Snake River Basin

Adult Chinook Salmon and Steelhead Monitoring

2019 Annual Report

Lostine River Weir – Jim Harbeck

Nez Perce Tribe

Department of Fisheries Resources Management

Research Division

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Snake River Basin Adult Chinook Salmon and Steelhead Monitoring – 2019 Annual Report

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Abstract

The Nez Perce Tribe Department of Fisheries Resources Management, Research Division, used various methods to monitor and evaluate the status of adult fall Chinook Salmon (*Oncorhynchus tshawytscha*), spring/summer Chinook Salmon (*O. tshawytscha*) and summer steelhead (*O.* mykiss) returns throughout tribal project areas in the Snake River Basin in 2019. We calculated abundance, life history, and productivity performance measures using data collected from returning adults at Lower Granite Dam, picket and floating weirs, spawning ground surveys, and in-stream PIT tag detection systems. When available, we reported 2019 adult metrics along with the previous 10 years of data to evaluate pattern shifts or developing trends. In 2019, the abundance of returning Chinook Salmon and steelhead at all monitoring locations and scales (i.e., basin, population and tributary) was alarmingly low, and further contributed to a persistent declining trend since 2010. For example, total escapement past Lower Granite Dam in 2019 was the lowest observed in the last 10 years for spring/summer Chinook Salmon (N = 27,539) and summer steelhead (N = 54,770), and it was the second lowest observed year for fall Chinook Salmon (N = 21,697). Chinook Salmon and steelhead life history metrics estimated for return year 2019 varied by species, population, and collection method. Spring/summer Chinook Salmon female proportion estimated from spawning ground survey data was consistently higher than weir- and in-stream PIT tag detection-methods and warrants further investigations to understand potential biases with each method. Fall Chinook Salmon proportion of hatchery spawner estimates also differed between two evaluation methods; run-reconstruction and parentage-based-tagging analysis (Young et al. 2020). Additionally, indicators of productivity in 2019, such as smolt-to-adult return and progeny-per-parent rates, suggest Snake River Basin anadromous fish populations returned adults at a rate of less than 1.0% for all out-migrating smolts, and spawner success was below replacement providing further evidence of population declines.

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Acknowledgments

The Nez Perce Tribe Executive Committee authorized the monitoring and evaluation contained within this report with funding provided by the U.S. Department of Energy, Bonneville Power Administration. Monitoring Snake River Basin anadromous stocks would not be possible without the dedication of many co-managers, field biologists, technicians, and office personnel. Their contributions and efforts to assist the Department of Fisheries Resources Management staff in collecting, summarizing, and analyzing fish data have been invaluable. Specifically, we would like to thank the Idaho Department of Fish and Game, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Shoshone-Bannock Tribe, and U.S. Fish and Wildlife personnel for their commitment and expertise of our shared fisheries resources. Too many individuals contributed to this work for us to list; however, we have captured a few names, that, without these individuals, the collection of this data and understanding of it would have been impossible.

Project Administration and Report Review

We would like to thank the Research Division adult technical team, project leaders, managers, and administrative staff for their expertise, guidance, and assistance in the development of this report and the day-to-day operations of our projects. Jason Vogel, Jay Hesse, and William Young, provide excellent management and coordination that maintains cohesion across our various monitoring and evaluation projects, yet, still allowing for necessary independence to capture species and geographic nuances. Peter Cleary, Sherman Sprague and Clark Watry are recognized for their leadership and project oversight, and for technical review and editing of the document. Cameron Albee, Doug Nelson, John Robbins and Neal Espinosa are recognized for their participation on the adult technical team and for helping to conceptualize, develop and review our first collaborative report. Finally, we would like to thank the Research Division support staff, Chris Nahsonhoya, Jody Conner, and Paulette Smith, who reduced the chaos in our daily lives and helped to keep our programs running smoothly.

Data Collection, Summary and Analysis

Nez Perce Tribe We would like to thank the numerous Nez Perce Tribe field staff that assisted in spawning ground surveys, picket weir operations, in-stream PIT-tag detection system maintenance and data management, including; Adam Capetillo, Anthony Capetillo, Bailey Peters, Brian Simmons, Chris Eaton, Cobi Bisbee, Dale Brown, Eric Wilcox, Fred Haberman, Jacob Hesse, Jay Oatman, John Byrne, John Gebhards, Jon Rombach, JR Inglis, Leander Goodteacher, Lora Tennant, Lynne Price, Marina Cawley, Mark Maze, Rob Hill, Ryan Jain, Samuel Williams, Travis Hodsdon, and Tyler Stright.

Idaho Department of Fish and Game Dave Rhinehart, Josh Poole, Kaitlyn Wauhkonen, Kurt Westenhagen are recognized for helping conduct spawning ground surveys in Big Creek, Lake Creek, and the Secesh River. We are also grateful for Micah Davison and Nampa Research Ageing Lab staff for their efforts in processing and analyzing our collected fin ray samples. We also want to thank numerous IDFG staff for PIT tagging and genetic sampling at Lower Granite Dam adult trap which we rely on for in-stream PIT tag detection systems monitoring, and especially the efforts of Matt Campbell and John Hargrove at the Eagle Genetics Lab for data analysis, and Tim Copeland for his assistance in developing monitoring strategies.

Oregon Department of Fish and Wildlife Joseph Feldhaus is recognized for organizing northeast Oregon spawning ground surveys and assisting with Lostine/Wallowa River data analysis.

Columbia River Inter-Tribal Fish Commission We recognize Ilana Koch, Shawn Narum, and the rest of the Hagerman Genetics Lab staff for their efforts in processing and analyzing Johnson Creek genetic samples for parentage and age analyses, and in analyzing fall Chinook Salmon carcasses for determining percent hatchery-origin spawners.

Biomark ABS The operation and analysis of data collected at in-stream PIT tag detection systems would not be possible without the contributions and expertise of Chris Beasley, Kevin See, Kyle Meir, and Mike Ackerman, in addition to the funding we receive through the Integrated In-stream PIT tag Detection Systems Operations and Maintenance (BPA Prj. No. 2018-002-00, Contract No. 83489) project.

University of Idaho We recognize Brain Kennedy and his students for their assistance with carcass collections in Big Creek.

Project Funding

This document includes data collected during spawn year 2019, which was conducted with funding provided by the Bonneville Power Administration and Lower Snake River Compensation Plan for six DFRM Research Division projects; including: Grande Ronde Supplementation Monitoring and Evaluation (BPA Project 1998-007-02, Contract 74017 REL 42), Imnaha River Steelhead Status and Smolt Monitoring (BPA Project 1997-015-01, Contract 010780), Johnson Creek Artificial Propagation and Enhancement (BPA Project 1996-043-00, Contract 74017 REL 30), Lower Snake River Compensation Plan (LSRCP Contract F16AC00029), Nez Perce Tribal Hatchery Monitoring and Evaluation (BPA Project 1983-350-03, Contract 74017 REL 38), and, the Snake Basin Steelhead Assessments (BPA Project 2010-057-00, Contact 74017 REL 34).

Introduction

Persistence of the Nez Perce Tribe (Tribe) is attributed in large part to the vast abundance and accessibility of anadromous fish returning to the Snake River Basin (basin). The annual returns of fish served the Tribe as a primary food source, trade item, and cultural resource for thousands of years (Landeen and Pinkham 1999). The Tribe's reliance upon anadromous species influenced their historic occupation of the west, which included over 13 million acres of present day north-central Idaho, southeastern Washington, and northeastern Oregon, and is considered the Tribe's usual and accustomed area. The degree to which the Tribe is physically and spiritually coupled to returning salmon and other anadromous fish for sustenance (Landeen and Pinkham 1999) was recognized and protected in the Treaty of 1855, 12 Stat, 957. Later modifications to the Treaty of 1855 confined the Tribe to a fraction of the original identified territory but maintained their right to access all usual and accustomed fishing areas, and conferred co-management responsibilities, providing a framework for their involvement in fish protection and management actions, population recovery efforts, and habitat restoration throughout Nez Perce Tribe territory.

Significant declines in adult Chinook Salmon (*Oncorhynchus tshawytscha*), Coho Salmon (*O. kisutch*), Sockeye Salmon (*O. nerka*), steelhead (*O. mykiss*) and Pacific Lamprey (*Entosphenus tridentatus*) returning to the basin have affected the Tribe's ability to preserve its culture, identity, and subsistence. In the basin, Chinook Salmon and steelhead abundance decreased significantly over the past five decades (Nehlsen et al. 1991; McClure et al. 2003, NWFSC 2015). Similar declines are observed in most anadromous stocks across the Pacific Northwest of the United States (Heard et al. 2007) with many runs now listed as either threatened or endangered under the Endangered Species Act (ESA). Because of historic declines and future threats to survival, two Chinook Salmon Evolutionary Significant Units (ESUs) and one steelhead distinct population segment (DPS) in the basin are listed as threatened under the ESA (NMFS 2005).

The Tribe honors their cultural duty and obligation to protect and recover Snake basin fish stocks, and in part carries out their legal responsibility to co-manage these resources through the work of their Department of Fisheries Resources Management (DFRM; NPT 2013). The DFRM focuses on the protection and restoration of all aquatic resources and habitats in a manner consistent with the Tribe's way of life (DFRM Management Plan 2013). The Research Division (division) assists in meeting the goals of the DFRM by monitoring and evaluating fish hatchery production programs and naturally spawning fish returning to the basin and other usual and accustomed areas. The division implements their adult salmon and steelhead monitoring with five Bonneville Power Administration (BPA) Fish and Wildlife funded projects, one Lower Snake River Compensation Plan project, and through collaboration with co-managers. Division projects gather, summarize, and analyze data collected annually across basin tributaries and National Oceanic Atmospheric Administration's (NOAA) Interior Columbia River Technical Review Team (ICTRT) defined populations and management areas (ICTRT, 2003). The scale at which we summarize and report data in this report differs across each species and run depending on specific project, DFRM, and regional management objectives.

Fall Chinook Salmon returning to the Snake River Lower Mainstem population are monitored throughout available spawning areas by the division's Nez Perce Tribal Hatchery (NPTH) Monitoring and Evaluations (BPA Project 1983-350-03) project. The fall Chinook Salmon Lower Mainstem population consists of four major spawning aggregates: Lower Hells Canyon, Upper Hells Canyon, Lower Clearwater, and the South Fork Clearwater/Selway reaches (ICTRT 2005). We monitor adult returns to Snake River, Clearwater River, and Salmon River mainstem transects and tributaries to evaluate hatchery production releases, abundance trends, and life history characteristic shifts for each spawning aggregate.

Adult spring/summer Chinook Salmon monitoring is conducted at tributary and ICTRT population levels by five division projects. Tributary reporting is completed to perform hatchery program effectiveness monitoring, while population-level reporting contributes to regional monitoring and status assessments for 7 major population groups (MPG) representing 31 individual ICTRT (ICTRT 2005) populations. Division projects completing hatchery program effectiveness monitoring include: Grande Ronde Supplementation Monitoring and Evaluations (BPA Project 1998-007-02), Johnson Creek Artificial Propagation and Enhancement (BPA Project 1996-043-00), Lower Snake River Compensation Plan (LSRCP Contract F16AC00029), and, NPTH Monitoring and Evaluations (BPA Project 1983-350-03). The Snake Basin Steelhead Assessments project (BPA Project 2010-057-00) completed population monitoring and estimated natural-origin Chinook Salmon adult return metrics for NOAA's status assessments.

Summer steelhead metrics, reported at the tributary and ICTRT population levels using data collected and summarized by three division projects. The Grande Ronde Supplementation Monitoring and Evaluations (BPA Project 1998-007-02), and the Imnaha River Steelhead Status and Smolt Monitoring (BPA Project 1997-015-01) projects collect and report data for the Lostine River and individual tributaries within the Imnaha River watershed for sub-population monitoring and to identify spatial distribution shifts. Steelhead population monitoring for NOAA's status assessments is completed in 22 ICTRT populations by the Snake Basin Steelhead Assessments (SBPA Project 2010-057-00) project in conjunction with data collected by Grande Ronde Supplementation Monitoring and Evaluations and Imnaha River Steelhead Status and Smolt Monitoring projects.

This report includes a subset of standardized fish metrics developed by the Ad Hoc Supplementation Workgroup (AHSWG; Beasley et al. 2008) that describe the current status of anadromous fish returning to Snake River Basin populations and tributaries contained within the Tribe's usual and accustomed areas. Reported metrics include key abundance and life history performance measures for adult returns through spawn year 2019 and productivity metrics through brood year 2014. Reported metrics facilitate detailed project evaluations, adaptive management, and NOAA's status and trends monitoring. Metrics reported are not comprehensive of all data collected or those summarized annually for project-specific objectives, and may differ across fall Chinook Salmon, spring/summer

Chinook Salmon, and summer steelhead due to differences in monitoring strategies and species and run life history characteristics. Non-reported metrics and supporting data are available from report authors or the division's centralized data repositories, available online at https://npt-cdms.nezperce.org and https://nptfisheries.shinyapps.io/kus-data/.

This report is prepared by the division's Adult Technical Team to satisfy funding conditions, and to describe annual work completed and data collected under BPA Fish and Wildlife program contracts 74017 REL 42, 74017 REL 38, 74017 REL 34, 74017 REL 30, 010780, and 83489, and the LSRCP contract. The Adult Technical Team consists of fisheries biologists representing each of the division's projects responsible for collecting, summarizing, and analyzing returning adult fish data.

Methods

The division calculated tributary and population abundance, life history, and productivity performance measures (Beasley et al. 2008) using data collected from Lower Granite Dam (LGD), picket and floating weirs, spawning ground surveys, and in-stream PIT tag detection systems (IPTDS). We used different combinations of these datasets for fall Chinook Salmon, spring/summer Chinook Salmon and summer steelhead to meet specific geographic and project objectives. Within each species and run, we used consistent definitions of performance measures, estimation methods when possible, and levels of biological organization to facilitate comparisons among hatchery programs and populations within the basin.

Data Collection

Adult Trapping The Research Division collects broodstock and adult return data from the LGD adult trap, and using picket and floating weirs installed on Snake River Basin tributaries.

During spawn year 2019 the adult trap at LGD trapped returning Snake River Chinook Salmon and steelhead. Trapping at the adult trap was supervised and staffed by NOAA employees with assistance from Idaho Department of Fish and Game (IDFG). A portion of trapped fish were sampled for genetic tissue and scales to determine origin (i.e., parentage-based tagging), hatchery release group, and age. A portion of trapped fall Chinook Salmon were also collected for broodstock and hauled to either Lyons Ferry Hatchery or NPTH. For additional Lower Granite adult trap operational details see Harmon (2003) and Ogden (2019).

The DFRM operated picket and floating weirs throughout the basin to trap spawn year 2019 returns of adult spring/summer Chinook Salmon and summer steelhead. Production and Research Division staff worked collaboratively at the adult traps to collect broodstock, in addition to monitoring and evaluation data, and to manage in-season harvest and in-stream spawner contributions. Research Division-led spring/summer Chinook Salmon and summer steelhead monitoring relied on adult return data collected from four trapping locations in the basin: Freezeout Creek, Johnson Creek, Lolo Creek, and the Lostine River.

DFRM adult spring/summer Chinook Salmon and summer steelhead weirs and traps followed similar operational protocols across all locations; however, periods of operation differed according to the target species run-timing, location and elevation of the trap site, and annual environmental conditions. Staff collected data electronically or on paper datasheets at DFRM weirs and later uploaded data to www.finsnet.org. Data and additional details regarding DFRM weir protocols and methods can be queried at https://nptfisheries.shinyapps.io/kus-data/, and at https://www.finsnet.org.

In 2019, we collected adult spring/summer Chinook Salmon data at adult weirs on Johnson Creek, Lolo Creek, and the Lostine River. Production and Research Division staff installed the Johnson Creek weir on June 25 and operated the weir until September 14. On May 17 through July 23 Research Division staff installed and operated the Lolo Creek weir. Production staff operated the Lostine River weir from February 15 to November 26, capturing spring/summer Chinook salmon between June 19 and September 14. Department staff operated weirs continuously throughout the season without any missed trapping periods. DFRM staff collected broodstock at each weir for local hatchery production and supplementation programs. Production staff transferred broodstock collected at the Johnson Creek weir to IDFG's McCall Hatchery satellite facility on the South Fork of the Salmon River. Research staff transferred fish collected at the Lolo Creek weir to the NPTH, while Production staff transferred Lostine River broodstock to Oregon Department of Fish and Wildlife's (ODFW) Lookingglass Fish Hatchery. Returning spring/summer Chinook Salmon not collected for broodstock were either: marked and released upstream for abundance estimation and allowed to spawn naturally; transported and released downstream for potential harvest in their respective fisheries; or, removed for ceremonial purposes, subsistence use, or stray removal. Specific details for the operation of Johnson Creek, Lolo Creek, and Lostine River weirs can be found in Hill and Gebhards (2020), Kosinski and Sprague (2018), and Northeast Oregon Annual Operations Plan (2019), respectively.

Research Division staff installed adult summer steelhead weirs in Camp Creek, Freezeout Creek and the Lostine River. During operation we marked, biologically sampled, and released trapped fish upstream for abundance studies and to estimate sex and age proportions of returning fish. Summer steelhead weirs on Freezeout Creek operated from March 24 to June 16 and on the Lostine River from February 15 to November 30. We attempted to operate steelhead weirs continuously, but high spring flows created unsafe conditions and damaged equipment causing extended days of non-operation. Following installation on February 27, the Camp Creek weir was damaged several times in March and April during high flows. Attempted trapping at Camp Creek was discontinued on April 8 after a rain storm and resulting high flows permanently damaged the weir. No adult steelhead were interrogated at this weir prior to the high water events. Further details regarding summer steelhead weirs can be found in Harbeck et al. (2016) and Harbeck and Espinosa (2012).

Spawning Ground Surveys The division conducted spawning ground surveys throughout the Snake River Basin to monitor adult Chinook Salmon and steelhead spawn year 2019 returns. We conducted surveys to obtain an index of spawner abundance, contribute to mark-recapture escapement estimates, collect life history data, and monitor spawner spatial distribution. Fall Chinook Salmon were surveyed in the Clearwater River, Salmon River, and Snake River subbasins. Surveyed areas for spring/summer Chinook Salmon included: Clearwater River, Grande Ronde River, South Fork Salmon River, and Middle Fork Salmon River subbasins. We surveyed summer steelhead in the mainstem Imnaha River and select Imnaha River tributaries.

