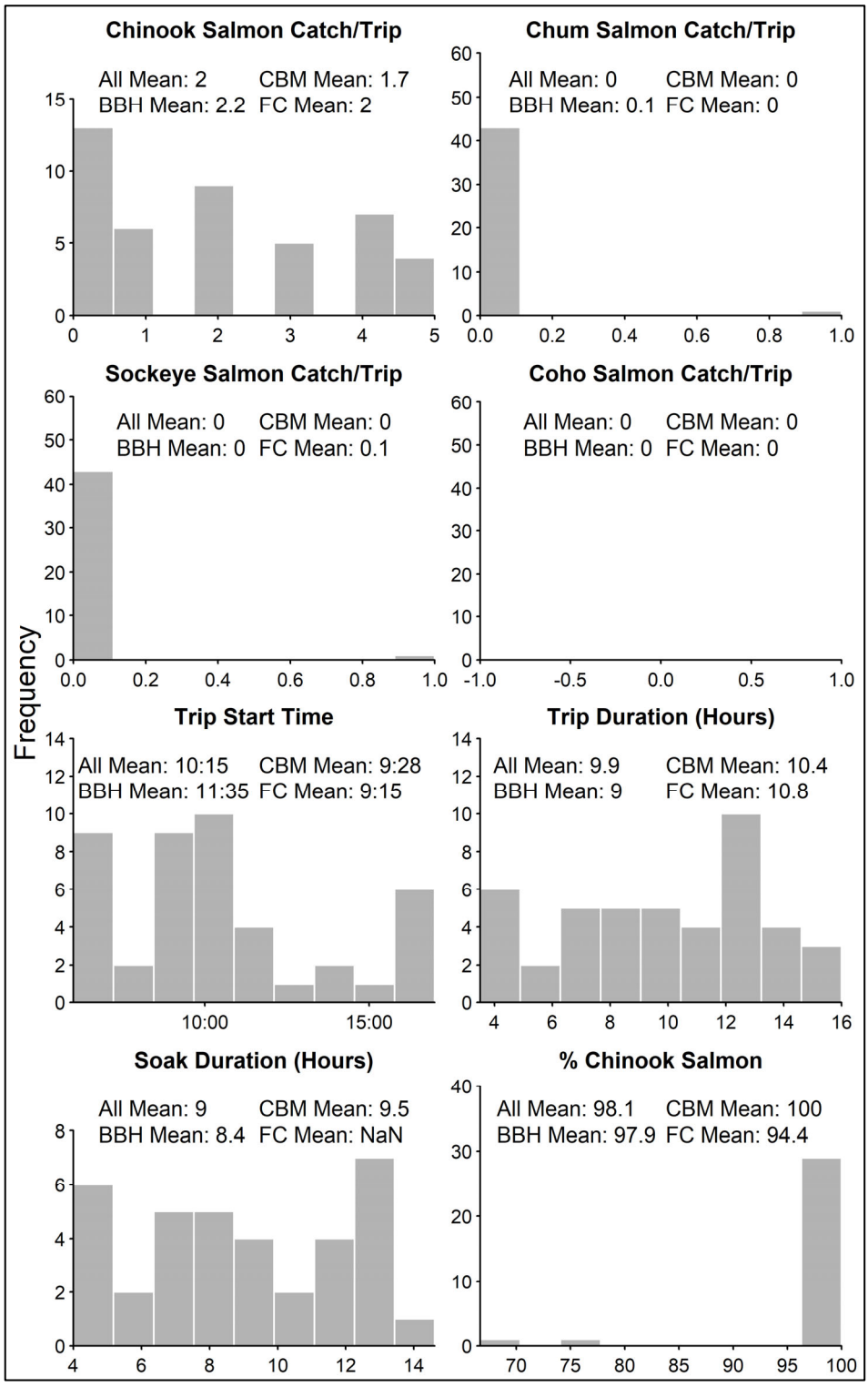

Figure 7. Distribution of relevant quantities from completed setnet trip interviews during the 6/6/2023 opening, with means for all available interviews and by data source. BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC

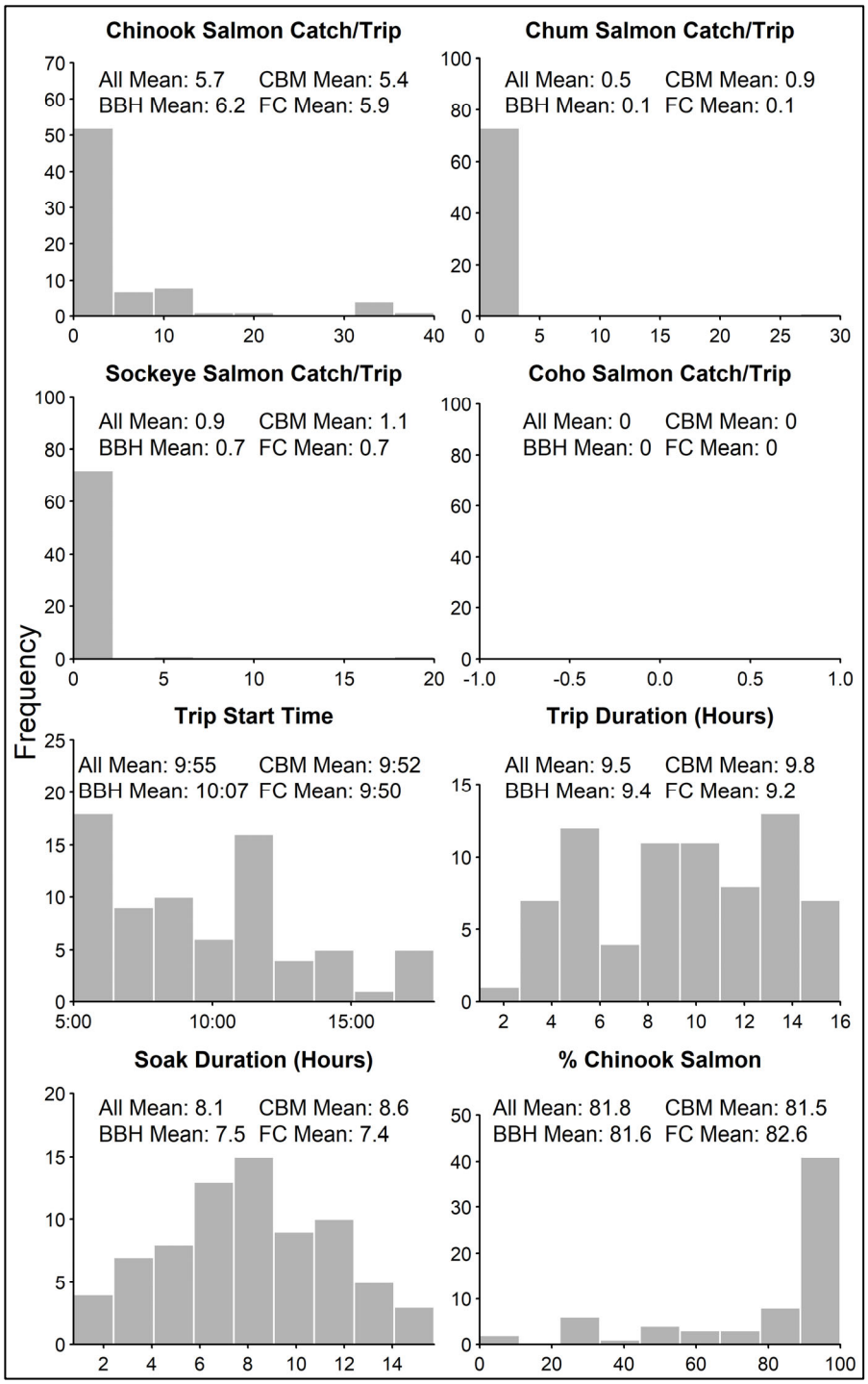

Figure 8. Distribution of relevant quantities from completed setnet trip interviews during the 6/9/2023 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