Spawning ground surveys consisted of multiple-pass aerial surveys for fall Chinook Salmon and single- or multiple-pass ground surveys for spring/summer Chinook Salmon and summer steelhead. Multiple-pass ground surveys provided a count of new redds constructed following the previous pass(es); thereby establishing a spawn timing reference. Multiple-pass surveys also provided additional carcass-based life history data that may otherwise be unavailable through a single-pass survey. Redds, and in some cases carcasses, were geospatially referenced and all carcasses collected were sampled for biological characteristics and distinguishing marks or tags. Data was either recorded electronically or on field datasheets and subsequently transferred to a standardized collection repository: https://npt-cdms.nezperce.org. Specific data collection methods and spawning ground survey protocols are found at https://nptfisheries.shinyapps.io/kus-data/ and https://www.monitoringresources.org/Document/Protocol/Details/2255. Feldhaus et al. (2017) provides details regarding survey methods in the Wallowa River subbasin.

Division staff completed fall Chinook Salmon spawning ground surveys between October 7 and November 25. We conducted aerial helicopter surveys in the Clearwater River, Grande Ronde River, Imnaha River, Potlatch River, Salmon River, Selway River, and South Fork Clearwater River. In 2019, we evaluated the use of unmanned aerial vehicles (UAVs) in the lower Clearwater River as a redd survey alternative to the more dangerous helicopter surveys conducted presently. Additionally, we collected life history data from carcasses recovered in the Clearwater River. Further details regarding fall Chinook Salmon spawning ground surveys can be found in Arnsberg et al. (2018).

We used spawning ground survey methods to survey spring/summer Chinook Salmon throughout tributaries belonging to five Snake River Basin MPGs representing ten ICTRT populations. Surveys began on August 1 and continued until October 15. Surveyed ICTRT populations included portions of Big Creek, East Fork South Fork Salmon River, Little Salmon River, Lochsa River, Lolo Creek, Meadow Creek, Secesh River, South Fork Salmon River mainstem, Upper South Fork Clearwater, and Wallowa/Lostine. Spring/summer Chinook Salmon spawning ground survey data informed abundance, life history, and distribution metrics for project evaluations and NOAA status assessments (NWFSC 2015); however, we only reported spawning ground survey data for population areas surveyed by the Tribe and/or co-produced with ODFW for northeast Oregon survey reaches.

Staff surveyed summer steelhead in ICTRT Imnaha River MPG/population tributaries from March 19 through June 13. Tributaries surveyed included: Bear Gulch Creek, Blackhorse Creek, Camp Creek, Crazyman Creek, Dry Creek, Freezeout Creek, Grouse Creek, Gumboot Creek, Lick Creek, Morgan Creek, Mahogany Creek, North Fork Gumboot Creek, and Upper Imnaha River mainstem. Unlike Chinook Salmon redd survey data, steelhead redd data were not used to develop an index of abundance, but instead only used to monitor spawning locations and spawner spatial distribution.

In-stream PIT tag Detection Systems The Tribe's research and monitoring efforts that track abundance, distribution, and diversity of spring/summer Chinook Salmon and summer steelhead in the Snake River basin through PIT tag observations were performed in collaboration with a large number of state, federal, and tribal agencies. NOAA coordinated trapping at LGD (BPA Project 2005-002-00; Harmon 2003; Ogden 2019). The Idaho Steelhead Monitoring and Evaluation Studies (BPA Project 1990-055-00) and the Idaho Natural Production Monitoring and Evaluation Program (BPA Project 1991-073-00) coordinated the biological sampling of adults at LGD and provided length, age, and passage timing data. The Snake River Chinook and Steelhead Parental Based Tagging (BPA Project 2010-031-00) project provided parentage-based tagging (PBT) baselines within the Snake River basin, while the Snake River Genetic Stock Identification (BPA Project 2010-026-00) project provided SNP genotype data for population-level genetic diversity and structure analyses. The previously funded Integrated Status and Effectiveness Monitoring Project (BPA Project 2003-017-00) developed much of IPTDS infrastructure used to monitor populations throughout the basin. In addition, the funded Integrated Status and Effectiveness Monitoring Project also developed two critical run decomposition models to: (1) estimate the number of wild adults at LGD with uncertainty, and (2) partition the LGD abundance into ICTRT population and tributary level abundances with uncertainty based on PIT tag observations (See et al. 2016). The Snake Basin Steelhead Assessments project (BPA Project 2010-057-00) was tasked with executing and reporting the results of the two developed run decomposition models for spawn year 2019. For many summer steelhead populations above LGD, the PIT tag-based run decomposition methodology was the only means available to estimate population-level escapement because high spring flows precluded the use of other methodologies.

The number of PIT tag observation sites varied within individual ICTRT populations. Many of the PIT tag detection sites used in this study were installed and initially operated by the ISEMP project; during spawn year 2019 these sites were maintained under BPA Project 2018-002-00 (QCI 2013; Orme and Albee 2012; Orme and Albee 2013). In 2019, IPTDS sites in the basin operated with minimal to no downtime, or they experienced considerable equipment loss and did not contribute to fish monitoring (Meier 2019). For example, high water damaged the IPTDS at Camp Creek (CMP), Skookumchuck Creek, Lolo Creek (LC2), and Mission Creek (MIS) sites thereby precluding abundance estimates at these sites for spawn year 2019. Because PIT tag detection sites were not always aligned with established ICTRT population boundaries, PIT tag observations were pooled at the most downstream IPTDS location to generate population estimates (IPTDSW 2020). In addition to population-level estimates, site-specific estimates were also generated providing tributary or spawning aggregate level abundance, in addition to a measure of spawning distribution in some subbasins. Specific details for IPTDS operation, maintenance, data collection, and analysis can be found at IPTDSW (2020), Orme and Kinzer (2018), Orme et al. (2019), https://nptfisheries.shinyapps.io/kus-data/, and https://www.monitoringresources.org/Document/Protocol/Details/2262.

Data Analysis

Specific details regarding data summaries and estimation methods for each fall Chinook Salmon, spring/summer Chinook Salmon, and summer steelhead performance metrics can be found in Kinzer et al. (in preparation) and Young et al. (2020) under the documents link https://nptfisheries.shinyapps.io/kus-data/. Protocols and methods are also available in draft form at https://www.monitoringresources.org; including: Nez Perce Tribe Adult Abundance and Life History Data Analysis (Protocol 2246), Nez Perce Tribe Survival and Productivity Data Analysis (Protocol 2249), and IPTDSW (2020) for IPTDS escapement estimation. Reported performance measures and summary data are available at https://nptfisheries.shinyapps.io/kus-data/.

Data collected from adult traps, spawning ground surveys and IPTDS was used collectively to generate estimates of performance metrics for adult Chinook Salmon and steelhead. Adult metrics, as reported in this document, adhered to the definitions of AHSWG performance measures (Beasley et al. 2008) and cover abundance and life history metrics for spawn year 2019 returns. Reported productivity metrics were through brood year 2014 and included age-5 adult returns in 2019. We reported metrics at the tributary level when sufficient data were available to support management decisions, hatchery evaluations, and project-specific objectives. We also reported several metrics as a Snake River aggregate at the basin level (e.g., abundance at LGD) and at ICTRT populations, originally reported by IPTDSW (2020), to provide comparisons to other methods, and key information for DFRM and regional fish managers, and status and trends monitoring for NOAA's species status assessments.

Fall Chinook Salmon performance measures in this report included metrics for abundance, life history, and productivity. Abundance metrics included Snake River Basin escapement, as estimated by the Fall Chinook Salmon Run-reconstruction Group (Young et al. 2020), and an index of spawner abundance (i.e., redd counts) for each surveyed stream reach. Life history metrics included female and age proportions estimated from spawning ground survey data and the hatchery fraction observed at LGD (Young et al. 2020). Reported productivity metrics include pre-spawn mortality, progeny-per-parent ratios, and smolt-to-adult return ratios.

Spring/summer Chinook Salmon performance measures included abundance, life history, and productivity metrics. Abundance metrics included aggregated Snake River Basin escapement at LGD, ICTRT population escapement, tributary escapement and fish disposition, index of spawner abundance (i.e., redd counts), and the proportion of hatchery returns to the weir (i.e., hatchery fraction) and spawning grounds (i.e., pHOS). Life history metrics included female proportion, pre-spawn mortality, returning age composition (i.e., age-at-return), and adult size-at-return. Reported productivity metrics were limited to populations with adult trapping data, and included smolt-to-adult return rates and progeny-per-parent ratios. Productivity estimates for spring/summer Chinook Salmon populations generated from IPTDS data are currently in development and may be available in the spawn year 2020 annual report.

Summer steelhead performance measures included abundance, life history, and productivity metrics. Abundance metrics included an aggregated Snake River Basin escapement at LGD, ICTRT population escapement, tributary escapement, and proportion of hatchery returns to a weir. Life history metrics included female proportions, returning age composition (i.e., age-at-return), and adult size-at-return. Reported productivity metrics were limited to populations with adult trapping data, and included smolt-to-adult return rates and progeny-per-parent ratios. Productivity estimates for summer steelhead populations generated from IPTDS data are currently in development and may be available in the spawn year 2020 annual report.

Results and Discussion

Fall Chinook Salmon

Abundance

Snake Basin Abundance Annual return abundance of Snake River fall Chinook Salmon back to LGD in 2019 remained below the ten-year average (Figure 1; Young et al. 2020). The abundance of adult and jack natural-origin fall Chinook Salmon generally followed the same declining abundance trend as hatchery-origin fish to LGD since 2014. However, the ten-year geometric mean escapement of natural-origin adults was 10,856, which continued to be significantly higher than NOAA's minimum recovery goal of 4,000 adults (Young et al. 2020).

Index of Abundance – Redd Counts The Nez Perce Tribe completed multiple-pass aerial spawning ground surveys during the 2019 fall Chinook Salmon spawning period (Table 1). Total redds in the Clearwater River was similar to 2018, and lower than in previous years (Figure 2). The Middle Fork Clearwater River, Salmon River, and Selway River redd counts were slightly higher than in 2018; however, all other survey streams declined from the previous year (Figure 3).

The paired UAV surveys for fall Chinook Salmon redds in the lower Clearwater River resulted in an estimated 885 total redds compared to 727 total observed redds during traditional helicopter surveys. We assume UAV counts were more accurate because staff had the ability to review high definition video multiple times to quantify the presence of individual redd pockets more clearly; especially in high-density spawning transects or where redd superimposition occurred. We will continue our comparisons between UAV and traditional helicopter surveys during spawn year 2020.

Life History Characteristics

Female Proportion In spawn year 2019, we only surveyed and collected fall Chinook Salmon carcasses from the lower Clearwater River. The female proportion of natural and hatchery-origin fish combined was 0.59 (95% CI 0.50-0.68) female in 2019 which was higher than in 2018 (Table 2; Figure 4). It is important to recognize, however, that the estimated female proportions obtained from a limited sample of carcasses are highly variable across all years of record and may not accurately represent the full spawning aggregate (Figure 4).

Proportion Hatchery Origin Young et al. (2020) run-reconstruction methods for fall Chinook Salmon enabled precise estimates of pHOS in the population escaping past LGD. In 2019, the run reconstruction pHOS estimate (66%; Figure 5) was the second-lowest since spawn year 2010. Estimated pHOS across years was variable with no observable trend development. Since 2016, pHOS estimated from assigning fish to hatchery-of-origin using PBT was also evaluated to examine the accuracy of the run reconstruction pHOS estimation methods. In 2019, the run reconstruction method was 11.8% higher than the pHOS estimated using PBT methods (Young et al. 2020). Method differences were also found to be variable across years and sex, with the greatest differences occurring among males and the lowest among jacks. In 2019, female (4.9%) and jack (0.3%) differences were relatively small and similar to previous years. However, the difference between PBT and run-reconstruction pHOS estimates for males was 30.3%, thereby leading to the higher divergence observed for all fish. Applying the PBT pHOS estimate by sex to total abundance passing LGD resulted in abundance estimates of 1,649 fewer natural-origin fall Chinook Salmon compared to the run-reconstruction estimate; including, 259 fewer females, 1,373 fewer males, and 18 fewer jacks (Young et al. 2020).

Age Composition Age composition of fall Chinook Salmon carcasses in 2019 was dominated by age-4 fish, followed by age-3, then age-2 (Table 2). Trends in time-series carcass data indicate age composition remains relatively consistent, except for an observable decrease in age-3 and an increase in age-4 returns (Figure 6). Variability and pattern shifts may be attributed to differences in cohort strength; since the results are presented by spawn year.

Size at Return Returning fall Chinook Salmon in 2019 followed a similar size distribution to previous years (Figure 7).

Productivity

Prespawn Mortality We used female carcass data obtained from our 2019 fall Chinook Salmon spawning ground surveys to estimate prespawn mortality rates in the lower Clearwater River subbasin. Prespawn mortality rates have remained low across all years in the Clearwater (Figure 8).

Progeny-per-Parent Productivity of brood year 2014 fall Chinook Salmon, as measured by progeny-per-parent ratios, was below replacement levels in natural-origin and >2.0 for hatchery-origin fish (Figure 9). Since brood year 2005, there have been only two years where natural-origin fall Chinook Salmon have replaced themselves, whereas the hatchery-origin fish have been > 2.0 for all years during the same period (Figure 9).

Smolt-to-Adult Ratio We calculated smolt-to-adult return (SAR) ratios for brood year 2014 fall Chinook Salmon from NPTH and associated acclimation sites, and from the Fall Chinook Salmon Acclimation Project (FCAP) sites (Table 3). All calculations were estimates of coded wire tag jack and adult returns back to LGD from 2015-2019 developed through run-reconstruction efforts (Young et al. 2020). SAR estimates ranged from a low of 0.08% for the second FCAP Captain Johns subyearling release to LGD to 0.45% for both the NPTH Lukes Gulch and FCAP Pittsburg Landing subyearling releases. The SARs in general for brood year 2014 were lower than we observed in the past; most likely due to less favorable ocean conditions in recent years.

Spring/summer Chinook Salmon

Abundance

Snake Basin Abundance The return abundance of adult spring/summer Chinook Salmon to the basin in 2019 was the lowest observed in the past 10 years (Figure 10; Appendix A). Escapement of spring/summer Chinook Salmon at LGD was dominated by hatchery-origin adipose fin-clipped returns, followed by natural-origin, and then unclipped hatchery-origin returns (IPTDSW 2020). Returns of hatchery and natural-origin Chinook Salmon to the basin in 2019 contributed to a consistent declining trend spanning the last 10 years.

Population Abundance ICTRT population abundance estimates generated by IPTDS in spawn year 2019 were comparatively low and underscored a continuing declining trend since 2010 in spring/summer Chinook Salmon abundance across a broad landscape (IPTDSW 2020; Figure 11; Appendix B). A consistent trend across virtually every basin population evaluated showed 2019 escapement was lower than 2018, and it was below the 10-year average.

Tributary Escapement In addition to IPTDS, we used data collected from picket weirs and spawning ground surveys to generate escapement estimates. Similar to population abundance estimates made at IPTDS, weir-based escapement for spring/summer Chinook Salmon were also very low in 2019.

Johnson Creek The 2019 escapement estimate to the Johnson Creek weir was 277 spring/summer Chinook Salmon (Table 4). This estimate included 214 fish estimated upstream of the weir, and 63 fish removed at the weir (Table 5). The 2019 escapement to the Johnson Creek weir was lower than escapement in 2018, which contributed to a five-year downward trend that is similar to those observed at other DFRM weirs (Figure 12). Of the 243 fish captured and handled at the weir: 62 were removed for broodstock, 180 were released upstream for natural spawning, and one was intentionally euthanized due to stray removal protocols.

<u>Lostine River</u> The 2019 weir escapement estimate to the Lostine River weir was 704 spring/summer Chinook Salmon (Table 4). The 2019 Lostine River weir escapement was lower than 2018; however, it was slightly higher than returns in 2017 (Figure 12). Of the 667 fish handled at the weir, 256 were removed for broodstock and food distribution needs, 373 were released above the weir to spawn naturally, and 38 fish were out-planted in the Wallowa River (Table 5).

<u>Lolo Creek</u> In 2019, the Lolo Creek weir operated only for broodstock collection; population estimation parameters were not developed. Only four adults and four jacks were captured and hauled to NPTH for broodstock needs; no other results are presented.

IPTDS Tributaries Estimated escapement at all IPTDS locations is reported in Appendix C. Site-specific estimates provide abundance at the tributary- or spawning aggregate-scale, this also provides a measure of spawner distribution within some basins. The relative location and distribution of IPTDS sites can be found in Orme and Kinzer (2018). In addition, site-specific PIT tag detection probabilities used for abundance estimation are reported in Appendix D.

Index of Abundance – Redd Counts The division completed multiple-pass spawning ground surveys across 11 spring/summer Chinook Salmon populations during the 2019 return year (Table 6). Collectively, the index of spawner abundance throughout all areas was lower than previous spawn years and continued to trend downward since 2010 (Figure 13).

Redd counts in 2019 across some Clearwater River populations were alarming low (Table 6). Within the Clearwater River subbasin, the majority of redds occurred in the upper South Fork Clearwater River (*n* = 21) and Lolo Creek (*n* = 21). While counts in Meadow Creek (*n* = 6) and Lochsa (*n* = 4) populations were at, or near, historic lows.

Life History Characteristics

Female Proportion In spawn year 2019, natural-origin spring/summer Chinook Salmon at IPTDS (Figure 14) had similar sex proportions as those of combined natural- and hatchery-origins at NPT-monitored weirs (Figure 15). Reported proportions include age-3 returning fish in the calculations. Female proportions of combined natural- and hatchery-origins observed during spawning ground surveys were biased toward females (Table 6). For example, females accounted for 36% of all returns to the Lostine River weir compared to 48% of Lostine River carcasses being female. We observed a similar pattern in female proportions for the East Fork South Fork Salmon River population of 43% and 66% for Johnson Creek weir methods compared to carcass methods, respectively. Examining spawning ground survey data only, female proportions for natural-origin fish averaged 53% while hatchery-origin fish averaged 69% across ICTRT populations in 2019 (Figure 16). An observed higher female proportion in hatchery-origin fish is likely attributed to small sample sizes of carcasses in 2019, and no natural-origin fish being collected in some populations.

Proportion Hatchery Origin In 2019, the proportion of the spring/summer Chinook Salmon return comprised of hatchery-origin fish was estimated using weir (i.e., hatchery fraction) and spawning ground survey (i.e., pHOS) data. At the two NPT weirs where sufficient data were available, the fraction of fish that were of hatchery-origin differed considerably between Johnson Creek and the Lostine River (Table 4). Hatchery-origin spring/summer Chinook Salmon accounted for only 30% of returns to the Johnson Creek weir (95 % CI 0.25 - 0.36), while they comprised 77% of returns to the weir in the Lostine River (95 % CI 0.74 - 0.80). Weir data for both sites suggests the hatchery fraction of returns are variable with no obvious positive or negative trend since 2010 (Figure 17). The pHOS, as estimated from carcasses, varied between populations and averaged 55% (Table 6). High variability is observed in pHOS between ICTRT populations and spawn years, as indicated by carcasses, with spawn year 2019 contributing to an upward trend in pHOS since 2014 for Lolo Creek, the South Fork Clearwater River, and the South Fork Salmon River mainstem (Figure 18).

Age Composition Similar to most spawn years, the age composition of adult spring/summer Chinook Salmon throughout the basin in 2019 was dominated by age-4 fish. Age composition for carcasses for combined natural- and hatchery-origins recovered during spawning ground surveys is provided in Table 7, and Figure 19 shows natural-origin only age composition estimated at IPTDS. In total, 140 carcasses were collected during 2019's surveys and were assigned an age from either dorsal fin or scale analysis, or from a known age mark/tag (i.e., juvenile PIT tagged or CWT). Overall, less than 1% of carcasses assigned to age-2, 14% of the return assigned to age-3, 83% assigned to age-4, and 3% assigned to age-5. Age composition by population varied in 2019 but was typically dominated by age-4 returns. For example, in the Secesh River population, 50 of the 64 carcasses (78%) were assigned to age-4, while 39 of the 42 (93%) carcasses collected in the East Fork South Fork population were also age-4.

Natural-origin only spring/summer Chinook Salmon recovered during spawning ground surveys in 2019 were almost all age-4, with only two ICTRT populations recording recoveries of age-3 fish; no age-5 natural-origin carcasses were observed in 2019. Contrary to carcass-based estimates, age composition across ICTRT populations using IPTDS showed age-three and age-five proportions were similar across ICTRT populations and did not differ significantly from age composition in previous years (Figure 20).

Size at Return Size at return for spring/summer Chinook Salmon collected throughout the various ICTRT populations during spawning ground surveys trended towards fish >600 mm (Figure 21). Although the number of carcasses collected in some populations was insufficient to identify a predominant mode (e.g., CRLOL, MFBIG, SCUMA), collections from others adequately identified the 750-800 mm length range as being the most common. Fork length frequency distributions in 2019 of hatchery-origin fish trapped at the Johnson Creek weir differed from that observed at the Lostine River weir (Figure 22), most notably when comparing length frequencies between 400 and 600 mm; these smaller, younger fish were uncharacteristically absent at the Johnson Creek weir but accounted for a considerable component of the Lostine River weir return. When considering natural-origin returns, the converse was true; there was a stronger presence of natural-origin fish in the 400-600 mm size range at the Johnson Creek weir than at the Lostine River weir.

Productivity

Prespawn Mortality We used female carcass data obtained from our 2019 spawning ground surveys to estimate prespawn mortality rates for eight populations monitored by the Tribe (Figure 23). Prespawn females were documented in only three of the ten monitored populations; Big Creek, South Fork Salmon mainstem, and Wallowa-Lostine. In Big Creek, one of the four female carcasses encountered had not spawned (25%), while in the South Fork Salmon River, one of the 11 female carcasses (from which spawn status was verified) had not successfully spawned (9%). The prespawn mortality estimate for the Lostine River portion of the Wallowa/Lostine population was 10%. Point estimates of prespawn mortality rates since 2010 have remained consistently low for most populations and generally below 10% (Figure 23).

Progeny-per-Parent Productivity for brood year 2014 spring/summer Chinook Salmon, as measured by progeny-per-parent ratios, was generally below replacement levels for populations monitored by the Tribe. For Johnson Creek, progeny-per-parent ratios were estimated at 0.33 for natural-origin fish and 3.74 for hatchery-supplemented fish (Table 8). Estimates of progeny-per-parent ratios for Lostine River spring/summer Chinook Salmon for brood year 2014 were 0.15 for natural-origin fish and 5.8 for hatchery-supplemented fish (Table 8). Higher progeny-per-parent rates for hatchery-origin fish likely provided a buffering to decreased return abundance for supplemented populations (Janowitz-Koch et al. 2018), and may contribute to a population's viability by reducing the impact caused by persistent out-of-basin limiting factors (i.e., poor ocean conditions).

Smolt-to-Adult Return We calculated SAR rates for brood year 2014 spring/summer Chinook Salmon from Johnson Creek, the Secesh River, and the Lostine River (Table 9). Since our calculations were abundance-based rather than PIT tag-based, they are intended to provide an index of productivity rather than a direct measure. SARs ranged from a low of 0.16 for Johnson Creek natural-origin returns to a high of 0.90 for Lostine River natural-origin returns. Hatchery-origin returns had SARs of 0.29 and 0.30 for Johnson Creek and Lostine River, respectively. The Northwest Power and Conservation Council (NPCC 2009) adopted a goal of achieving overall SARs (including jacks) in the 2%-6% range (minimum 2%; average 4%) for federal ESA-listed Snake River Chinook salmon and steelhead. The tributary to tributary, abundance-based SAR estimates for Tribe monitored populations for brood year 2014 were well below the minimum NPCC goal, and while the poor productivity may be blamed on a myriad of factors, the majority occur out-of-basin (e.g., Sontag 2013; Tiffan et al. 2009).

Summer Steelhead

Abundance

Snake Basin Abundance The annual abundance of the Snake River DPS, except for the Tucannon River population, is determined from returning adults at LGD. The steelhead return for any given spawn year at Lower Granite Dam is bracketed by a July 1 arrival date from the previous year through June 30 of the current year.

In spawn year 2019, the LGD window count of all natural- and hatchery-origin steelhead was 63,850 fish (http://www.fpc.org). Based IPTDSW (2020) modeling results, the estimated spawn year 2019 escapement was 10,389 natural-origin steelhead (95% CI 8,366 -18,348) representing 16% of the total return (Appendix A; IPTDSW 2020). Within the past decade, the spawn year 2019 return of natural-origin steelhead was the second-lowest on record (Figure 24; Appendix A). Since 2016, the decline in abundance has been alarmingly steep. Total natural-origin steelhead abundance at LGD averaged nearly 38,000 adults from spawn year 2010 through 2016, but averaged only 12,000 individuals from spawn year 2017 through 2019 (IPTDSW 2020).

Population Abundance Similar to the entire DPS, adult escapement of natural-origin summer steelhead at the population level was extremely low across the basin as compared to escapement for the previous 10 years (Figure 25; IPTDSW 2020). In terms of this downward trend, the only outliers were the Wallowa and Lochsa rivers which saw a slight increase in spawn year 2019. Nonetheless, the majority of populations within the basin exhibited declines regardless of their run management category (i.e., B-Run or A-Run; Copeland et al. 2017). The largest population abundances for spawn year 2019 were adult Wallowa River steelhead (n = 634) and the Imnaha River (n = 704).

Tributary Escapement We used data collected from picket weirs and IPTDS to generate tributary escapement estimates. Similar to population abundance estimates made with IPTDS, summer steelhead tributary escapement was also low in 2019.

Camp Creek Estimated escapement of summer steelhead into Camp Creek was 18 fish (95% CI = 2 – 47) as determined by IPTDS (Appendix C). The IPTDS was fully operational through March, but was damaged during a high water event in April when two of the four antennas were lost. The first upstream fish detection occurred on March 23 and the last on April 18. No hatchery-origin adult steelhead were detected at this array in 2019.

Freezeout Creek The Freezeout Creek weir was operated from March 24 through June 16. High water compromised the floating weir during much of the season. Due to poor trapping conditions and low adult returns, we only captured four adult summer steelhead in 2019. Three fish were marked and released upstream to spawn naturally and one fish was a trap mortality (Table 10); therefore, our minimum escapement estimate is five fish above the site (95% CI = 4 - 7.8; Table 11). No hatchery-origin adult steelhead were interrogated at the Freezeout Creek weir in 2019.

Crazyman Creek The Crazyman Creek IPTDS was operational and started collecting data on April 2, and stopped collecting data on July 26. The first upstream adult summer steelhead detection occurred on April 13 and the last on May 29. Estimated escapement was 27 fish above the site (95% CI = 5.3 – 56.6; Appendix C). No hatchery-origin adult steelhead detections occurred at this array in 2019.

Lostine River The Lostine River weir operated from February 15 through June 30. Operations were not entirely continuous with some downtime due to high flows or mechanical issues; however, the weir was operational over 85% of the time in 2019. In all, 21 natural-origin adult summer steelhead were interrogated at the weir (Table 10). Summer steelhead escapement was estimated as 43 (95% CI = 26 – 116) for 2019. No hatchery-origin adult summer steelhead were interrogated at this weir in 2019.

Skookumchuck Creek This was the first year a portable IPTDS system was operated in Skookumchuck Creek. The IPTDS was installed on March 20 with an upstream and downstream antenna configuration. Data loss occurred on March 25 due to a power interruption, and again from April 9 to May 7 due to high discharge flushing out the first set of installed antennas. A single antenna was reinstalled on May 7 and operated continuously until June 1. Battery power issues from June 1 to June 23 caused multiple periods of downtime; the system was completely removed on June 23. No abundance estimate was developed due to loss of data during the multiple interruptions in operational dates and power failures; however, six adult summer steelhead were detected from March 24 to May 31, with the first upstream fish detected on March 24 and the last detected on May 31. No hatchery-origin adult steelhead were detected at this array during operational periods.

IPTDS Tributaries In addition to the tributaries specifically listed above, we report escapement for many other Snake River basin IPTDS site locations (Appendix C). Site-specific estimates provide abundance estimates at the tributary- or spawning aggregate-scale, which also provides a measure of spawning distribution within some basins. Additionally, site-specific PIT tag detection probabilities are estimated and reported in Appendix D. See Orme and Kinzer (2018) for a description of the relative location and distribution of IPTDS sites.

Life History Characteristics

Female Proportion Across the basin sex ratios of returning adult summer steelhead in 2019 ranged from 75% female in the Lochsa River population to 58% in the lower Grande Ronde steelhead population (Figure 26; IPTDSW 2020). Female proportions observed at IPTDS locations since 2010 have remained consistently skewed towards females across all monitored ICTRT populations.

Age Composition PIT-tag detections at IPTDS locations indicate the annual returns of summer steelhead consist of six age groups (i.e., cohorts) ranging from age-3 to age-8. In 2019, age-4 and age-5 fish generally represented the dominant age classes (Figure 27; IPTDSW 2020). However, both the Clearwater and Salmon MPGs had individual populations (e.g.; Lochsa, Selway, Big Creek, Secesh River and South Fork Salmon River) with predominantly age-6 fish. These populations, with older spawning cohorts, generally corresponded to the presumed B-Run steelhead populations in the Clearwater and Salmon rivers (Figure 27; Copeland et al. 2017). The majority of steelhead in the Selway and Lochsa river populations in 2019 were specifically age-6 and older—strongly indicative of longer ocean rearing and a B-run life history. The presumed A-Run steelhead returning to the Imnaha and Grande Ronde subbasins in 2019 were primarily age-4 and -5 fish; however, approximately 15% of the returning spawners were still age-6 and older (IPTDSW 2020).

In 2019, 20% of sampled scales from a high elevation Imnaha River tributary were from resident *O. mykiss*. Furthermore, scale analysis in this population revealed a variety of stream- and ocean-age combinations, as well as a small but important repeat spawning life history. Despite relatively low population abundance, great diversity in age-at-return likely remains in the Snake River steelhead DPS.

Spatial Distribution in the Imnaha Population In addition to abundance, productivity, and life history diversity, spatial distribution is also a useful metric status and trend monitoring. We specifically use steelhead redd locations in the Imnaha population to inform our understanding of where these fish reproduce and their distribution within the subbasin.

In 2019, we conducted multiple-pass spawning ground surveys in Camp Creek and single-pass surveys in 11 tributaries and the upper Imnaha mainstem. During our surveys, we observed the first redd on April 18 and the last new redd on May 23. No redds were found in Dry, Blackhorse, and Lick creeks, or in the upper Imnaha River mainstem.

Redd totals, redds per kilometer, survey lengths, and dates are summarized in

Table 12. In 2019, these Imnaha River steelhead reproduced as far as 922 km from the Pacific Ocean and as high as 1,354 m (4,442 ft). The upper elevation for most spawning in specific tributaries seems to be limited to the 1,200 to 1,300 m elevations. Similar spawner distribution patterns were observed in 2019 as compared to previous survey years (Figure 28).

Migration A migration year summary for summer steelhead is found in Table 13. Arrival at Bonneville Dam for all steelhead, regardless of origin or stock, peaked on August 9, 2018. A second but smaller peak of arriving steelhead at Bonneville Dam occurred on September 17 (Columbia River DART, 2020). The median arrival date of unclipped steelhead at Lower Granite Dam was October 5, 2018 and ranged from July 1, 2018 to May 27, 2019.

There was broad overlap in arrival dates between A-run and B-run summer steelhead. Median dates of A-run fish arrival were earlier than B-run fish regardless of their MPG or population. The median dates for A-run populations were from late July through early August. Median arrival dates for B-run populations occurred from late August to mid-September. That bimodal pattern was less distinct upon arrival at LGD. A-run summer steelhead generally arrived in late September while B-run steelhead generally arrived in early October. The following spring there was no clear distinction in arrival dates in terms of when the two groups of Snake River steelhead entered their spawning tributaries.

Nonetheless, all the migration dates above describe a 10-month freshwater migration pattern as Snake River summer steelhead moved through the Columbia River basin toward their spawning tributaries.

Productivity

Smolt-to-Adult Return We determined SARs for the Imnaha population using LGD-to-LGD estimates for comparability across other Snake River stocks, and SARs using Imnaha River-to-Imnaha River estimates for an actual rate back to the river of origin. SARs were quantified for both *survival*- and *monitor-mode* PIT tag groups according to juvenile steelhead segregation through the hydrosystem. *Survival-mode* steelhead are bypassed back to the river at a hydropower facility to assess juvenile steelhead survival for fish remaining in-river through emigration. *Monitor-mode* fish represent the run-at-large fish that may be barged or bypassed depending on daily management actions at each hydropower facility.

In 2019, adult returns allowed for the analyses of SARs for Imnaha River summer steelhead for juvenile migration year 2016 back through migration year 2009; an eight-year trend assessment. Generally, the LGD-to-LGD Imnaha River SAR estimates paralleled the adult escapement trend. The highest *survival-mode* tag group SAR was from migration year 2010 (2.37%) and the lowest was from 2015 (0.10%). The eight-year *survival-mode* mean SAR was 1.47%. *Monitor-mode* tag group SAR estimates for steelhead ranged from 4.16% (migration year 2009) to 1.01% (migration year 2015). The mean SAR for the *monitor-mode* tag group was 2.20% (Table 14). Likewise, the river-to-river SARs were also variable but tracked the LGD-to-LGD rates with the geometric mean SAR for the *monitor-mode* tag group being higher than the geometric mean for the *survival-mode* tag group (Table 15). *Monitor-mode* tag group SAR estimates for steelhead ranged from 2.88% in migration year 2009 to 0.06 % in 2015.

Conclusions and Recommendations

Over the last ten years, the abundance of anadromous fish returning to the Snake River Basin has decreased considerably. Although, natural- and hatchery-origin fall Chinook Salmon returns, as measured at LGD during spawn year 2019, were lower than the latest 10-year average, they are significantly higher than returns from the 1990's with natural-origin fish abundance above the NOAA recovery target. Similar downward trends in abundance were observed in spring/summer Chinook Salmon and summer steelhead returning to LGD for the same 10-year period. Estimated abundances throughout all monitored Snake River Basin ICTRT spring/summer Chinook Salmon and summer steelhead populations and tributaries only support the negative trends observed for the Snake River aggregate at LGD. Our overwhelming evidence of poor survival and adult returns support theories of limiting factors existing outside of the basin (e.g., juvenile migration survival, delayed mortality and ocean survival; Petrosky et al. 2020; McCann et al. 2018).

Chinook Salmon and steelhead life history characteristics in 2019 varied by species, population, and collection method. The fall Chinook Salmon female proportion estimate, which was solely determined through carcass collections on the lower Clearwater River, favored females. Although this provided an adequate index of female proportion, a more accurate method to define gender proportions is through Young et al. (2020) run-reconstruction efforts. Fall Chinook Salmon carcass based methods would benefit from an increased sample size and survey scope, which we recommend occur in the future. We also recommend that spring/summer Chinook Salmon and summer steelhead adult trapping data, IPTDS detection data, and spawning ground survey data be comparatively analyzed to determine the best approach to describe female and age proportions; as our point estimates often differ. For example, carcass collection bias was illustrated by Zhou (2002) and Murdoch et al. (2010) who found females and older fish were more easily detected during carcass surveys, especially considering their redd fidelity, carcass size (i.e., small jacks vs. larger males), and/or the elusiveness or low detectability of males attributed to their roaming behavior. Our estimated female proportions derived from spawning ground surveys were all higher than the other two methods, supporting earlier findings. The annual variability around female proportion estimates for steelhead populations remained remarkably synchronous over the past 9 years (Figure 26). Research supporting this finding (Schrader et al. 2011; Copeland and Roberts 2011; Campbell et al. 2012) establishes that returning adult steelhead cohorts tend to skew toward females. An even male:female ratio is normally optimal in vertebrate populations with open, polygamous mating systems (Karlin and Lessard 1986). Relatively equal sex ratios in some spawning populations are thought to be maintained in part by the yearly contributions of resident *O. mykiss* males (Campbell et al. 2012).

The pHOS estimate for fall Chinook Salmon in spawn year 2019 was notable since it represented the second-lowest pHOS recorded since spawn year 2010. However, the other lowest pHOS estimate was in 2018; these years were unique in that sampling and broodstock collections at LGD were heavily weighted towards the first 20% of the run. This was intentionally completed in the last two relatively low return years to meet broodstock objectives, maintain a minimum proportion of natural-origin brood (pNOB) equal to 30% and limit impacts to returning steelhead (Young et al. 2020). Confidence in this estimate would improve through the use of PBT, which was demonstrated to provide a more conservative yet robust measure of origin type (Young et al., 2020). The effects of skewed sampling on the observations and the difference between estimation methods of fall Chinook Salmon pHOS will continue to be explored.