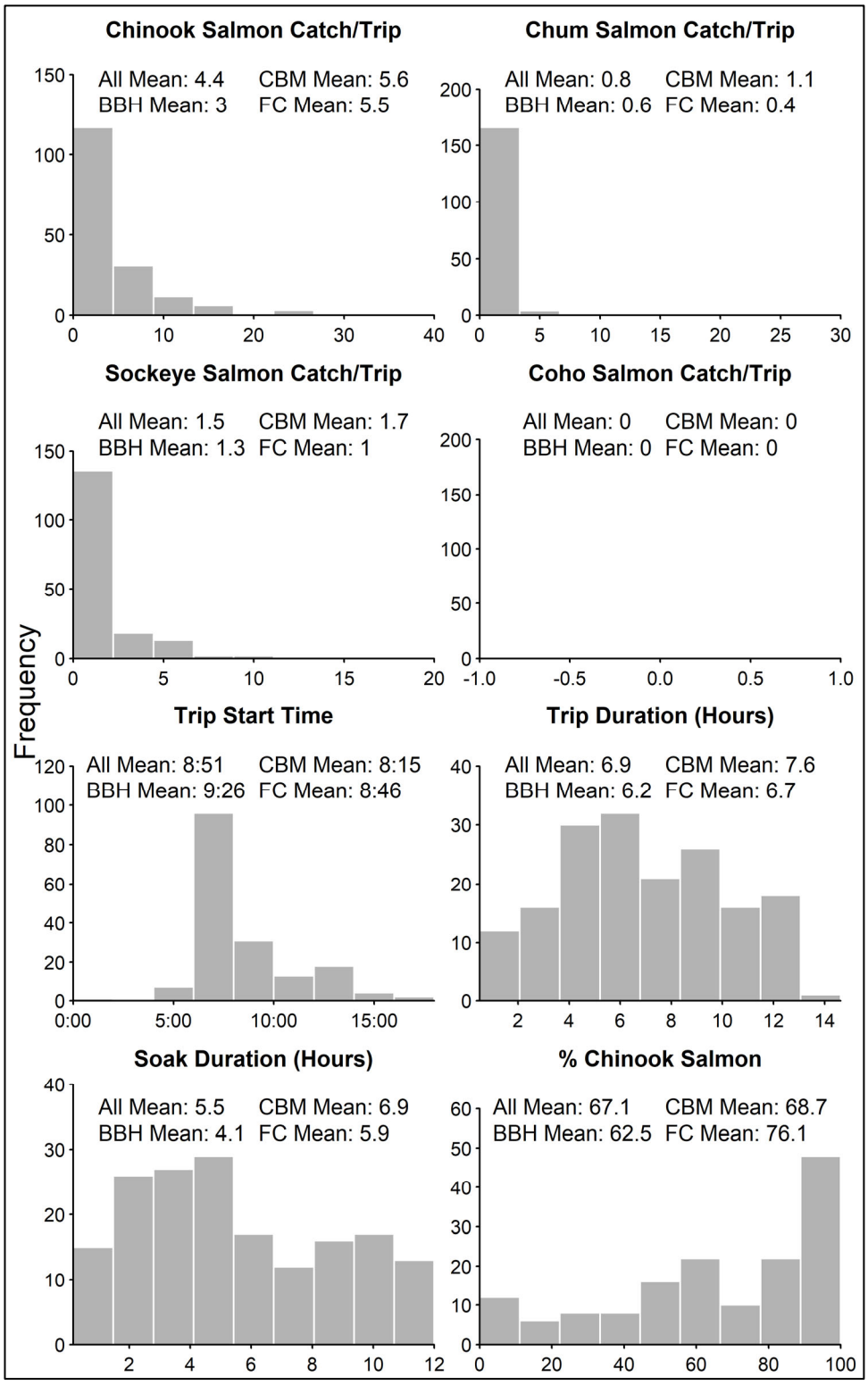

Figure 9. Distribution of relevant quantities from completed driftnet trip interviews for the 6/12/2023 opening, with means for all available interviews and by data source. BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

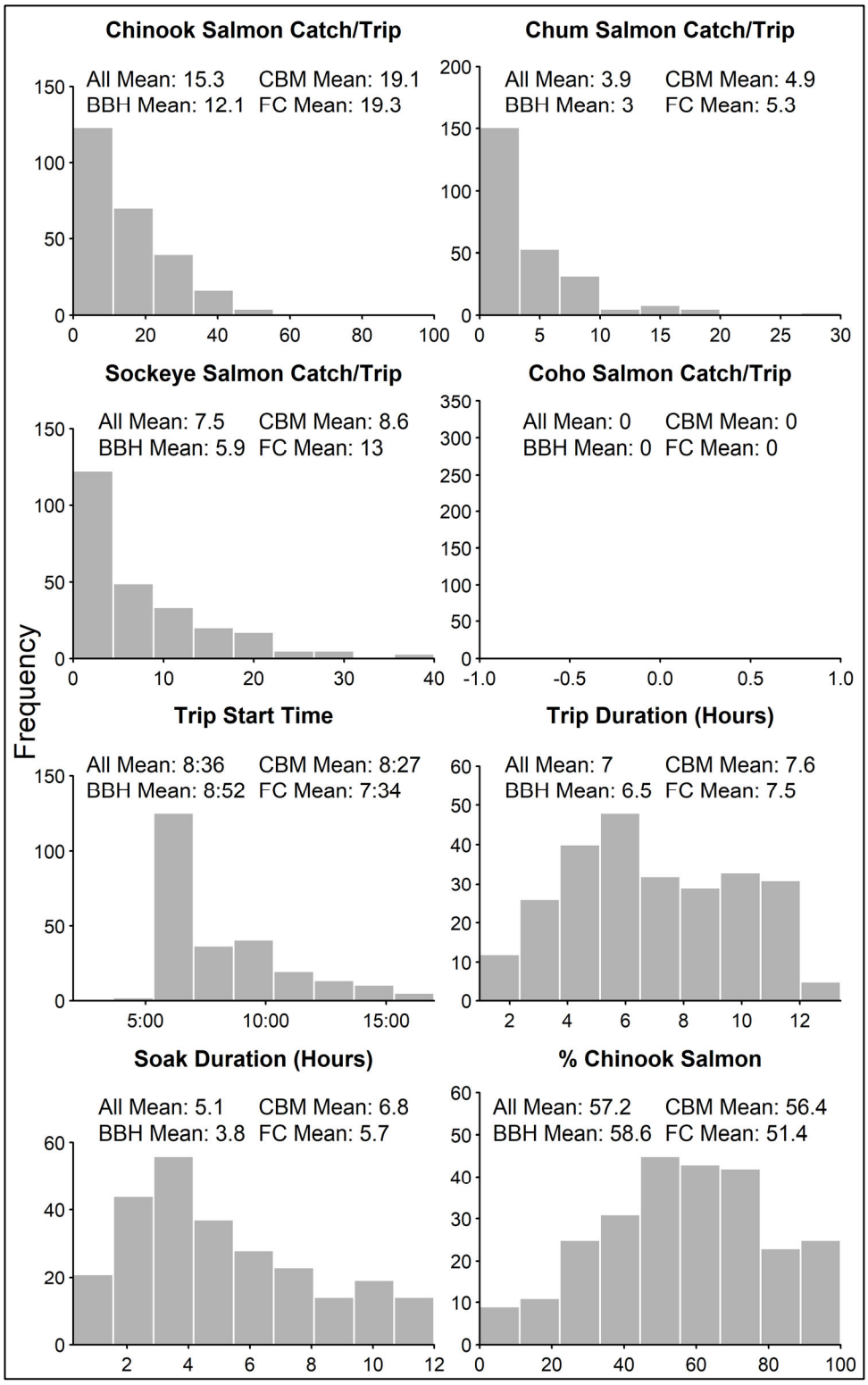

Figure 10. Distribution of relevant quantities from completed driftnet trip interviews for the 6/17/2022 opening, with means for all available interviews and by data source. BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

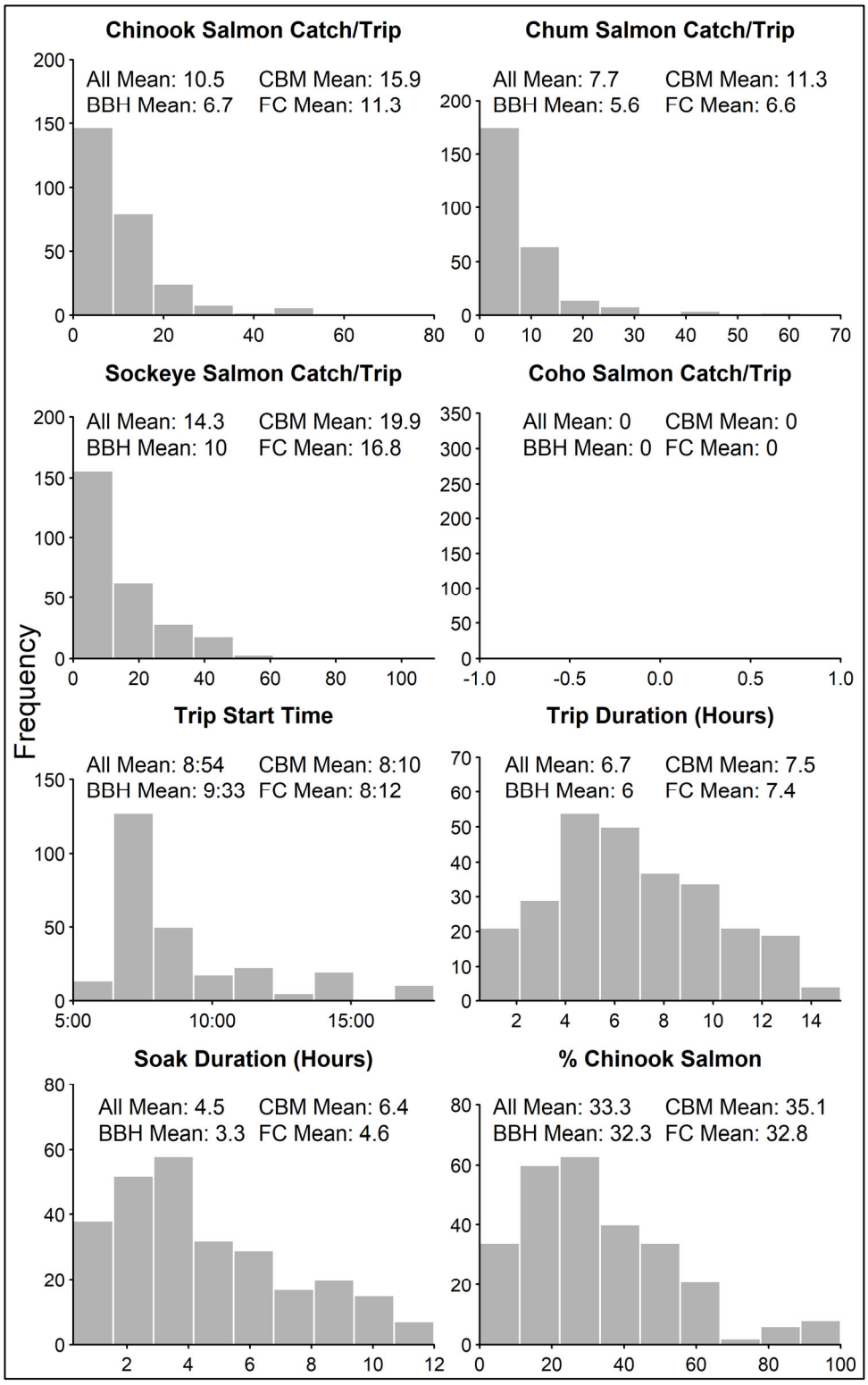

Figure 11. Distribution of relevant quantities from completed driftnet trip interviews for the 6/23/2023 opening, with means for all available interviews and by data source. BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

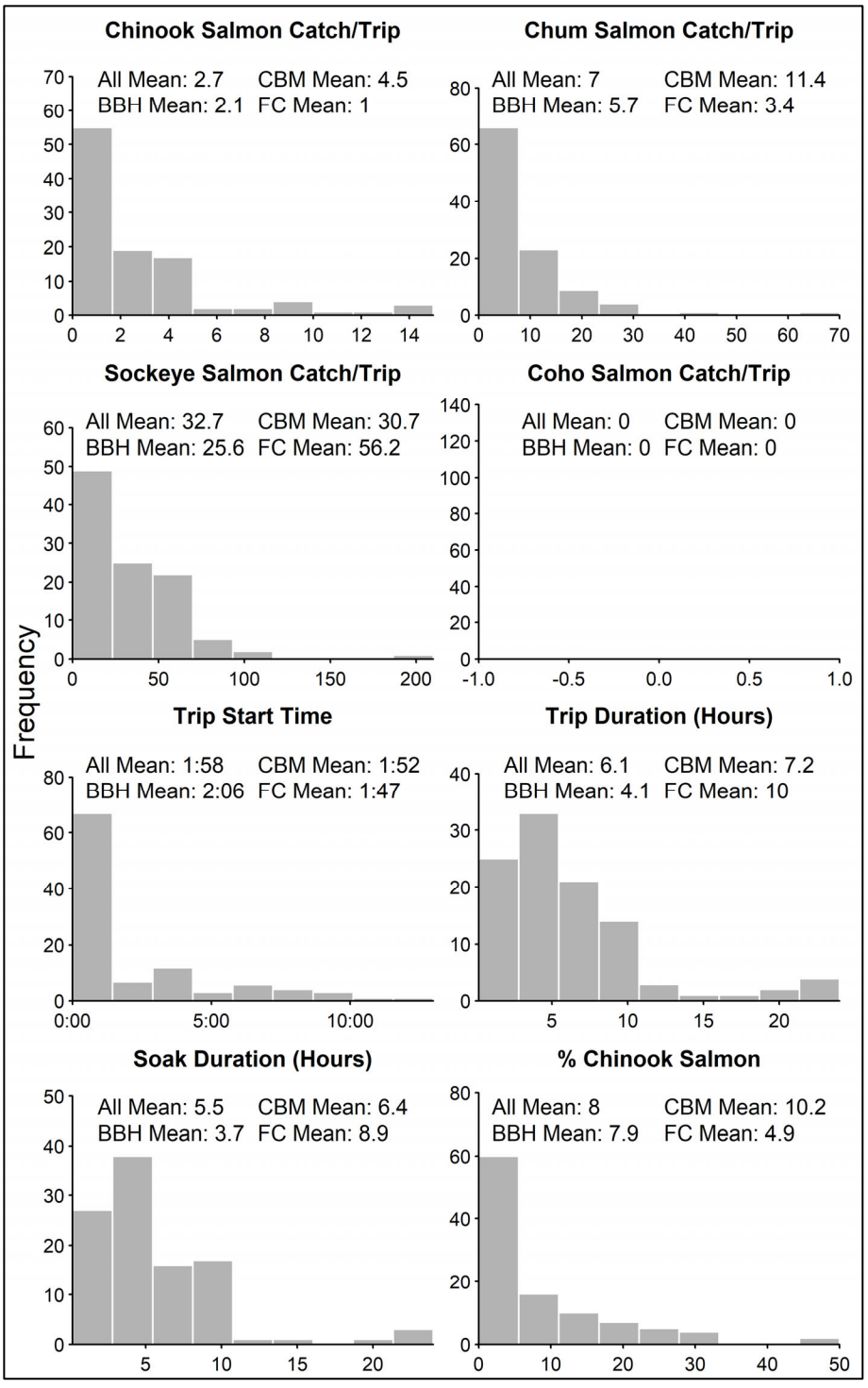

Figure 12. Distribution of relevant quantities from completed setnet trip interviews during the 6/30/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

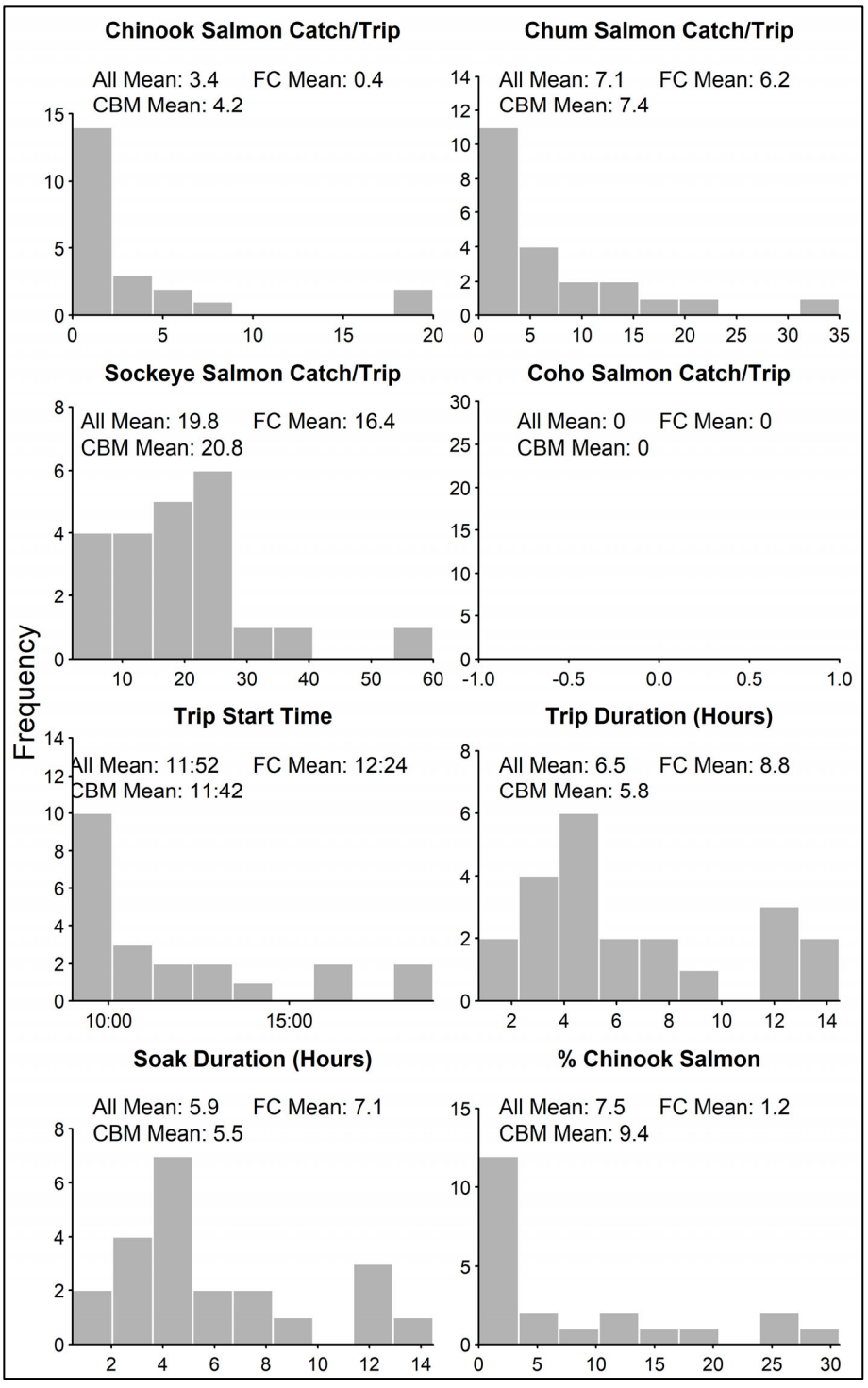

Figure 13. Distribution of relevant quantities from completed setnet trip interviews during the 7/4/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