Another notable observation in 2019 was recorded in the East Fork South Fork Salmon River spring/summer Chinook Salmon population. At the Johnson Creek weir, hatchery-origin fish accounted for only 30% of all returns to the weir, marking the second consecutive year of below-average hatchery-origin returns to this supplemented population. Similarly, carcasses collected in 2019 spawning ground surveys suggested a below-average proportion of hatchery-origin spawners (0.38). The low number of hatchery returns to Johnson Creek is of concern because of the expectation that the program produce returns that are equivalent to those of naturally-produced conspecifics, and at high enough proportion to supplement the natural population (e.g., Vogel et al. 2005). We recommend emphasis be placed on investigations that focus on identifying limiting factors unique to the Johnson Creek supplementation program.

An age composition difference existed between Chinook Salmon and steelhead returning to the basin; as expected between the two species. As observed in 2019, and in general, Chinook Salmon returned predominantly age-4 adults across both origin types and populations. Conversely, age-at-return for summer steelhead was more diverse across basin populations. The synchrony in Chinook Salmon age-class returns, across spawn years and populations, is not favorable, especially in stochastic environments such as those common throughout the basin. According to Schaffer and Elson (1975), when environmental conditions are harsh and unpredictable, natural selection favors populations capable of spawning at different ages. Saunders and Schom (1985) suggested that age structure variability is a safeguard against reproductive failure for a given brood year. Individuals from one brood year return over multiple years, thereby ensuring some contribution from that cohort over time. Chinook salmon populations returning at similar ages, regardless of subpopulation, hatchery influence, or relative abundance, suggests that out-of-basin effects are acting similarly upon all populations and have effectively reduced age class diversity. To understand these effects more thoroughly, we recommend future examinations on the synchronicity and potential loss of age class diversity between and within populations of Chinook Salmon and summer steelhead returning to the basin.

Snake River Basin adult summer steelhead arrival to the Columbia River mouth and their subsequent upstream spawning migration is unique when compared to other monitored species and runs. Summer steelhead destined for the basin normally enter the freshwater of the Columbia River during the summer and early fall in a sexually immature state and do not complete maturation until the following spring when they reach their high-elevation spawning grounds (Quinn 2005). Early migration, compared to most other anadromous Pacific salmonids, allows steelhead to move long distances before spawning (Keefer et al. 2008). Therefore, their migration is protracted and relatively complex. Knowledge of run-timing is an important component of fisheries management and contributes toward population monitoring. For example, summer steelhead populations are managed as two stocks, A-Run and B-Run. Historically, the two stocks were defined by arrival timing at Bonneville Dam. Fish arriving on or before August 25 were classified as A-Run steelhead and those arriving after August 25 were classified as B-Run steelhead (Copeland et al. 2017). However, a clear distinction based upon arrival date has been lost with A-Run steelhead now arriving later at Bonneville dam than indicated by historical records. Future migration studies between natural- and hatchery-origin stocks are warranted to better understand adult conversion rates, stray rates, and to improve harvest management.

The current basin-wide strategy for the management of anadromous stocks relies heavily upon continued monitoring of abundance-, life history- and productivity-based performance metrics. Our data collection efforts in 2019 provided us the necessary information to make in-year status assessments and will serve to inform future comparisons of natural- and hatchery-origin populations, and progress toward management targets and recovery goals. Recover goals include the 2014 Fish and Wildlife Program (NPCC2014) SAR goal for Snake River fish stocks of 2 to 6 percent, with an average of 4%, and an average progeny-per-parent ratio greater than 1.0 to indicate positive population growth. Our productivity estimates for the last complete brood year for all monitored populations of natural-origin fall Chinook Salmon, spring/summer Chinook Salmon, and summer steelhead indicate Snake River anadromous stocks had SAR's of less than 0.5% and progeny-per-parent ratios of less than 1.0. Combining these poor productivity metrics with a continuous declining trend in basin-wide abundance indicates a negative population growth trajectory with fewer fish returning to the basin in the future. Ongoing monitoring with continued funding from Bonneville Power Administration and Lower Snake River Compensation Plan will help Snake Basin fisheries managers understand how to reverse the current low returns, and how we can reach our desired recovery goals in the future.

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Tables

Table 1. Fall Chinook Salmon redds counted during 2019 aerial (helicopter) spawning ground surveys.

Stream	**Transect**	**Pass 1**	**Pass 2**	**Pass 3**	**Pass 4**	**Total**
Clearwater River	Lower Clearwater	104	225	335	63	727
	Upper Clearwater	11	21	0	0	32
Grande Ronde River	Lower Grande Ronde	5	34	6	12	57
Imnaha River	Lower Imnaha River	0	1	1	5	7
Middle Fork Clearwater River	M.F. Clearwater	0	26	2	0	28
Potlatch River	Lower Potlatch	0	6	8	0	14
Salmon River	Salmon River	5	12	0	0	17
Selway River	Lower Selway	4	10	9	0	23
South Fork Clearwater River	SF1	0	34	11	0	45

Table 2. Fall Chinook Salmon life history metrics (female proportion and age composition) calculated from carcasses collected during 2019 spawning ground surveys (95% confidence intervals are shown in parentheses).

Stream	**Transect**	**Female**	**Age-2**	**Age-3**	**Age-4**
Clearwater River	Lower Clearwater	0.59 (0.50, 0.68)	0.04 (0.01, 0.19)	0.35 (0.19, 0.54)	0.62 (0.43, 0.78)

Table 3. Fall Chinook Salmon smolt-to-adult ratios (SAR) for brood year 2014 hatchery-origin releases. Yearling SARs do not include mini-jack returns.

Release Site/Age	**CWTs Released**	**Ocean Age-at-Return**					**SAR %**
		Jack	**II**	**III**	**IV**	**Total**	
NPTH/ Subyearlings	612,447	265	330	395	26	1,012	0.17
NPTH Cedar Flats/ Subyearlings	204,614	280	199	119	5	603	0.29
NPTH Lukes Gulch/ Subyearlings	204,088	295	406	205	20	926	0.45
Big Canyon/ Subyearlings	190,371	190	180	130	12	512	0.27
Captain Johns/ Subyearlings	192,105	165	265	128	0	558	0.29
Captain Johns/2nd Subyearlings	208,878	55	51	68	0	174	0.08
Pittsburg Landing/ Subyearlings	193,404	260	426	165	28	879	0.45
Big Canyon/ Yearlings	153,927	130	237	43	0	410	0.27
Captain Johns/ Yearlings	152,801	306	273	22	0	601	0.39
Pittsburg Landing/ Yearlings	155,008	150	214	11	0	375	0.24

Table 4. Natural-origin and hatchery-origin spring/summer Chinook Salmon escapement to Department of Fisheries Resources Management weirs in spawn year 2019 with estimated hatchery fraction and female proportions observed at the weir (95% CIs are reported in the parentheses).

Weir	**Escapement**	**Weir Removal**	**Hatchery Fraction**	**Female Proportion**
Johnson Creek	277 (250, 303)	63	0.30 (0.25, 0.36)	0.43 (0.37, 0.49)
Lostine River	704	108	0.77 (0.74, 0.80)	0.36 (0.33, 0.40)

Table 5. Final disposition of spring/summer Chinook Salmon trapped and handled at Department of Fisheries Resources Management weirs during spawn year 2019.

		Natural-Origin		**Hatchery-Origin**	
Stream	**Disposition**	**Female**	**Male**	**Female**	**Male**
Johnson Creek	Brood Stock	33	29	-	-
	Distribution	-	-	-	-
	Natural Spawning	29	79	43	29
	Other	-	-	-	-
	Stray Removal	-	-	-	1
Lostine River	Brood Stock	17	17	66	69
	Distribution	-	-	-	107
	Natural Spawning	48	89	122	127
	Other	-	-	-	1
	Outplant	-	-	-	23

Table 6. Total redds counted and estimated life history metrics from combined natural- and hatchery-origin spring/summer Chinook Salmon carcasses collected during 2019 spawning ground surveys (MPG = major population group; pHOS = proportion of natural-origin spawners; 95% CIs are reported in parentheses).

MPG	Population	Total Redds	pHOS	Female Proportion	Prespawn Mortality
Dry Clearwater	Upper South Fork Clearwater	21	1.00 (0.51, 1.00)	0.75 (0.30, 0.95)	0.00 (0.00, 0.56)
Grande Ronde / Imnaha	Wallowa/Lostine	160	0.62 (0.53, 0.71)	0.48 (0.38, 0.57)	0.10 (0.04, 0.23)
Middle Fork Salmon River	Big Creek	12	0.00 (0.00, 0.39)	0.50 (0.19, 0.81)	0.00 (0.00, 0.56)
South Fork Salmon River	East Fork South Fork Salmon River	97	0.38 (0.25, 0.53)	0.66 (0.51, 0.78)	0.00 (0.00, 0.12)
	Little Salmon River	0	-	-	-
	Secesh River	70	0.00 (0.00, 0.06)	0.42 (0.31, 0.54)	0.00 (0.00, 0.13)
	South Fork Salmon River mainstem	63	0.83 (0.63, 0.93)	0.61 (0.41, 0.78)	0.09 (0.02, 0.38)
Wet Clearwater	Lochsa River	4	-	-	-
	Lolo Creek	21	1.00 (0.61, 1.00)	0.83 (0.44, 0.97)	0.00 (0.00, 0.43)
	Meadow Creek	6	-	-	-

Table 7. Age composition of natural-and hatchery-origin spring/summer Chinook Salmon carcasses collected during 2019 spawning ground surveys (MPG = major population group; 95% CIs are reported in parentheses).

MPG	**Population**	**Age-3**	**Age-4**	**Age-5**
Dry Clearwater	Upper South Fork Clearwater	0.50 (0.09, 0.91)	0.00 (0.00, 0.66)	0.50 (0.09, 0.91)
Grande Ronde / Imnaha	Wallowa/Lostine	0.00 (0.00, 0.23)	0.92 (0.67, 0.99)	0.08 (0.01, 0.33)
Middle Fork Salmon River	Big Creek	0.00 (0.00, 0.39)	1.00 (0.61, 1.00)	0.00 (0.00, 0.39)
South Fork Salmon River	East Fork South Fork Salmon River	0.07 (0.02, 0.19)	0.93 (0.81, 0.98)	0.00 (0.00, 0.08)
	Secesh River	0.20 (0.12, 0.32)	0.78 (0.67, 0.86)	0.00 (0.00, 0.06)
	South Fork Salmon River mainstem	0.18 (0.05, 0.48)	0.64 (0.35, 0.85)	0.18 (0.05, 0.48)
Wet Clearwater	Lolo Creek	0.00 (0.00, 0.66)	1.00 (0.34, 1.00)	0.00 (0.00, 0.66)

Table 8. Progeny-per-parent (P:P) ratios for brood year 2014 spring/summer Chinook Salmon spawning naturally in the river or artificially in the hatchery environment.

Stream	**Spawning Type**	**Spawners**	**Progeny**				**P:P**
			Age-3	**Age-4**	**Age-5**	**Total**	
Johnson Creek	Natural	1,530	87	374	43	504	0.33
	Hatchery	94	165	184	3	352	3.74
Lostine River	Natural	1,847	30	228	20	278	0.15
	Hatchery	159	150	751	21	922	5.80

Table 9. Smolt-to-adult return ratios (SAR) for brood year 2014 natural- and hatchery-origin spring/summer Chinook Salmon.

Stream	**Origin**	**Juvenile Abundance**	**Adult Escapement**	**SAR %**
Johnson Creek	Natural	309,829	504	0.16
	Hatchery	115,662	352	0.30
Lostine River	Natural	30,978	278	0.90
	Hatchery	259,506	922	0.29

Table 10. Summer steelhead trapped during spawn year 2019 at DFRM operated weirs.

Weir	**Ponded**	**Unique Fish Released**	**Disposed**	**Transferred**
Freezeout Creek	0	3	1	0
Lostine River	0	19	0	0

Table 11. Summer steelhead escapement above DFRM weirs in spawn year 2019 and the estimated hatchery and female proportions of fish returning to the weir (95% CIs are reported in parentheses).

Weir	Escapement	Weir Removal	Hatchery Fraction	Female Proportion
Freezeout Creek	5 (5, 5)	1	0.00 (0.00, 0.49)	0.75 (0.30, 0.95)

Table 12. Nez Perce Tribe summer steelhead redd count survey results from Imnaha River tributaries in 2019.

Stream	km Surveyed	Redds	Redds/km
Freezeout Creek	5.1	2	0.4
Grouse Creek	10.8	8	0.7
Morgan Creek (Grouse Creek Tributary)	0.8	2	2.5
Crazyman Creek	5.9	8	1.4
Mahogany Creek	0.9	1	1.1
Gumboot Creek	6.0	4	0.7
North Fork Gumboot Creek	1.0	1	1.1
Dry Creek	1.9	0	0.0
Camp Creek	7.6	13	1.7
Bear Gulch	0.8	2	2.5
Blackhorse Creek	0.5	0	0.0
Lick Creek	5.3	0	0.0
Upper Imnaha River Mainstem	4.0	0	0.0

Notes: Camp Creek was surveyed multiple times a week from March 19 to May 29. All other stream surveys were “single pass.”

Table 13. Median arrival dates at Bonneville Dam, Lower Granite Dam, and tributary instream PIT tag detection system arrays during the 2018/2019 summer steelhead adult migration according to PIT tag detections.

Presumptive Stock	**Steelhead Population**	**Bonneville Dam**	**Lower Granite Dam**	**Lowest Tributary Array**
B-Run	South Fork Salmon River	9/4/18	9/29/18	4/6/19
	Selway & Lochsa Rivers	9/13/18	10/12/18	3/24/19
	South Fork Clearwater River	8/24/18	10/7/18	3/14/18
A-Run	Upper Grande Ronde	7/26/18	9/29/18	3/18/19
	Wallowa River	7/27/18	9/29/18	4/6/19
	Joseph Creek	7/29/18	9/23/18	3/18/19
	Imnaha River	8/6/18	10/2/18	3/26/19
	Lower Clearwater River	8/28/18	10/15/18	3/26/19

Table 14. Smolt-to-adult return (SAR) index rates from Lower Granite Dam-to-Lower Granite Dam (dam-to-dam) for PIT tagged natural-origin Imnaha River summer steelhead from juvenile migration years 2009 to 2016. Smolt migration year 2016 SAR is incomplete until ocean age III and repeat spawners return in spawn year 2020.

Sort by Code Event	**Smolt Migration Year**	**Smolt detections at LGD**	**Adult detections at LGD**	**Ocean Age-at-Return**				**SAR (%)**
				I	**II**	**III**	**Repeat Spawner**	
In-River	2009	1,903	45	25	20	0	0	2.36
	2010	1,645	39	22	16	1	0	2.37
	2011	866	6	5	1	0	0	0.69
	2012	1,604	35	24	11	0	0	2.18
	2013	1,924	48	19	28	1	0	2.49
	2014	2,314	25	17	8	0	0	1.08
	2015	1,050	1	1	0	0	0	0.10
	2016	1,476	7	5	2	0	0	0.47
Monitor -Mode	2009	1,970	82	42	39	1	0	4.16
	2010	1,645	49	25	24	0	0	2.98
	2011	1,185	12	5	7	0	0	1.01
	2012	2,067	63	28	35	0	0	3.05
	2013	1,966	55	24	31	0	0	2.80
	2014	2,341	49	28	21	0	0	2.09
	2015	1,065	2	2	0	0	0	0.19
	2016	1,435	19	15	4	0	0	1.32

Table 15. Smolt-to-adult return (SAR) index rates from Imnaha River-to-Imnaha River (tributary-to-tributary) for PIT tagged natural-origin Imnaha River summer steelhead from juvenile migration years 2009 to 2016. Smolt migration year 2016 SAR is incomplete until ocean age III and repeat spawners return in spawn year 2020.

Sort by Code Event	**Smolt Migration Year**	**Smolt detections**	**Adult detections**	**Ocean Age at Return**				**SAR (%)**
				I	**II**	**III**	**Repeat Spawner**	
In-River	2009	2,591	42	24	18	0	0	1.62
	2010	3,068	31	18	12	0	1 (2012,2014)	1.08
	2011	1,268	6	6	0	0	0	0.47
	2012	2,467	29	19	10	0	0	1.18
	2013	3,516	40	18	21	1	0	1.14
	2014	3,340	26	16	8	0	0	0.72
	2015	3,088	1	1	0	0	0	0.03
	2016	2,354	11	9	2	-	-	0.47
Monitor-Mode	2009	2,567	74	39	34	1	0	2.88
	2010	3,080	47	23	24	0	0	1.53
	2011	1,361	12	7	5	0	0	0.88
	2012	2,991	56	27	28	0	1 (2014,2015)	1.91
	2013	3,483	46	21	25	0	0	1.32
	2014	3,357	46	28	18	0	0	1.37
	2015	3,090	2	2	0	0	0	0.06
	2016	2,412	21	17	4	-	-	0.87

Figures

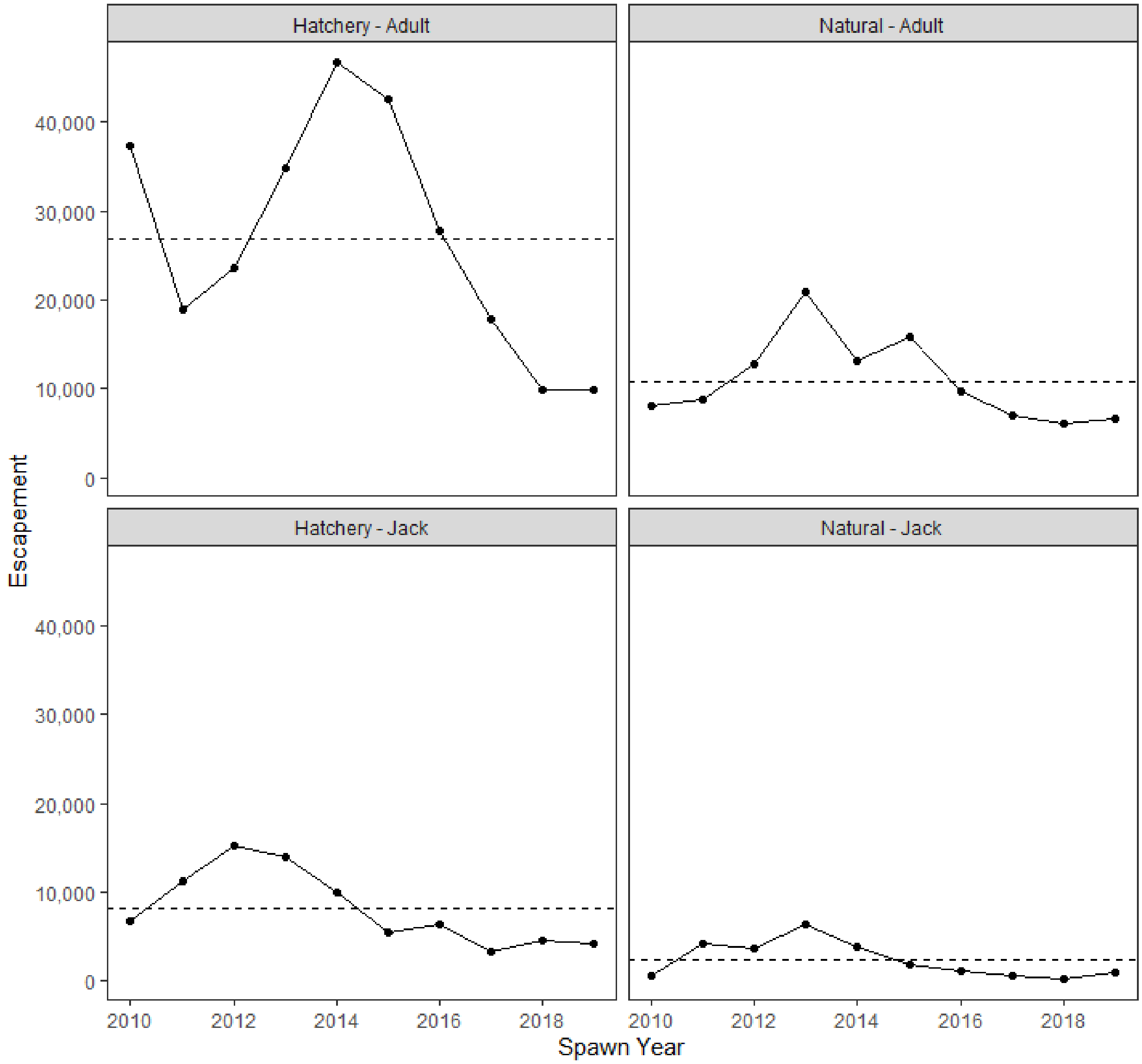

Figure 1. Natural- and hatchery-origin Snake River fall Chinook Salmon (adults and jacks <57cm) returns to Lower Granite Dam, by spawn year, experienced a declining trend over the last 6 years and were below the 10-year average (dashed line) in 2019 (Young et al. 2020).