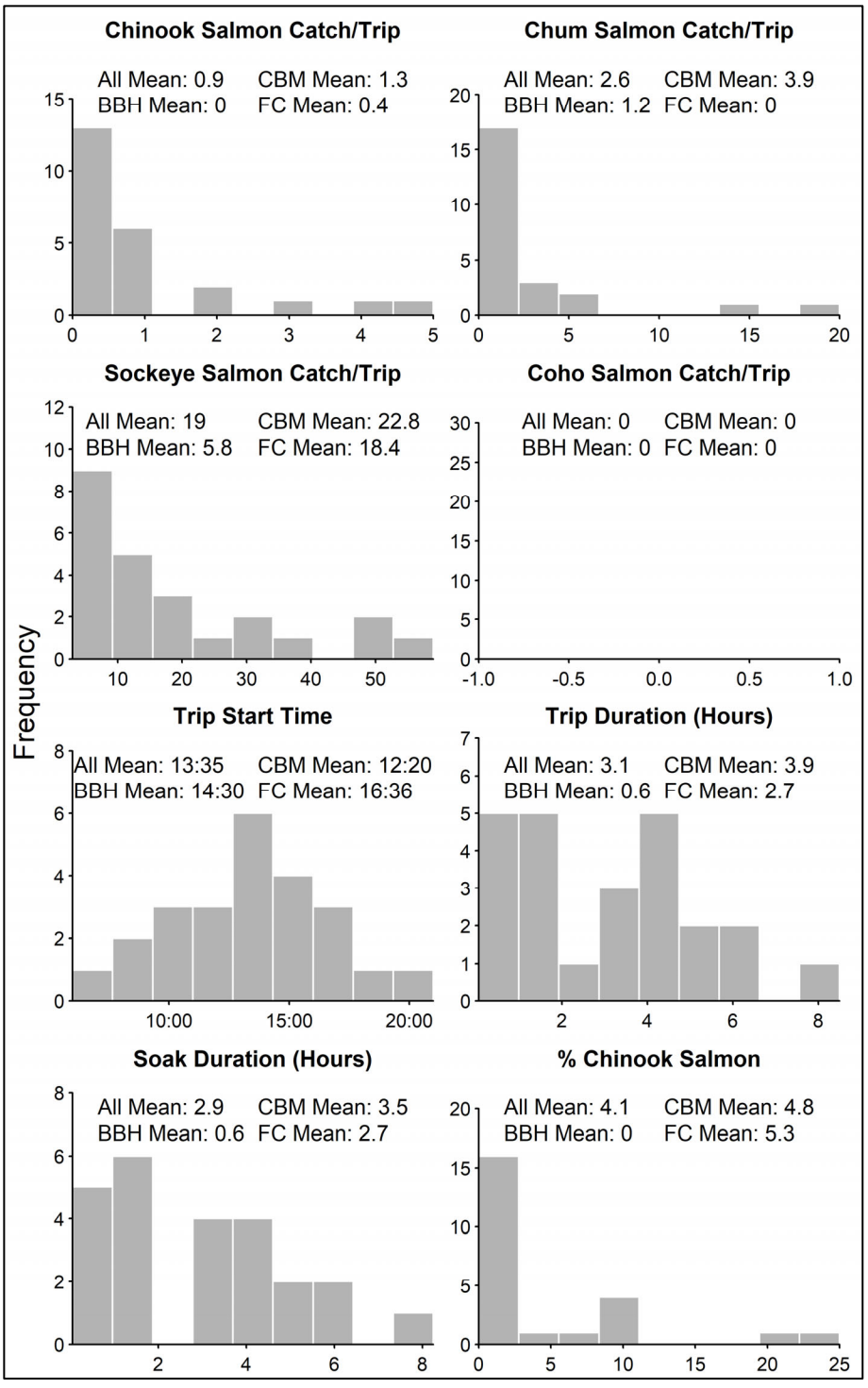

Figure 14. Distribution of relevant quantities from completed setnet trip interviews during the 7/5/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

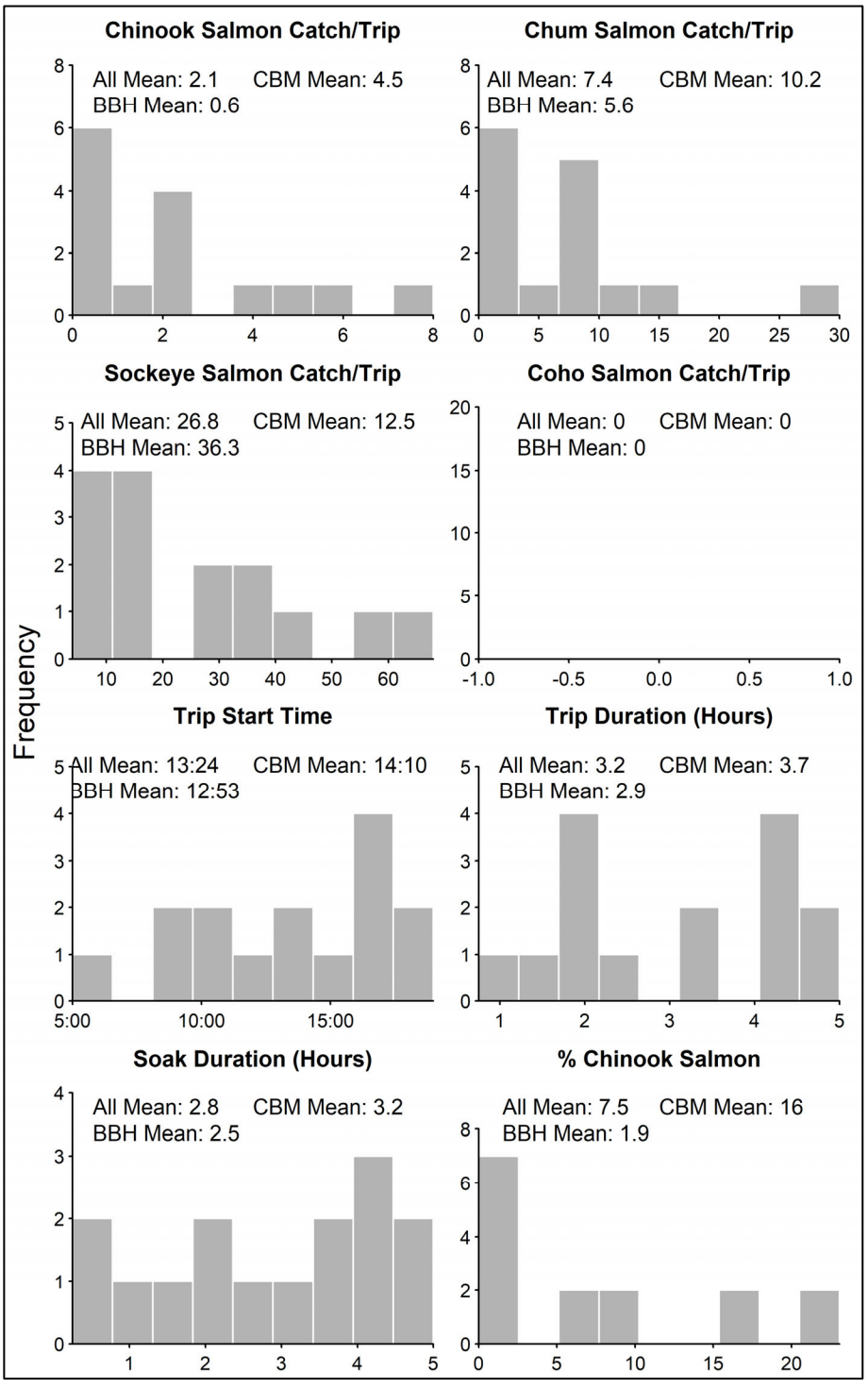

Figure 15. Distribution of relevant quantities from completed setnet trip interviews during the 7/7/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

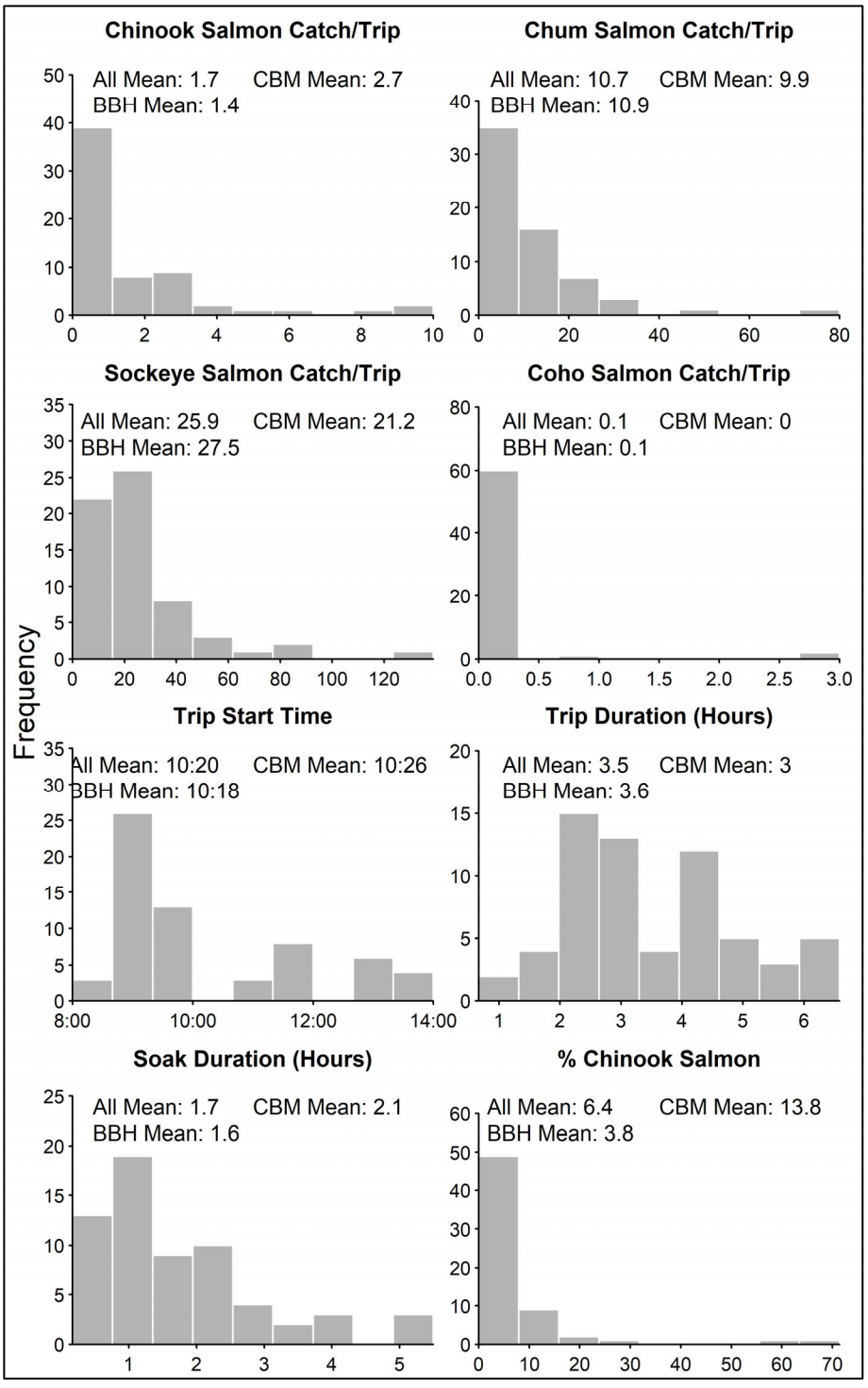

Figure 16. Distribution of relevant quantities from completed driftnet trip interviews during the 7/11/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

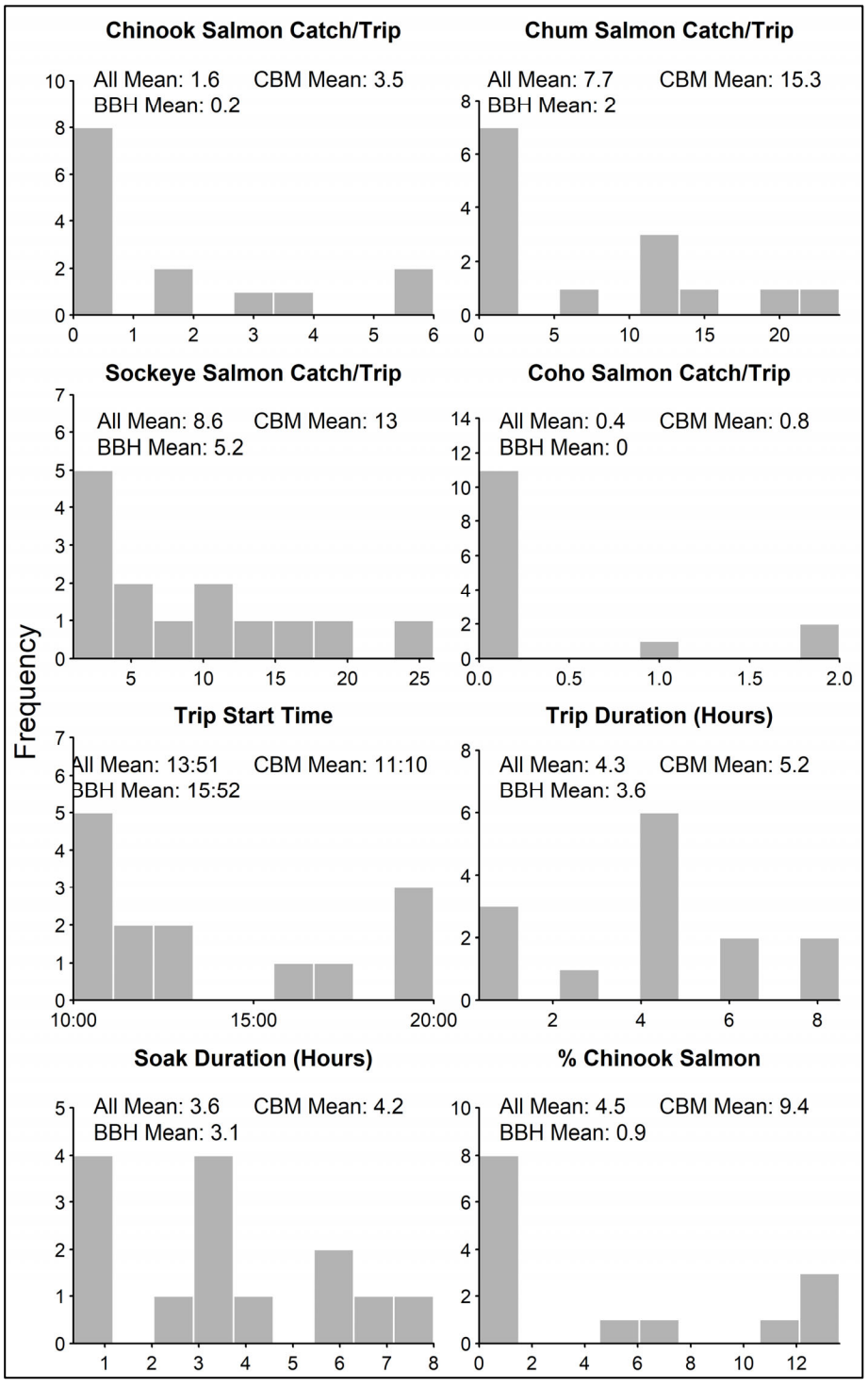

Figure 17. Distribution of relevant quantities from completed setnet trip interviews during the 7/17/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