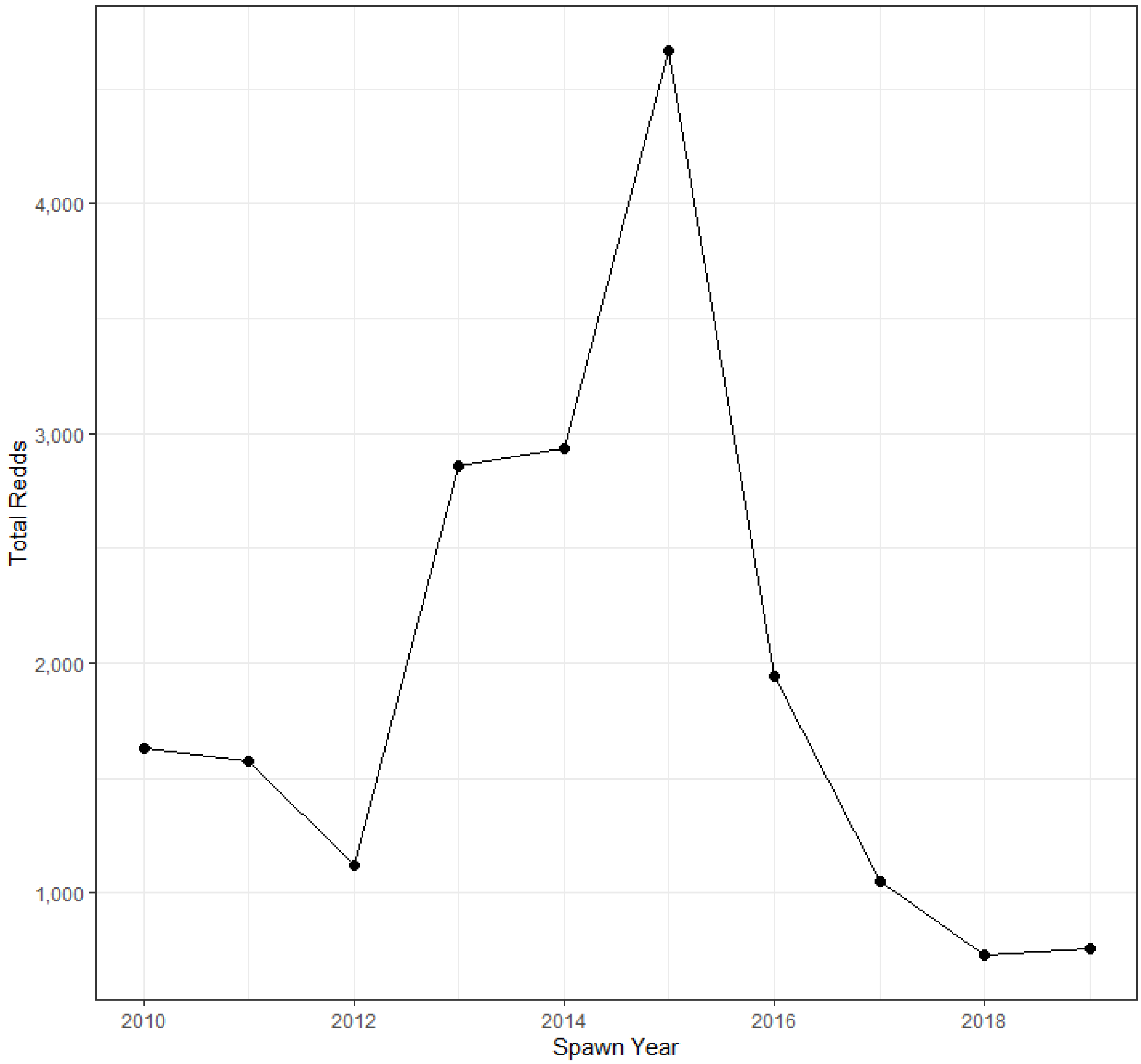

Figure 2. Total fall Chinook Salmon redds counted during aerial (helicopter) Clearwater River spawning ground surveys by spawn year; counts in 2019 were the second lowest observed over the last 10 years.

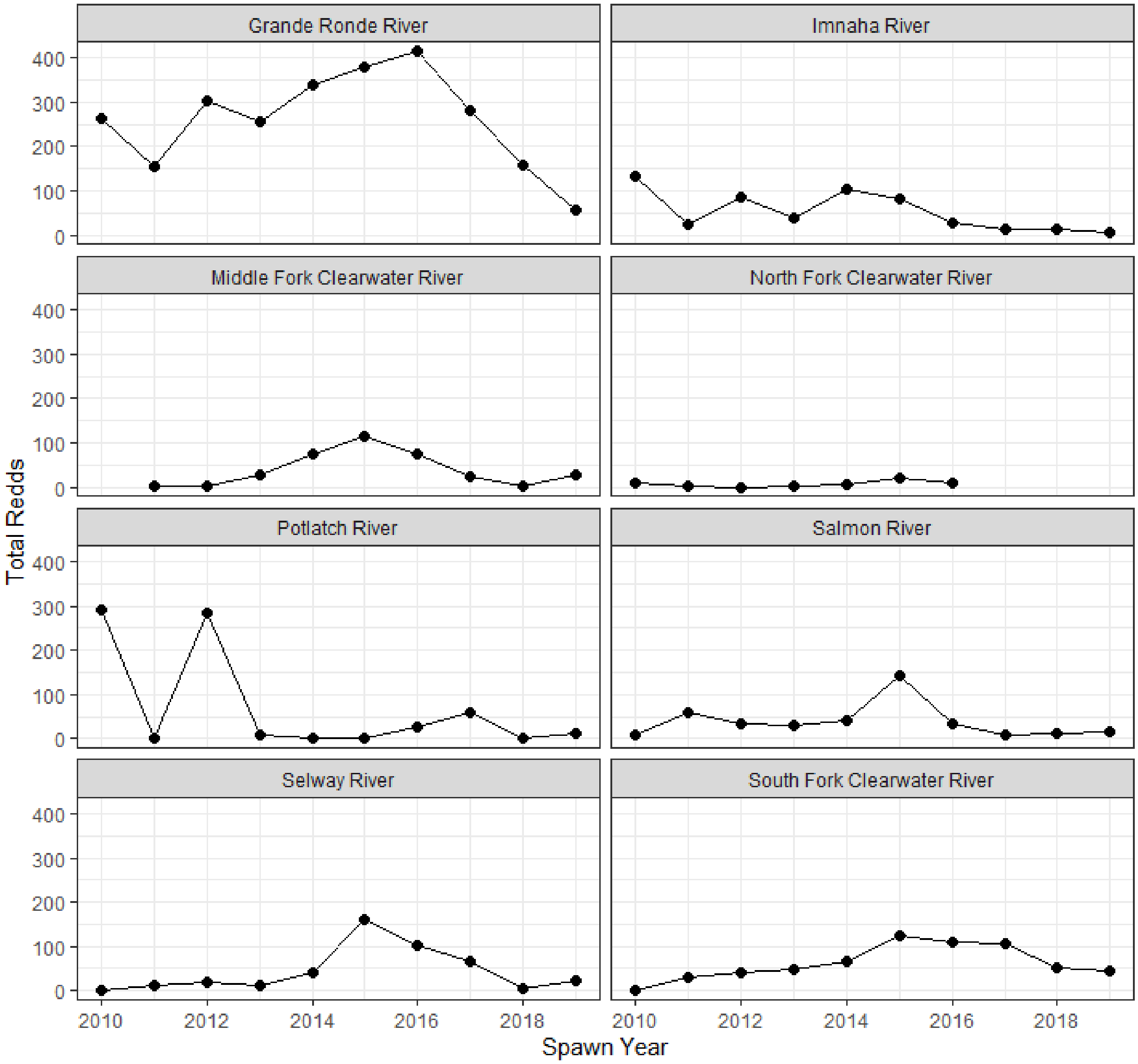

Figure 3. Total fall Chinook Salmon redds counted, by spawn year, throughout Snake River basin tributaries during aerial (helicopter) spawning ground surveys.

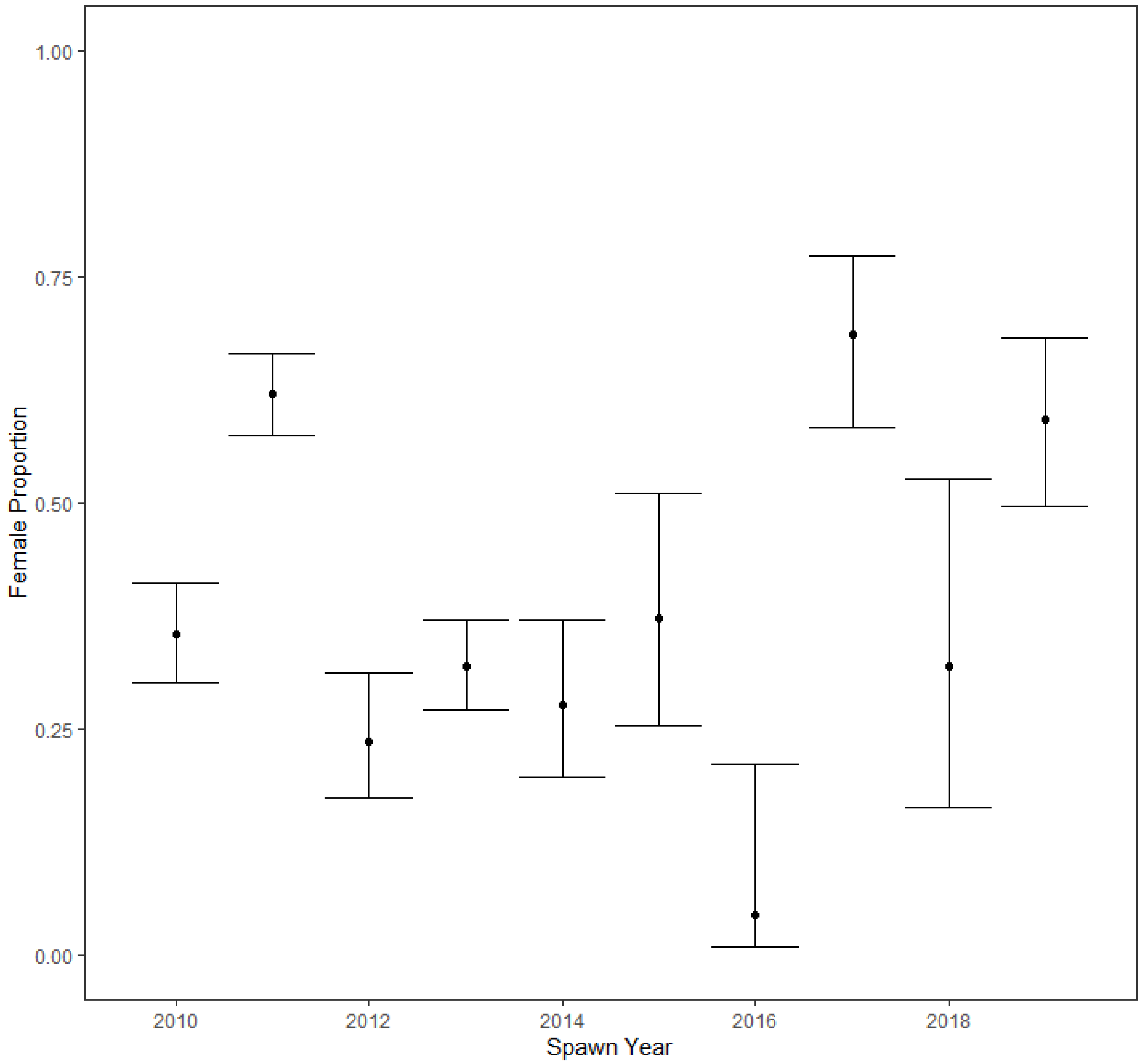

Figure 4. Fall Chinook Salmon female proportions estimated from carcasses collected in the Clearwater River during the last 10 years of spawning ground surveys show large variability in estimates between years and relatively low precision (error bars show 95% CIs).

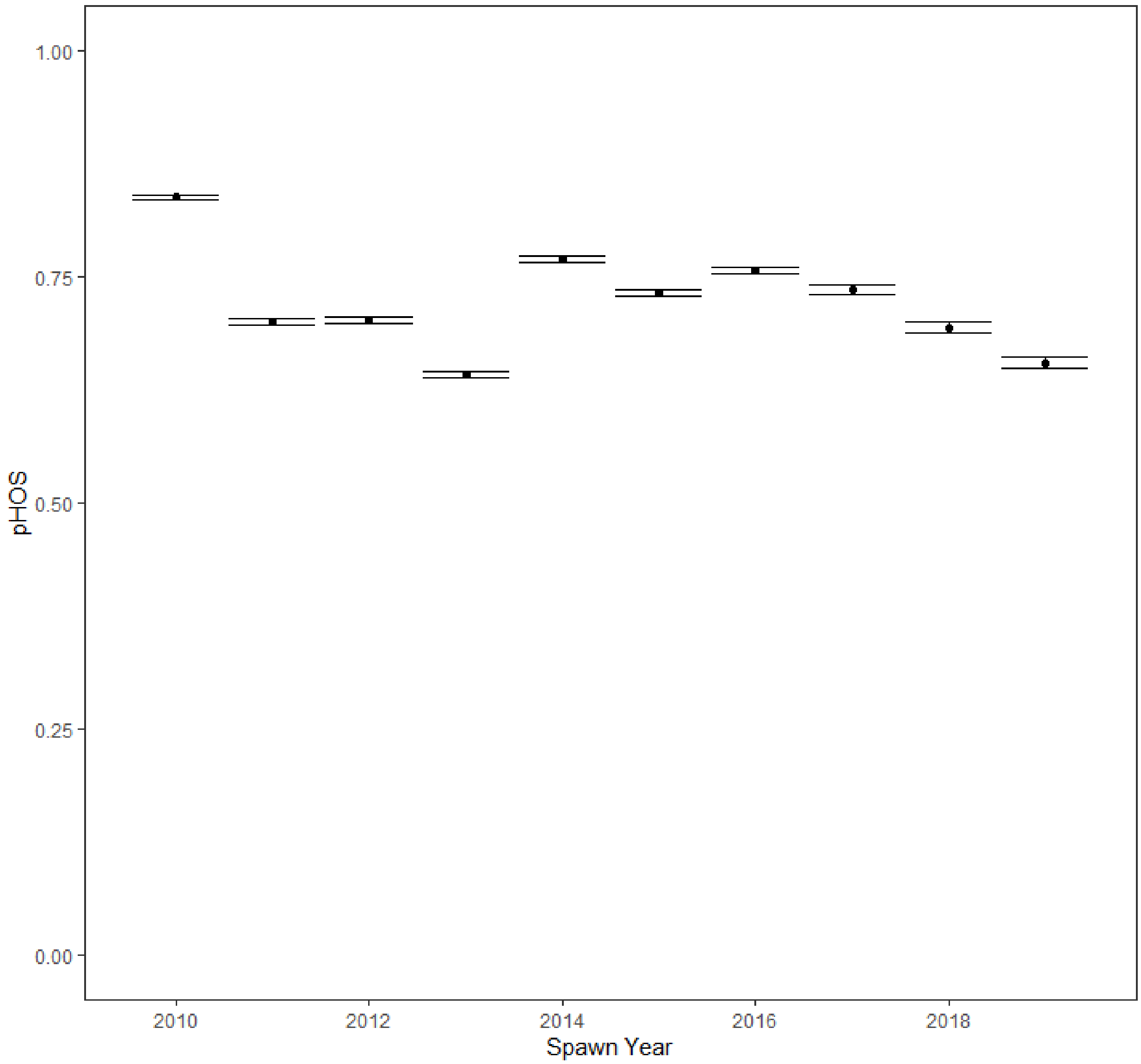

Figure 5. Proportion of fall Chinook Salmon hatchery-origin spawners (pHOS) estimated escaping Lower Granite Dam through run-reconstruction efforts (Young et al. 2020; error bars show 95% CIs).