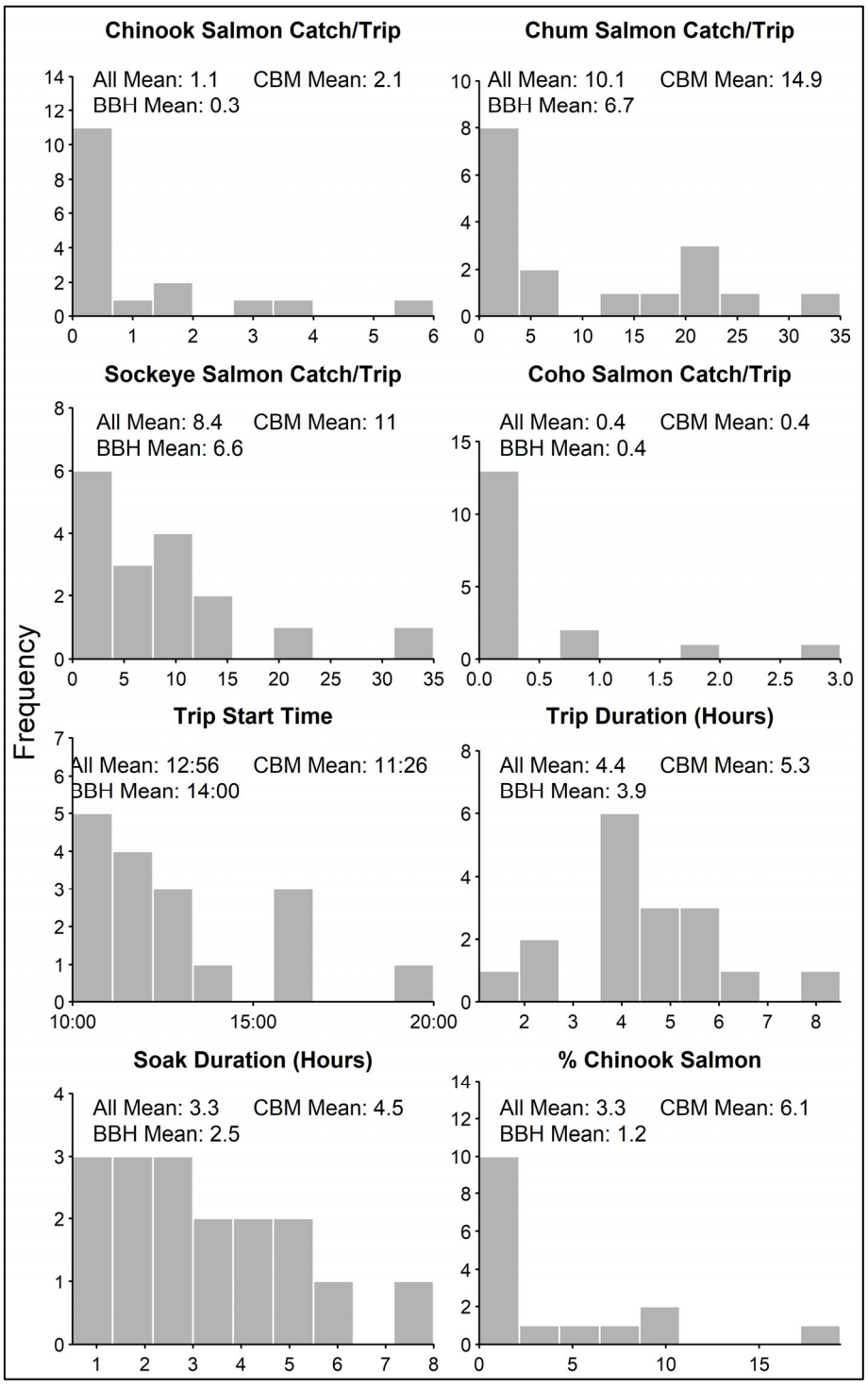

Figure 18. Distribution of relevant quantities from completed setnet trip interviews during the 7/19/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

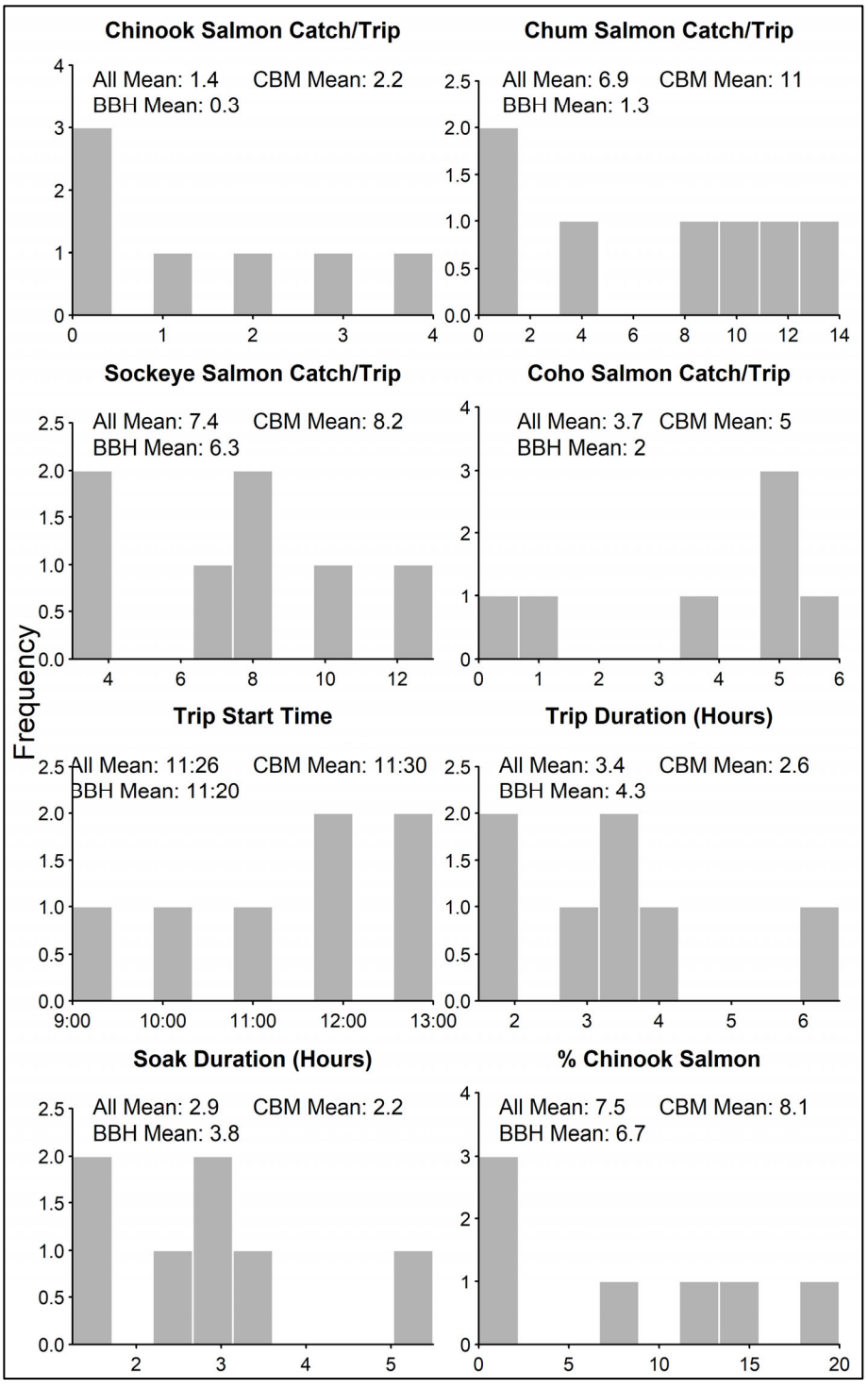

Figure 19. Distribution of relevant quantities from completed setnet trip interviews during the 7/24/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

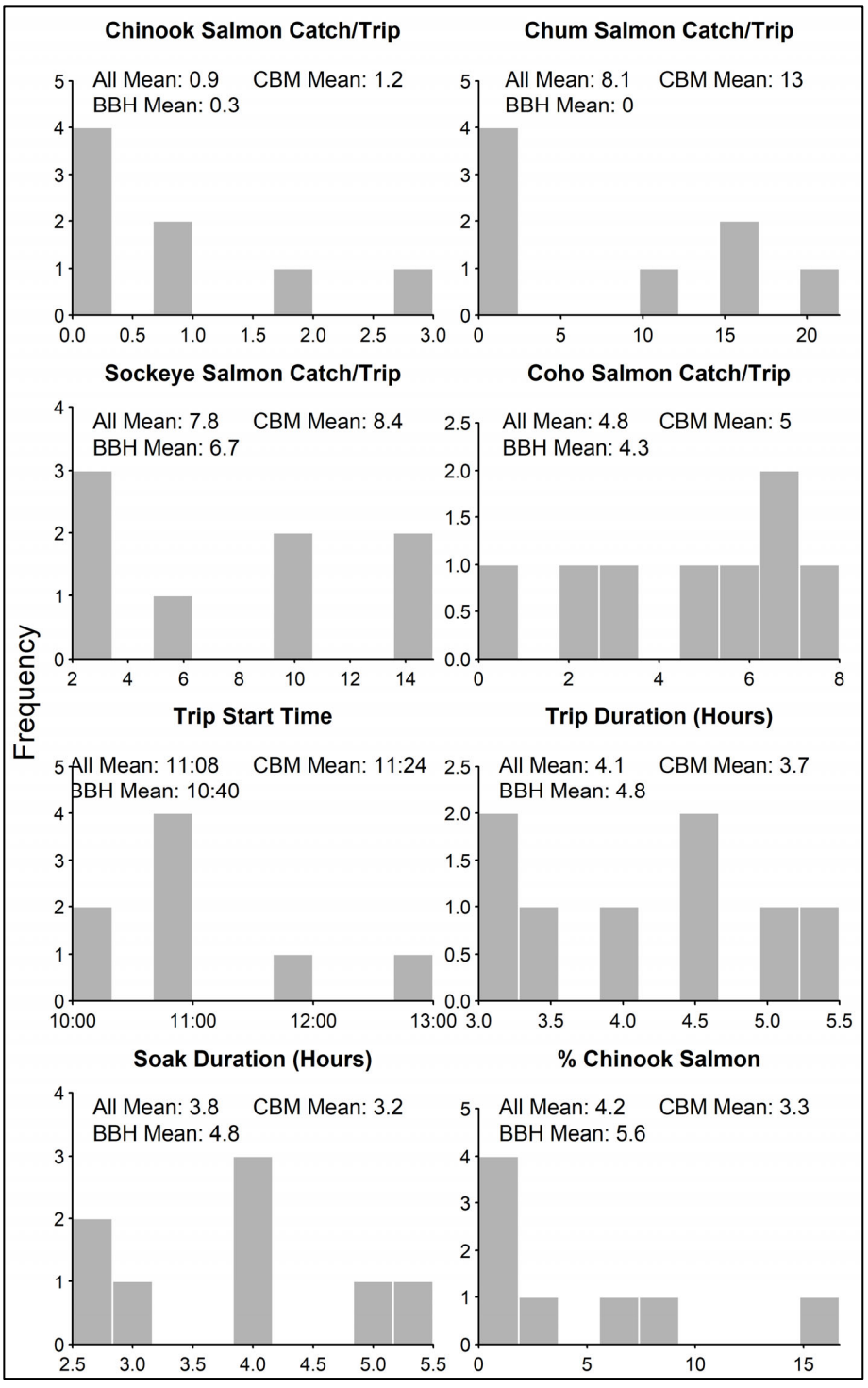

Figure 20. Distribution of relevant quantities from completed setnet trip interviews during the 7/26/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