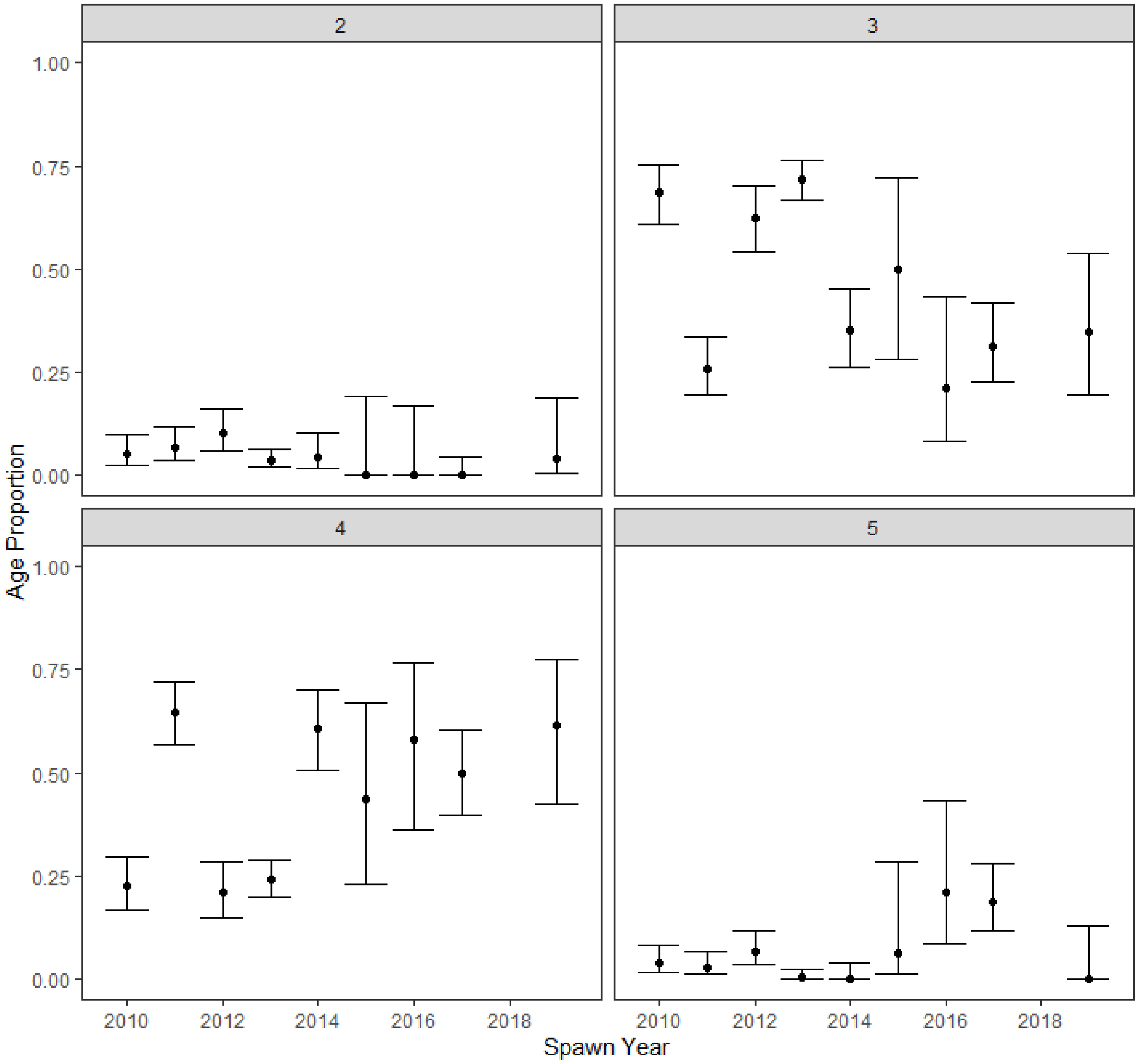

Figure 6. Clearwater River fall Chinook Salmon age composition estimated from carcasses collected during spawning ground surveys, by spawn year, indicate consistent yet highly variable and imprecise estimates over the last 10 years (error bars show 95% CIs).

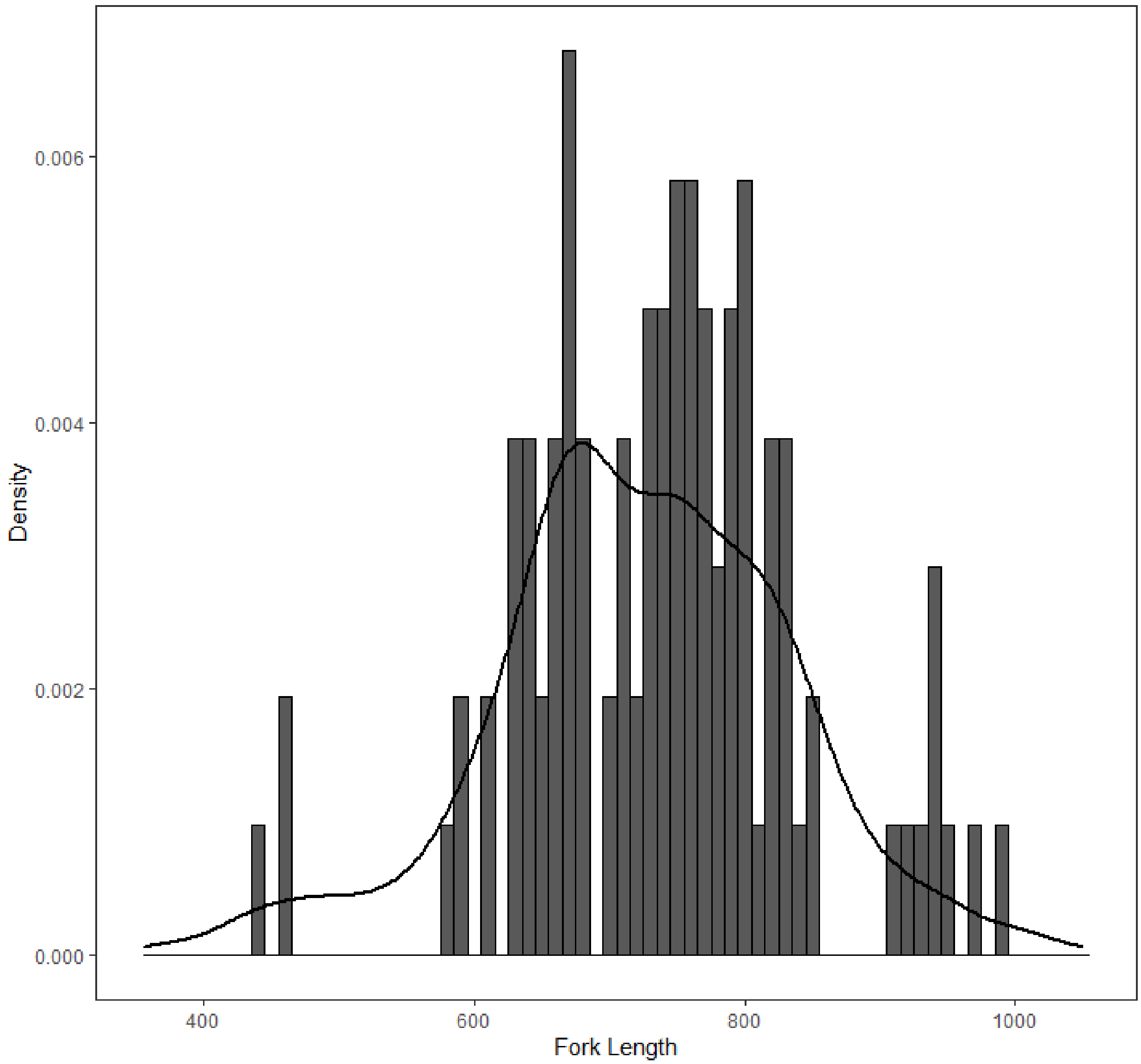

Figure 7. Observed fall Chinook Salmon fork lengths from carcasses collected in the Clearwater River during 2019 spawning ground surveys (bars) showed similar distribution patterns to all other carcasses collected within the last 10 years (line).

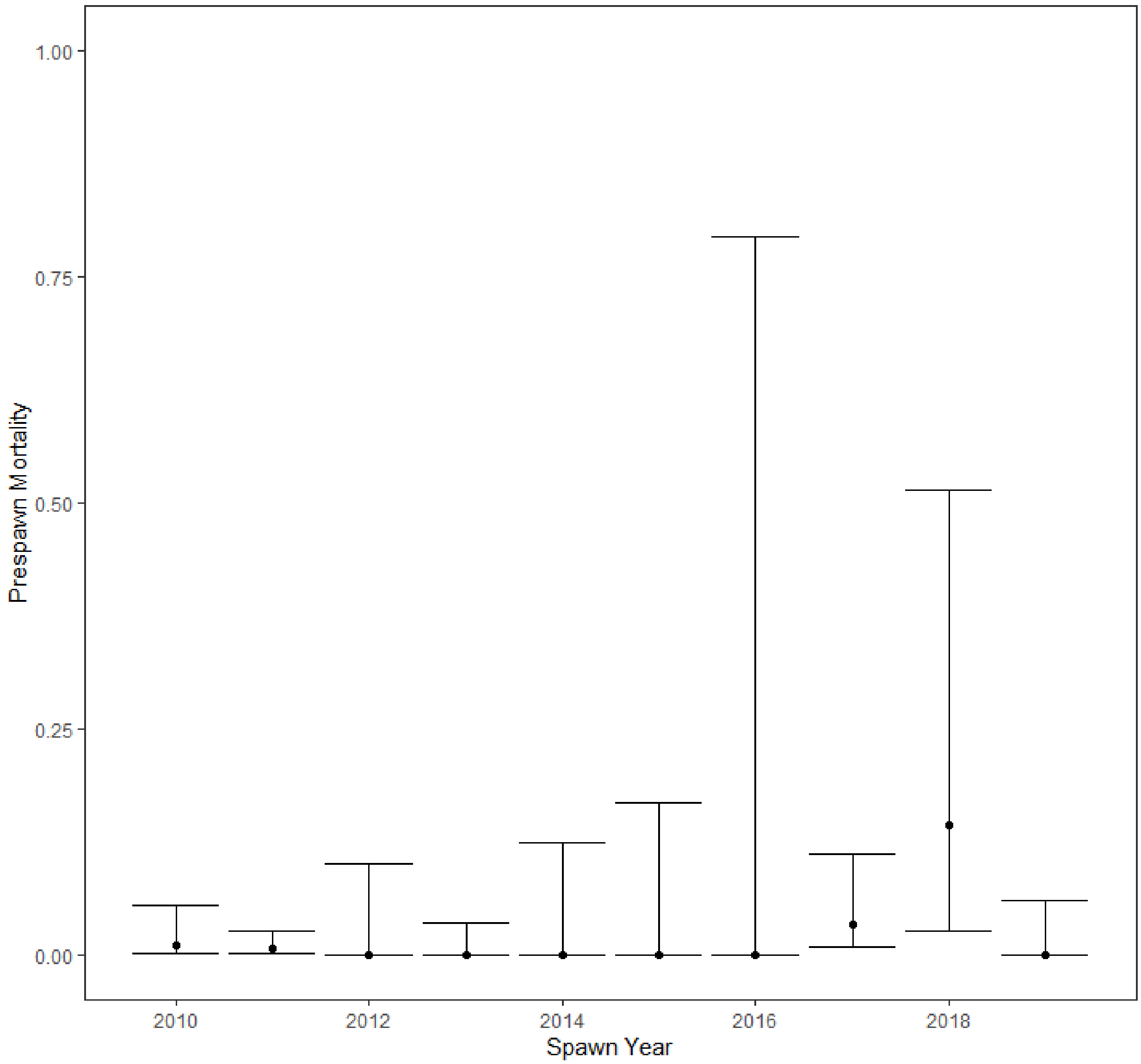

Figure 8. Prespawn mortality estimates, by spawn year, for fall Chinook Salmon carcasses collected in the Clearwater River.

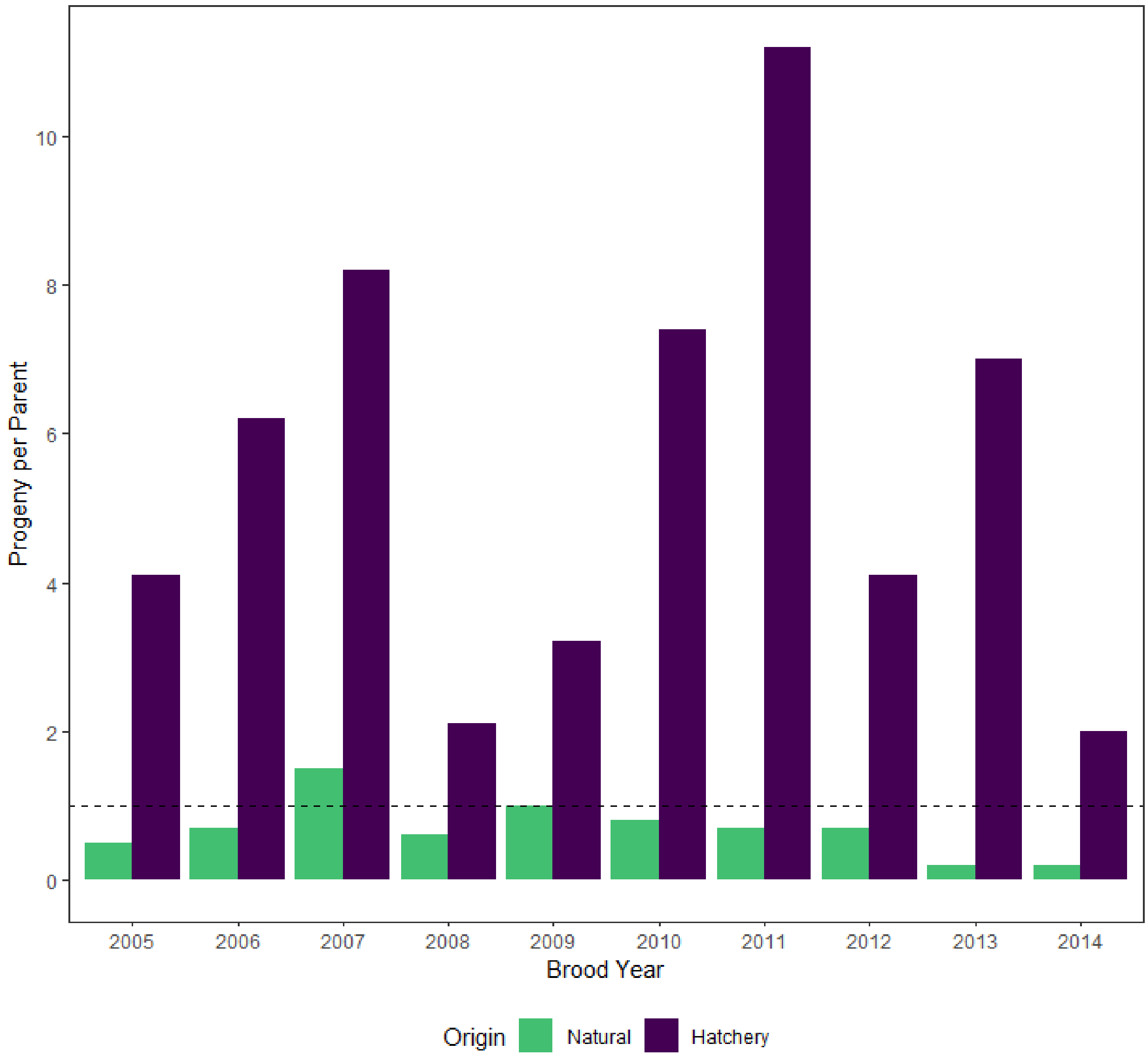

Figure 9. Natural- and hatchery-origin fall Chinook Salmon progeny-to-parent ratios to Lower Granite Dam for brood year 2005-2014 (dashed line indicates spawner replacement = 1.0).

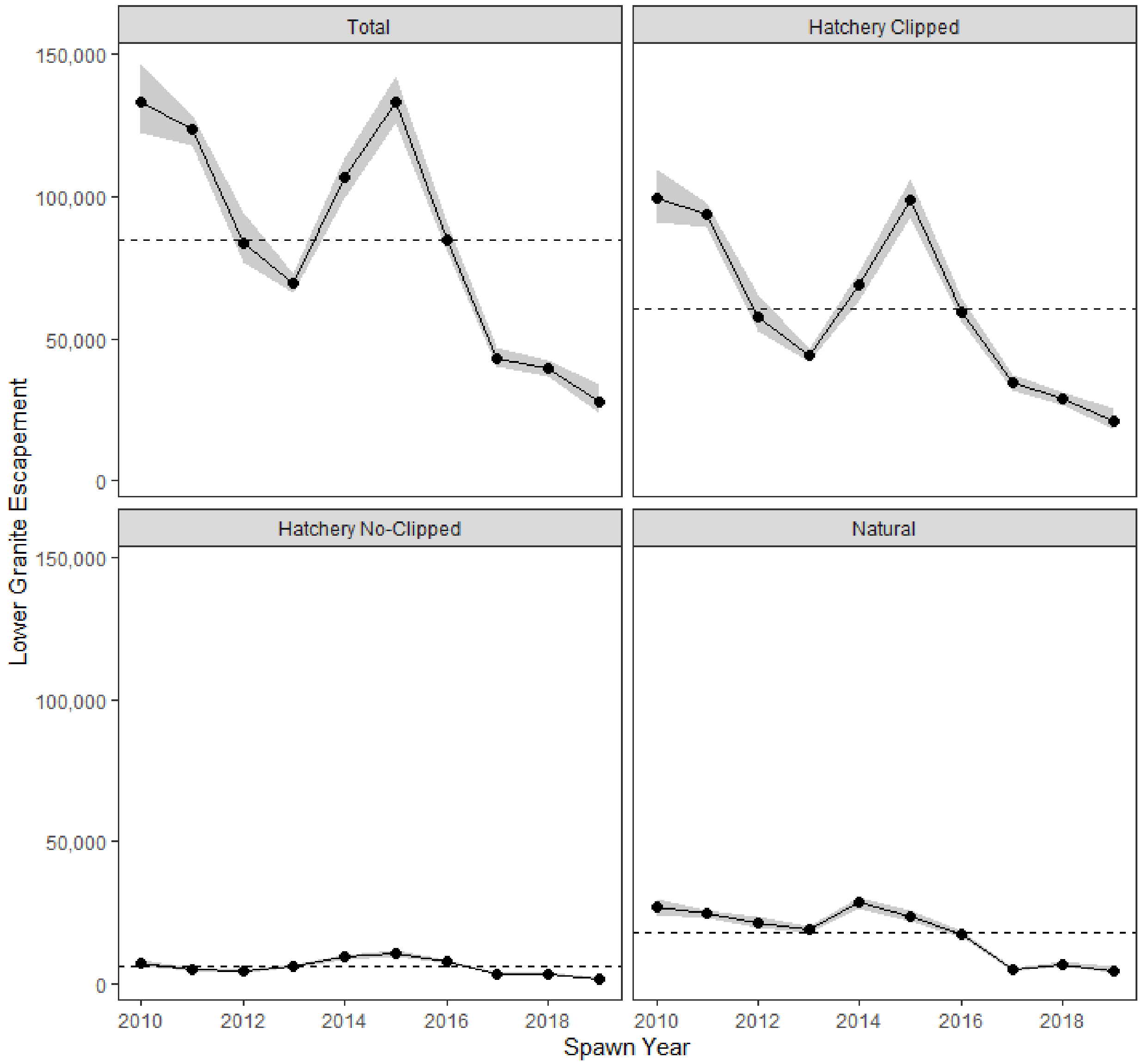

Figure 10. Spring/summer Chinook Salmon escapement past Lower Granite Dam (IPTDSW 2020; grey bands represent 95% CI). A decreasing trend is observed across origins over the last 10 years with spawn year 2019 returns falling below the 10-year average (dashed line).