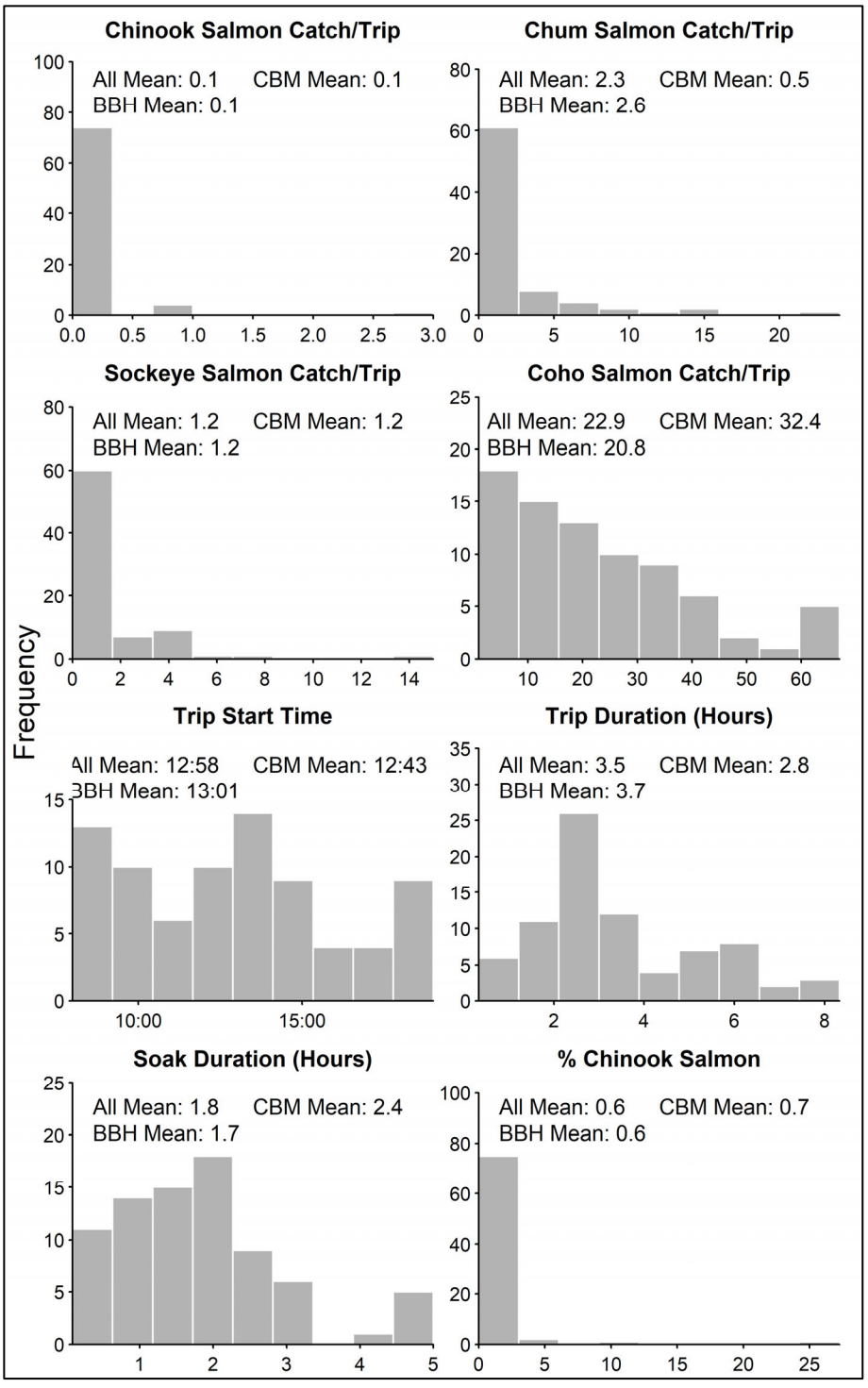

Figure 21. Distribution of relevant quantities from completed driftnet trip interviews during the 8/3/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

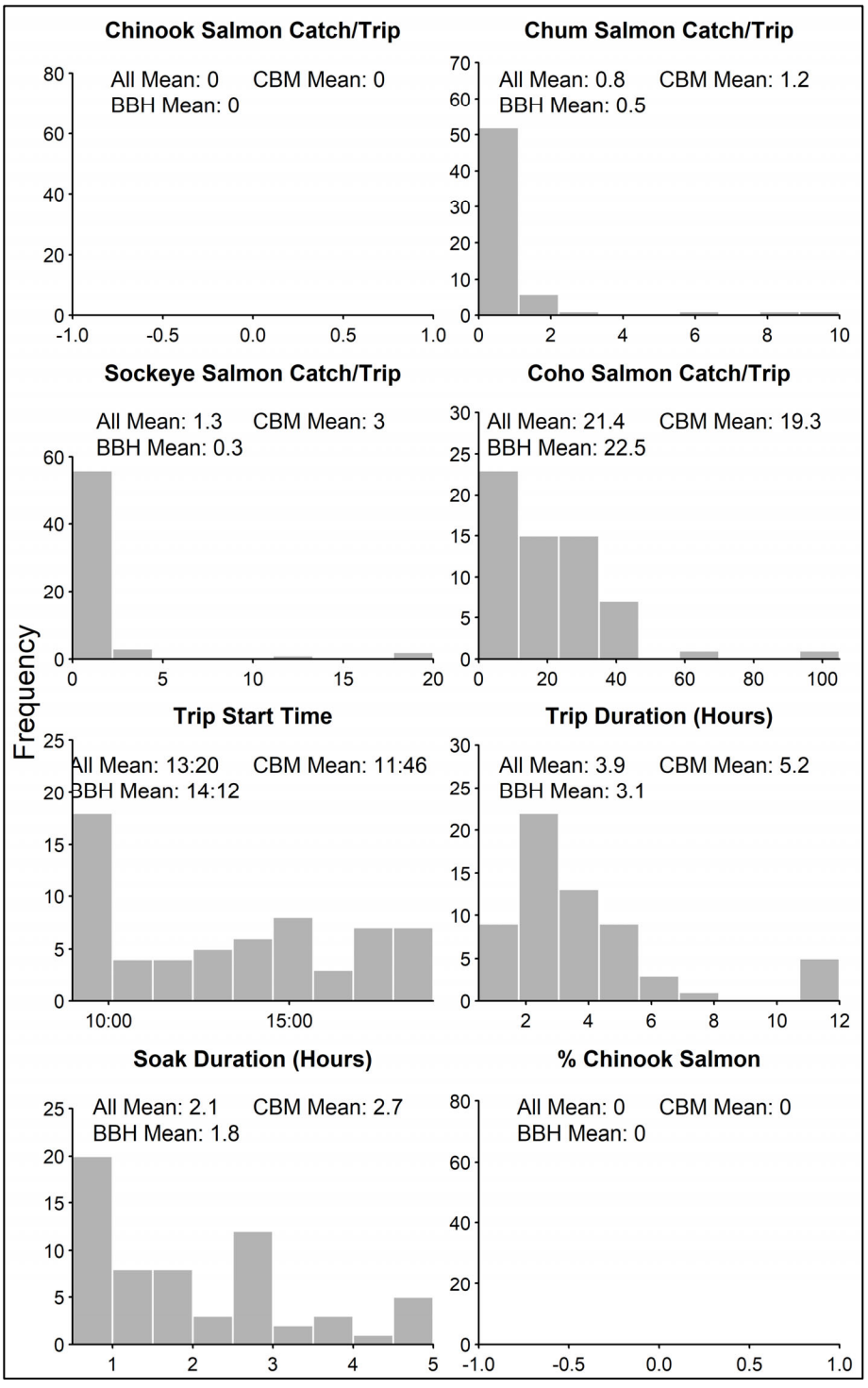

Figure 22. Distribution of relevant quantities from completed setnet trip interviews during the 8/9/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