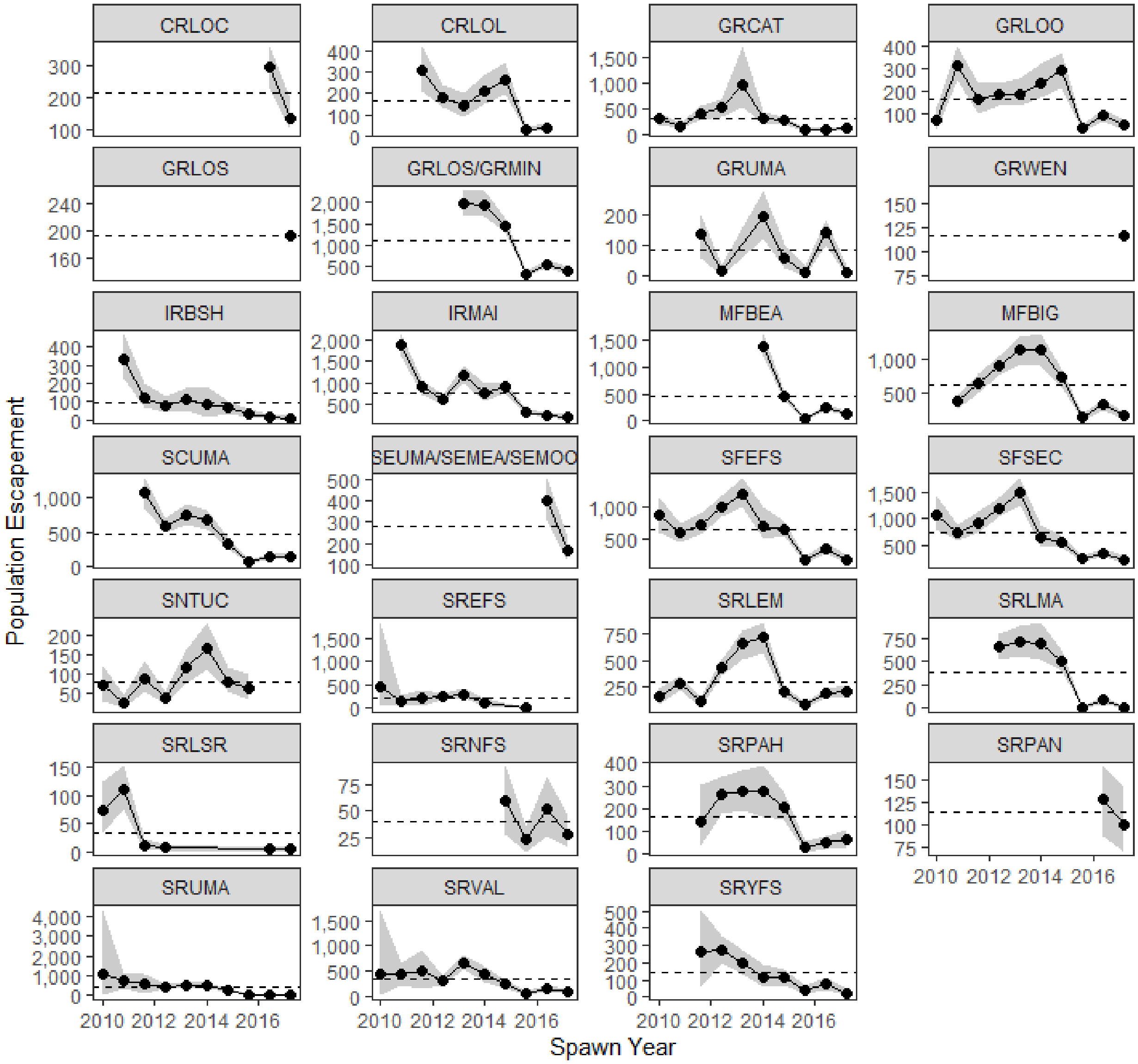

Figure 11. Natural-origin spring/summer Chinook Salmon escapement into ICTRT populations (IPTDSW 2020; grey bands represent 95% CI). Decreasing trends are observed across most populations over the last 10 years with spawn year 2019 returns falling below the 10-year averages (dashed line).

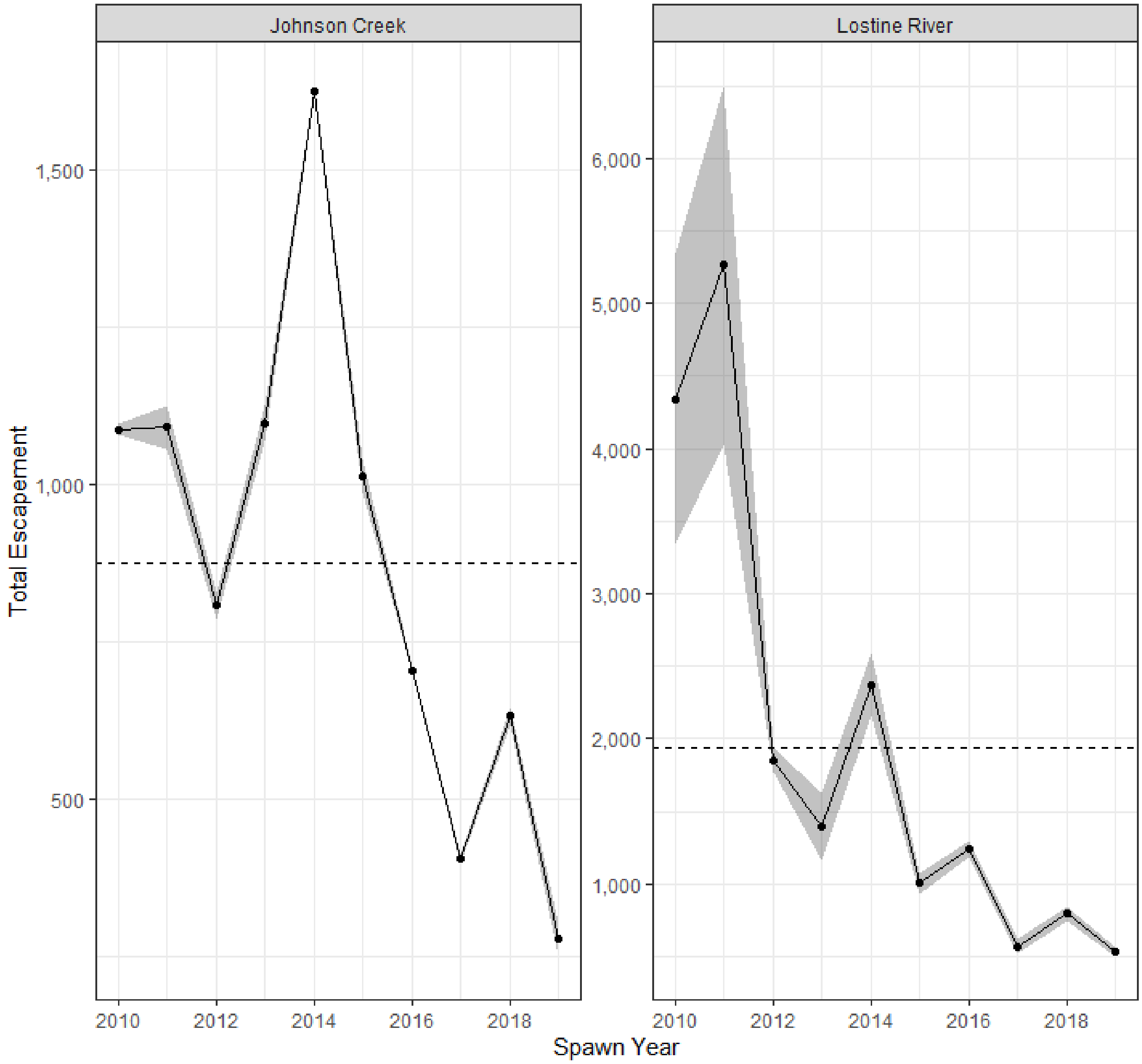

Figure 12. Total natural- and hatchery-origin spring/summer Chinook Salmon escapement (grey bands represent 95% CI) to Johnson Creek and Lostine River weirs shows a decreasing trend for the last 10 years with spawn year 2019 returns falling below the 10-year averages (dashed line).

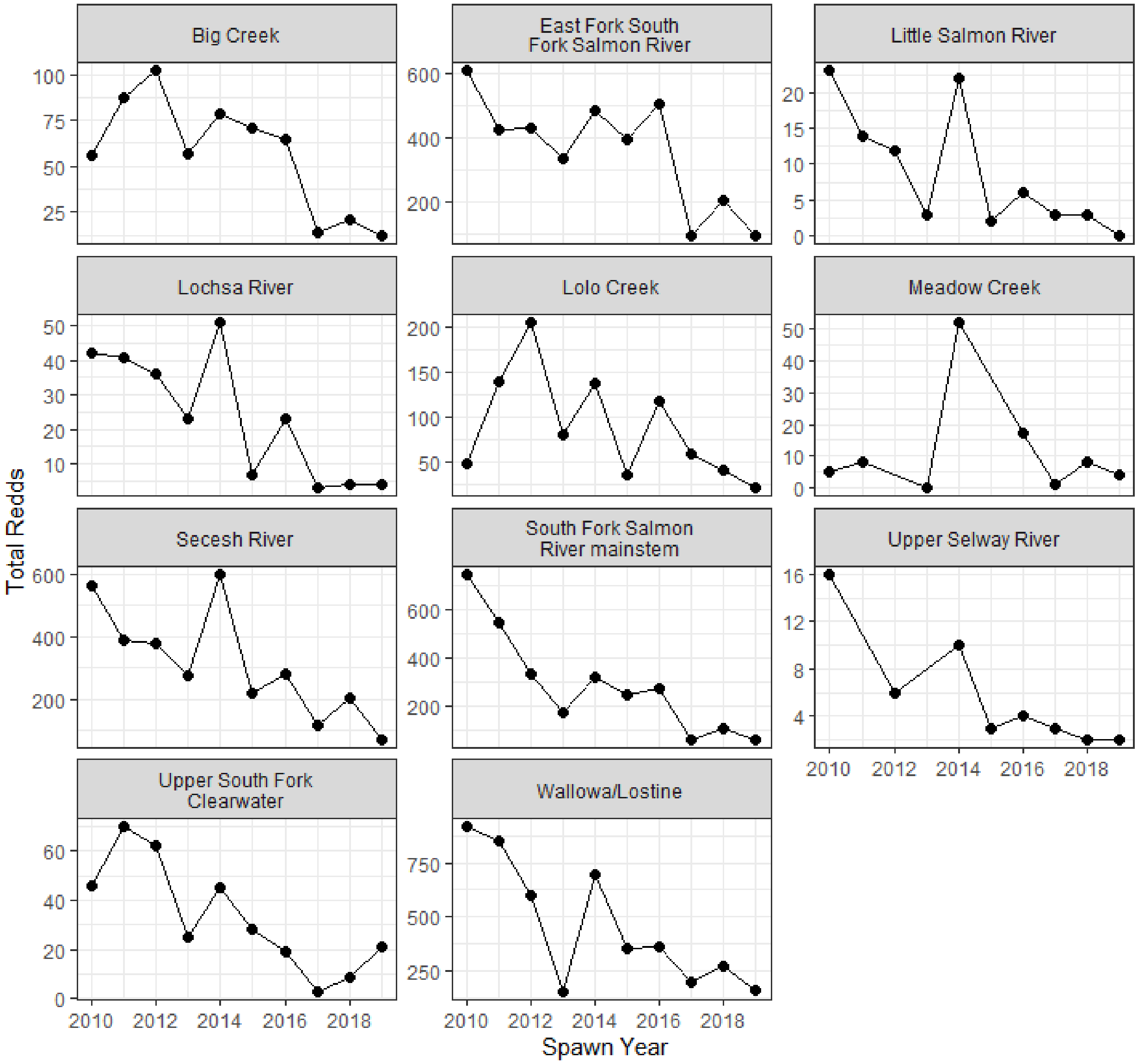

Figure 13. Observed redd count for spring/summer Chinook Salmon in Snake River Basin ICTRT populations by spawn year. Redds observed by Nez Perce Tribe staff have generally indicated declining trends for the past 10-years.

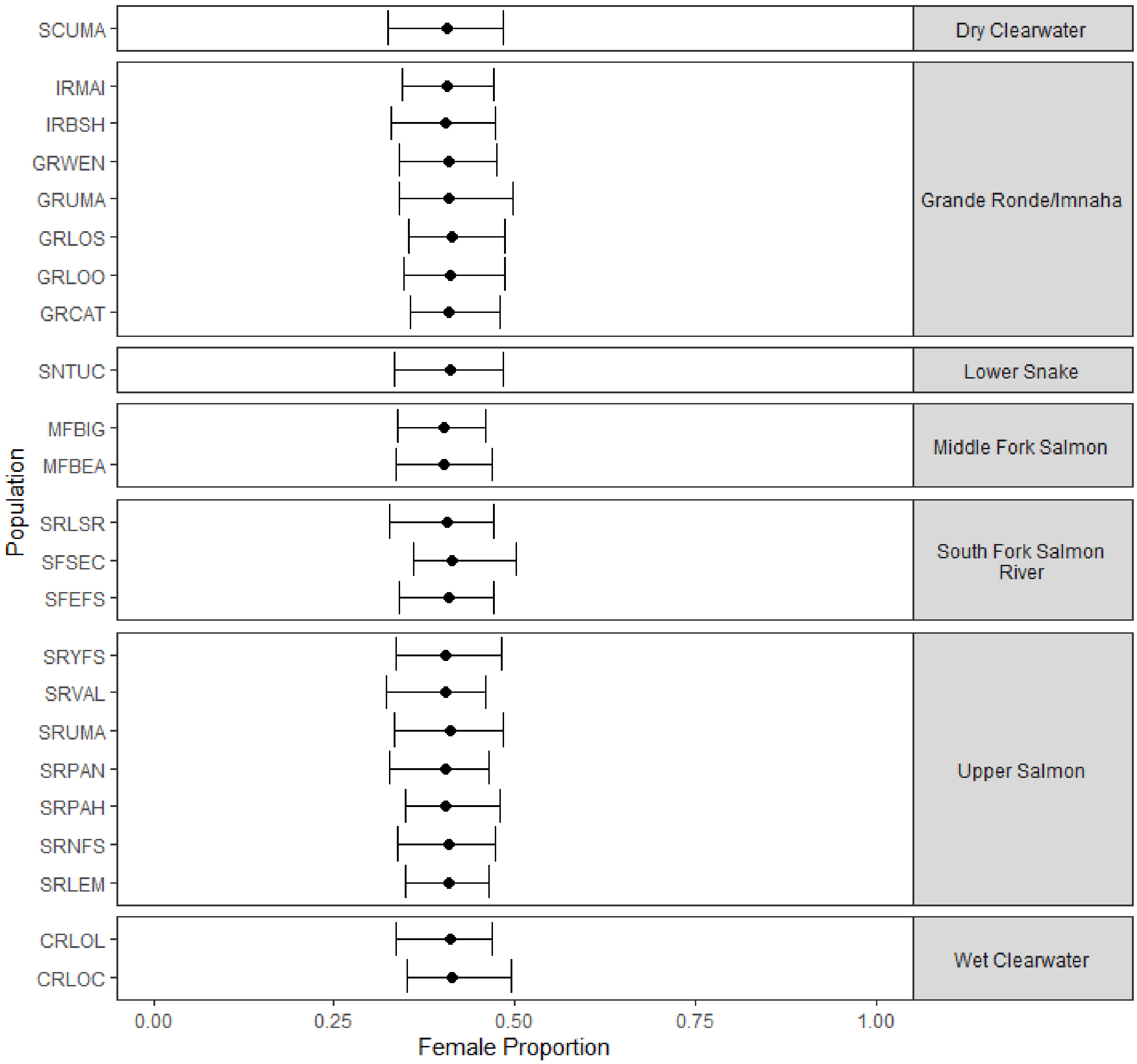

Figure 14. Spawn year 2019 female proportions (error bars show 95% CIs) estimated from PIT tag detections of natural-origin spring/summer Chinook Salmon across monitored ICTRT populations (IPTDSW 2020; left vertical axis). Populations are grouped by ICTRT major population designations (right vertical axis).