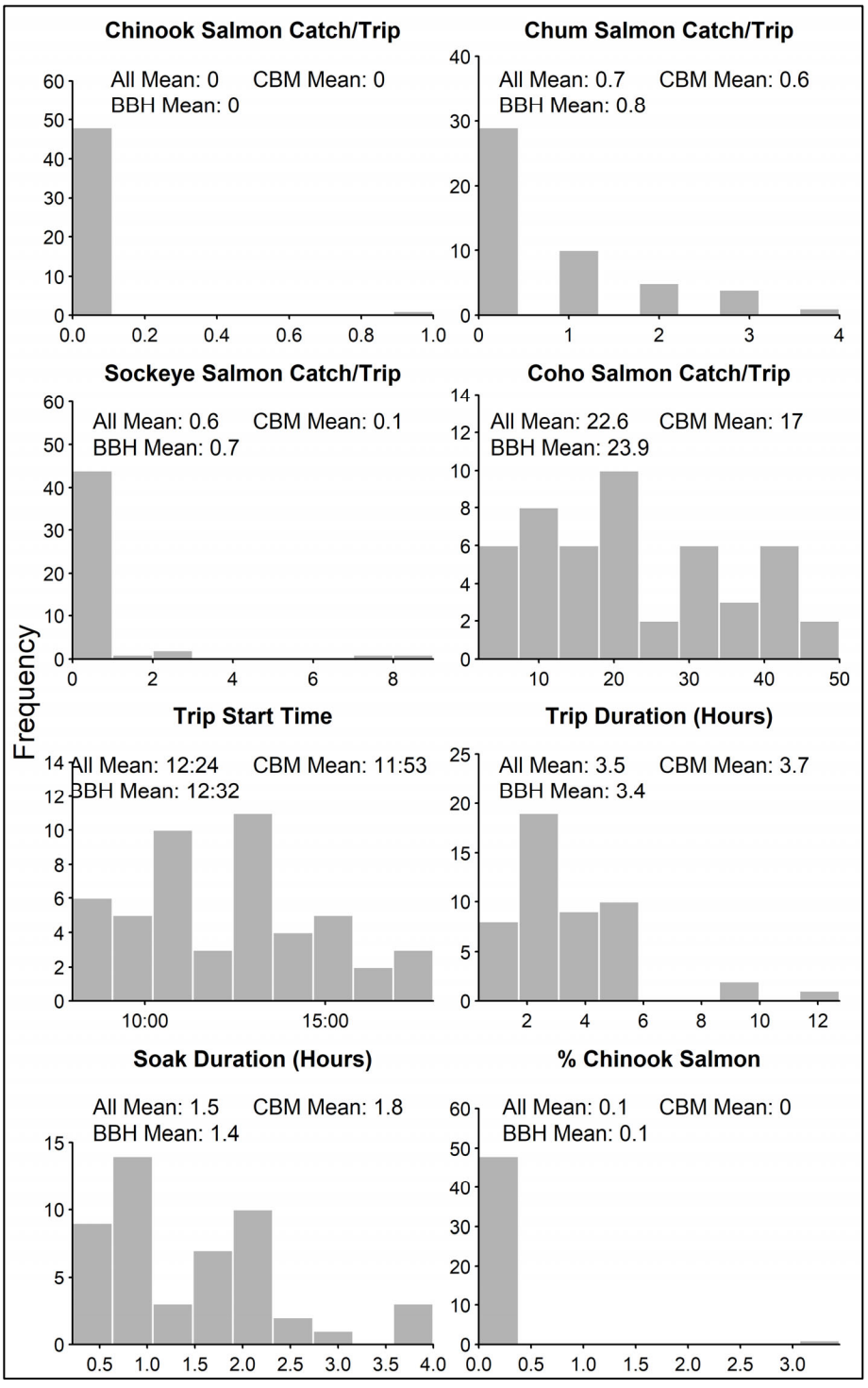

Figure 23. Distribution of relevant quantities from completed setnet trip interviews during the 8/12/23 opening, with means for all available interviews and by data source.
BBH = Bethel boat harbor (ONC), FC = Bethel area fish camps (ONC), and CBM = community-based harvest monitoring (KRITFC)

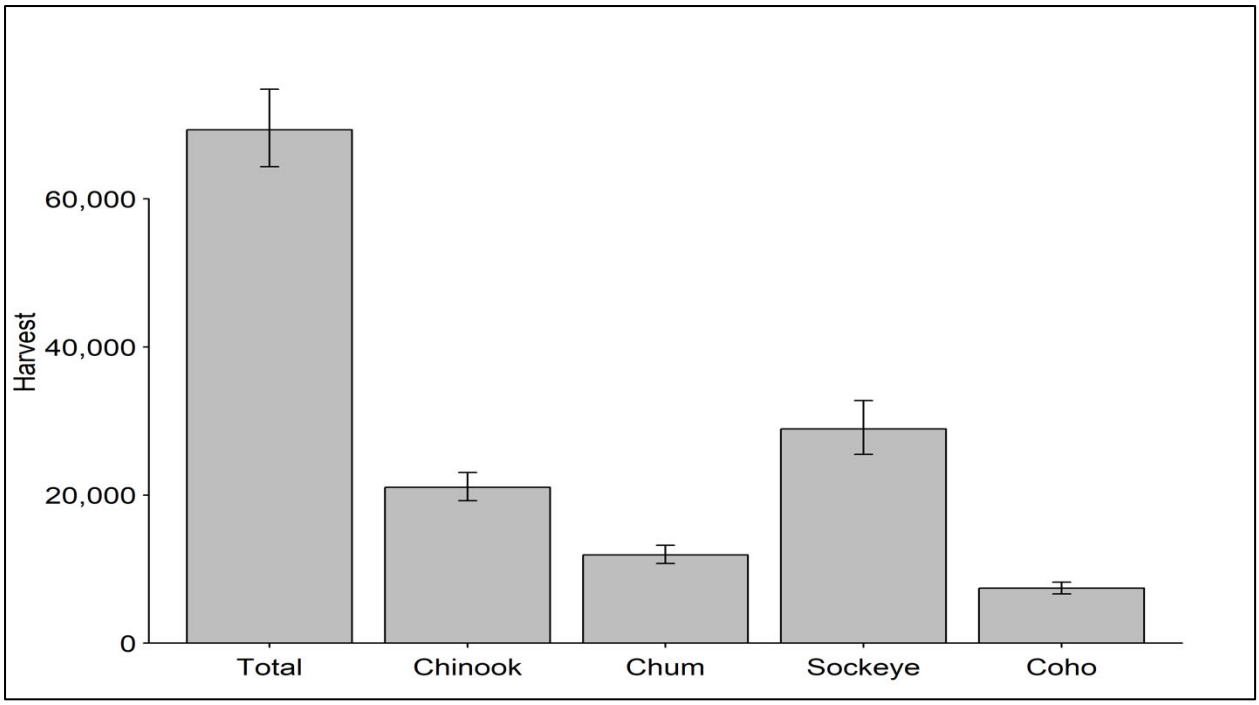

Figure 24. Total 2023 salmon harvest by species across all openers for which harvest estimates were produced including both driftnets and setnets.

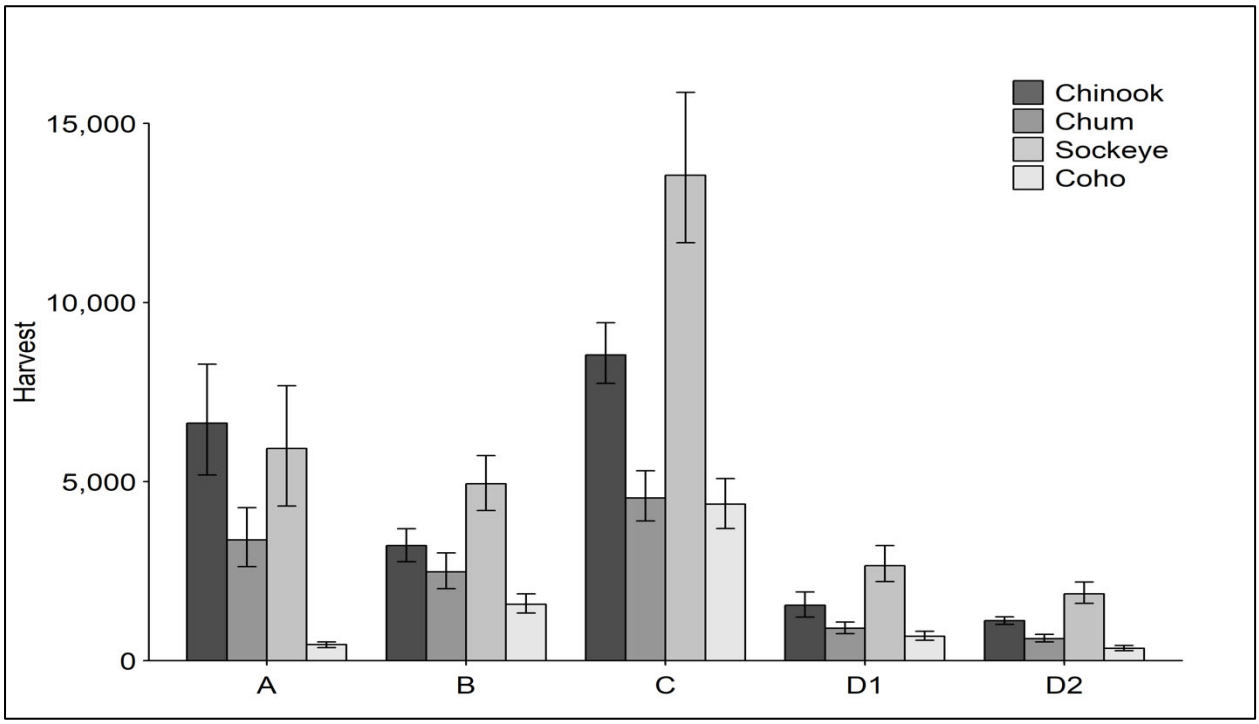

Figure 25. Total 2023 salmon harvest by species and strata across all openings for which harvest estimates were produced, including both driftnets and setnets.
Geographic strata are: A = below Johnson River, B = Johnson River to Napaskiak, C = Napaskiak to Akiachak, and D = Akiachak to Akiak.