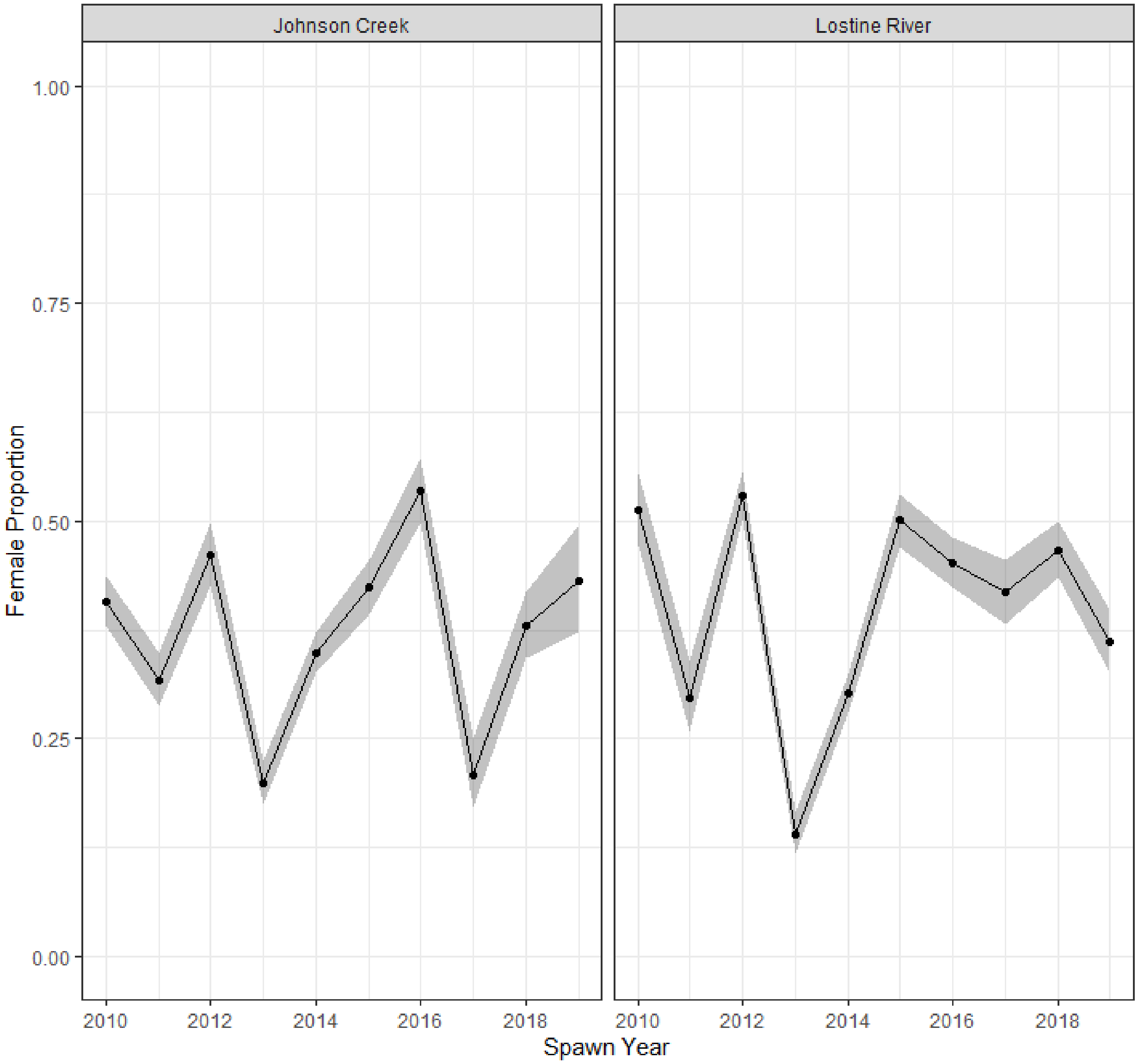

Figure 15. Female proportion of natural- and hatchery-origin spring/summer Chinook Salmon escaping to Johnson Creek and Lostine River weirs show high variability across the last 10-years.

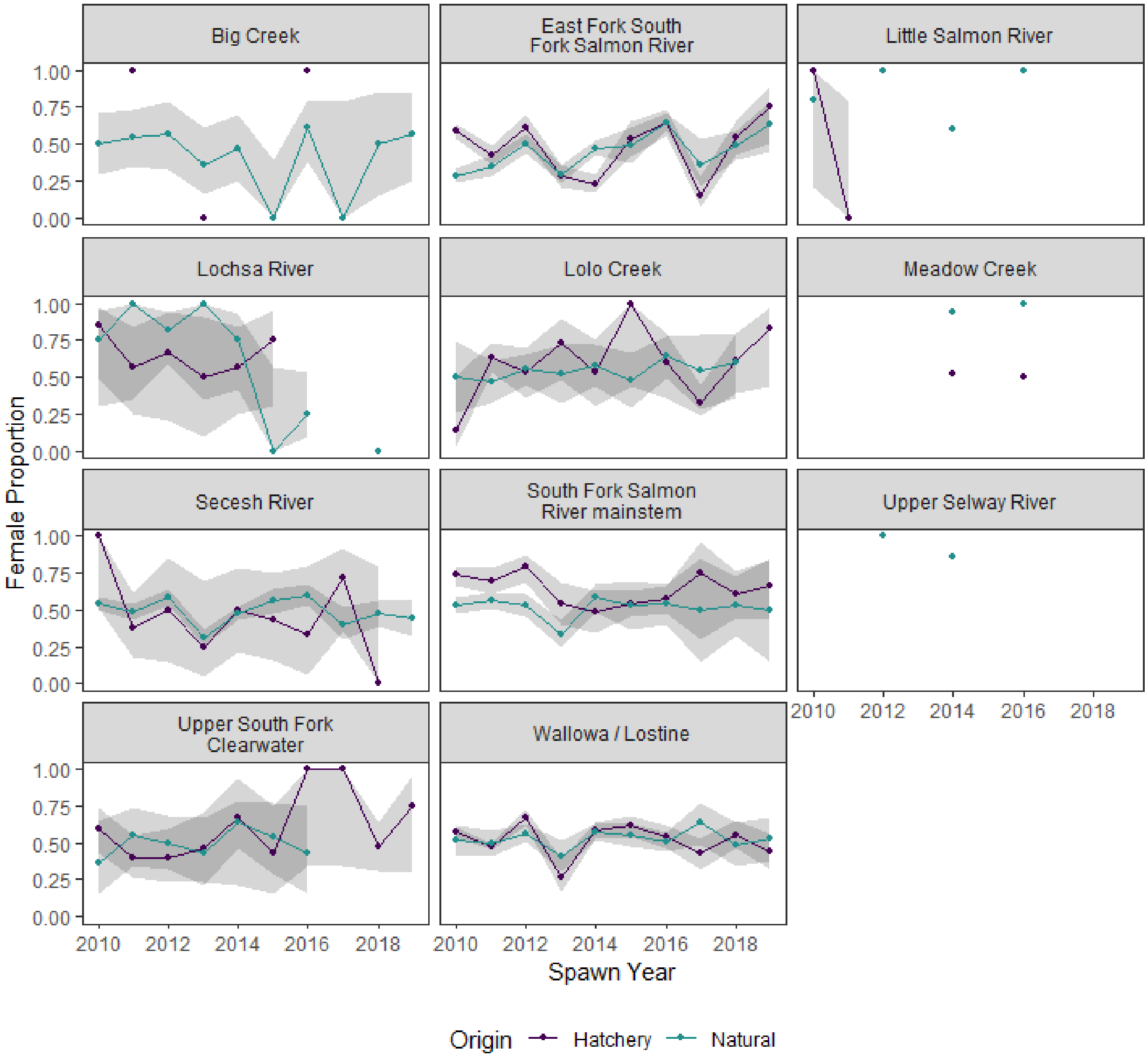

Figure 16. Proportion of natural- and hatchery-origin spring/summer Chinook Salmon female spawner abundance estimated from carcasses collected during spawning ground surveys show consistent trends across origins, surveyed ICTRT populations, and the last 10 spawn years.

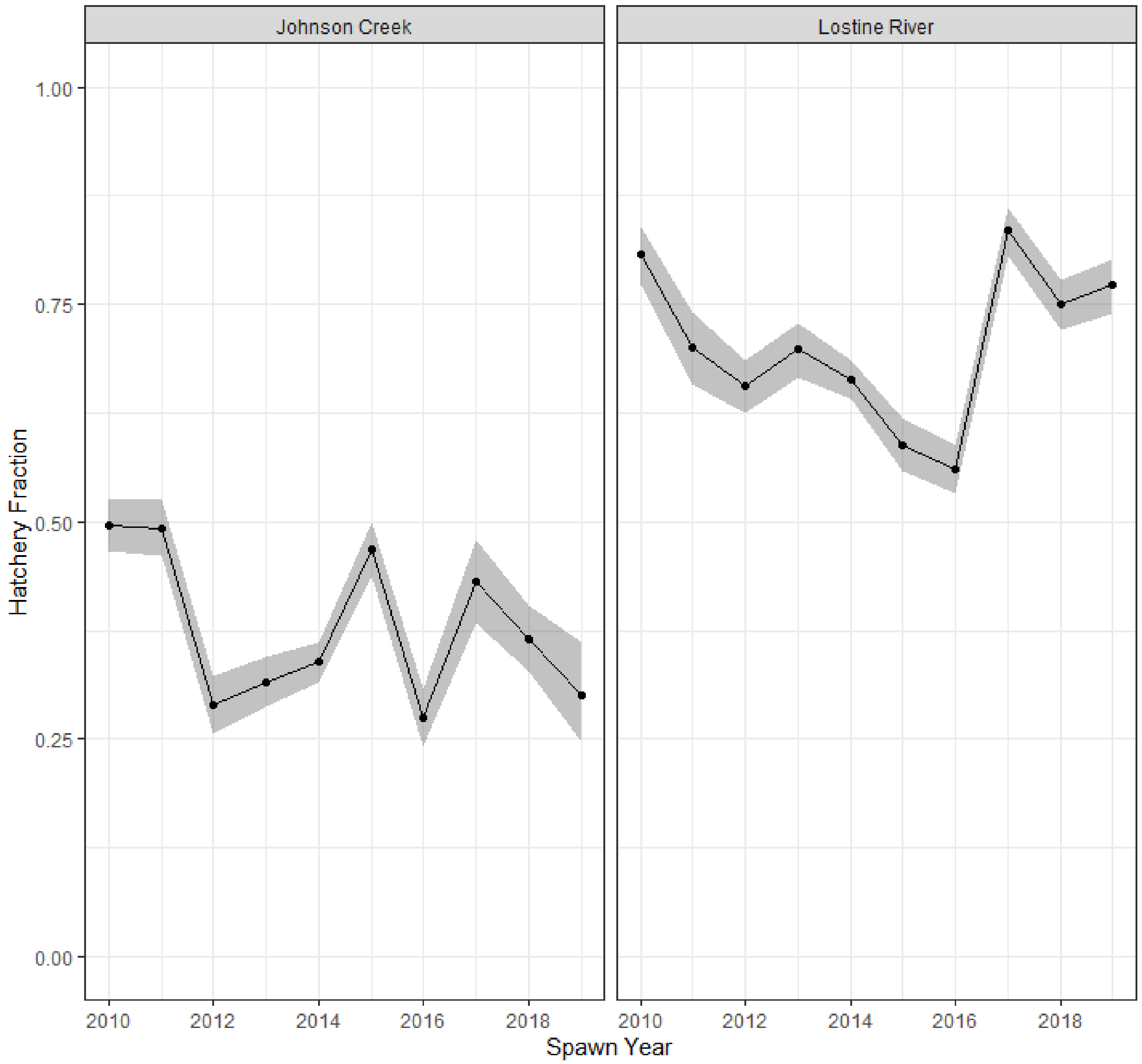

Figure 17. Hatchery fraction of spring/summer Chinook Salmon escaping to Johnson Creek and Lostine River weirs by spawn year.

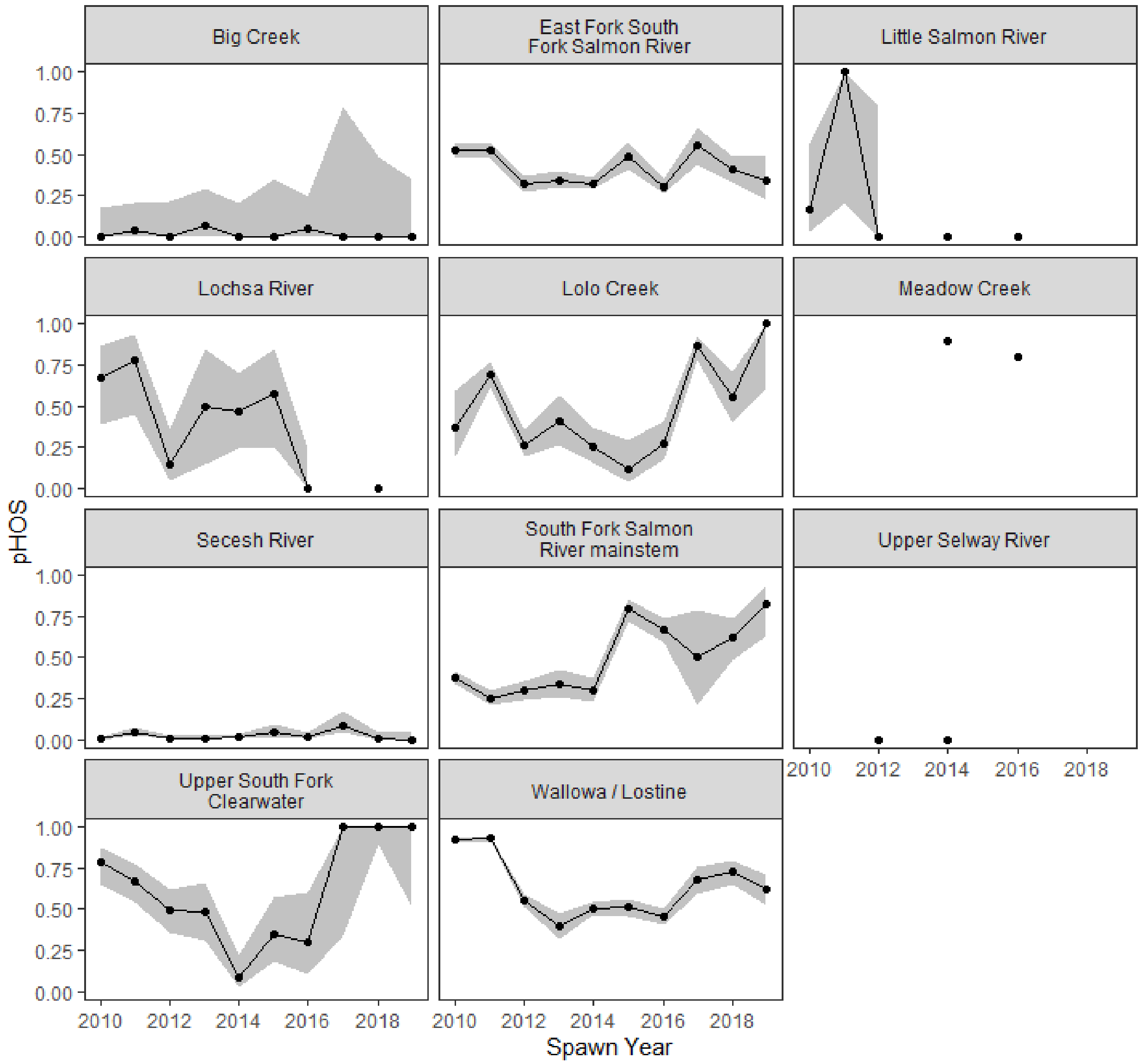

Figure 18. Proportion of hatchery-origin spring/summer Chinook Salmon spawners (pHOS) in each Nez Perce Tribe surveyed ICTRT population estimated from carcasses collected during spawning ground surveys over the last 10 years (grey bands represent 95% CI).

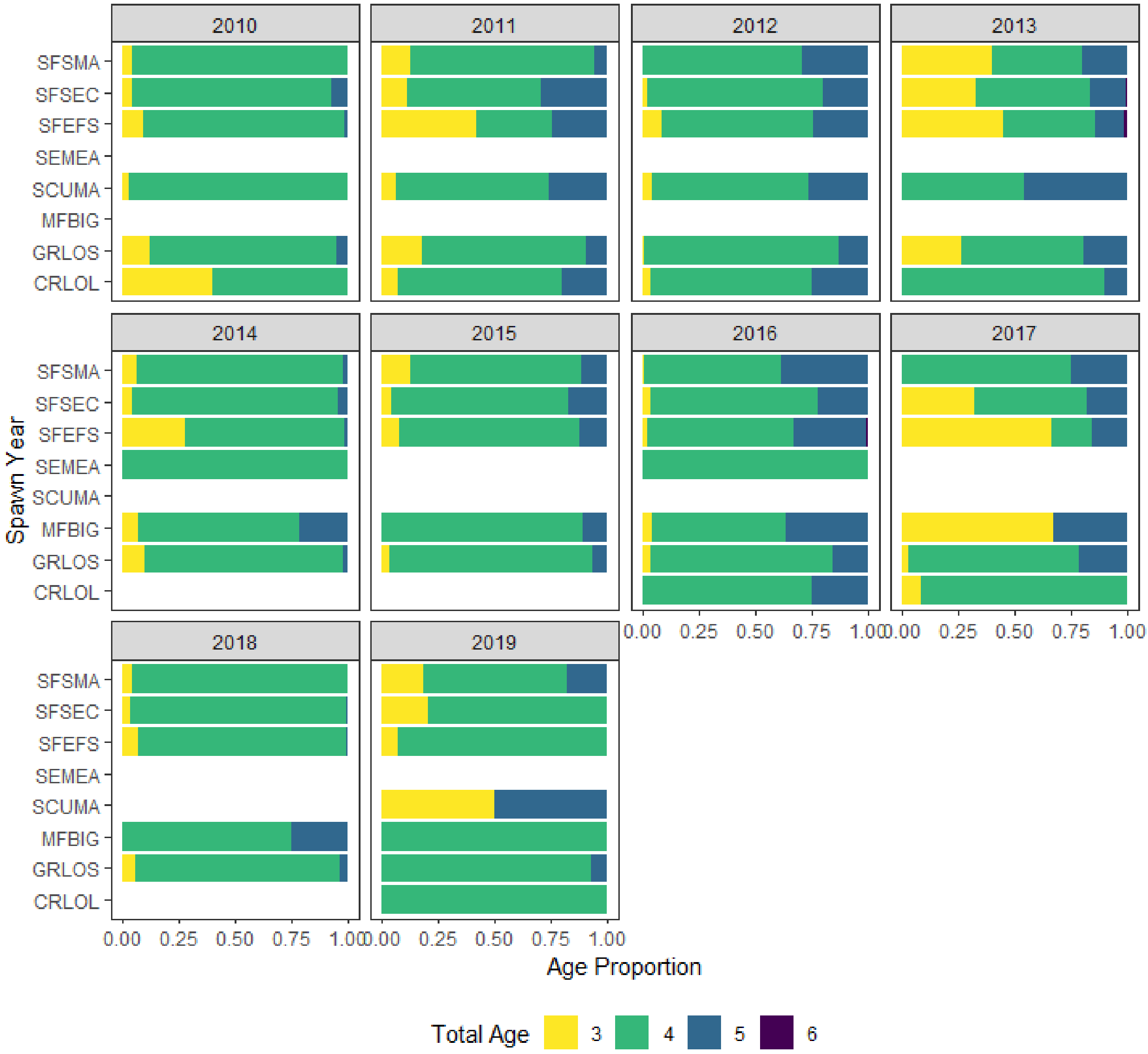

Figure 19. Combined natural- and hatchery-origin age proportions of spring/summer Chinook Salmon spawners in each Nez Perce Tribe surveyed ICTRT population as estimated from carcasses collected during the last 10 years of spawning ground surveys. With a few exceptions, the predominate spawner is age- 4, with spawn years 2013 and 2017 having a large component of age- 3 fish.

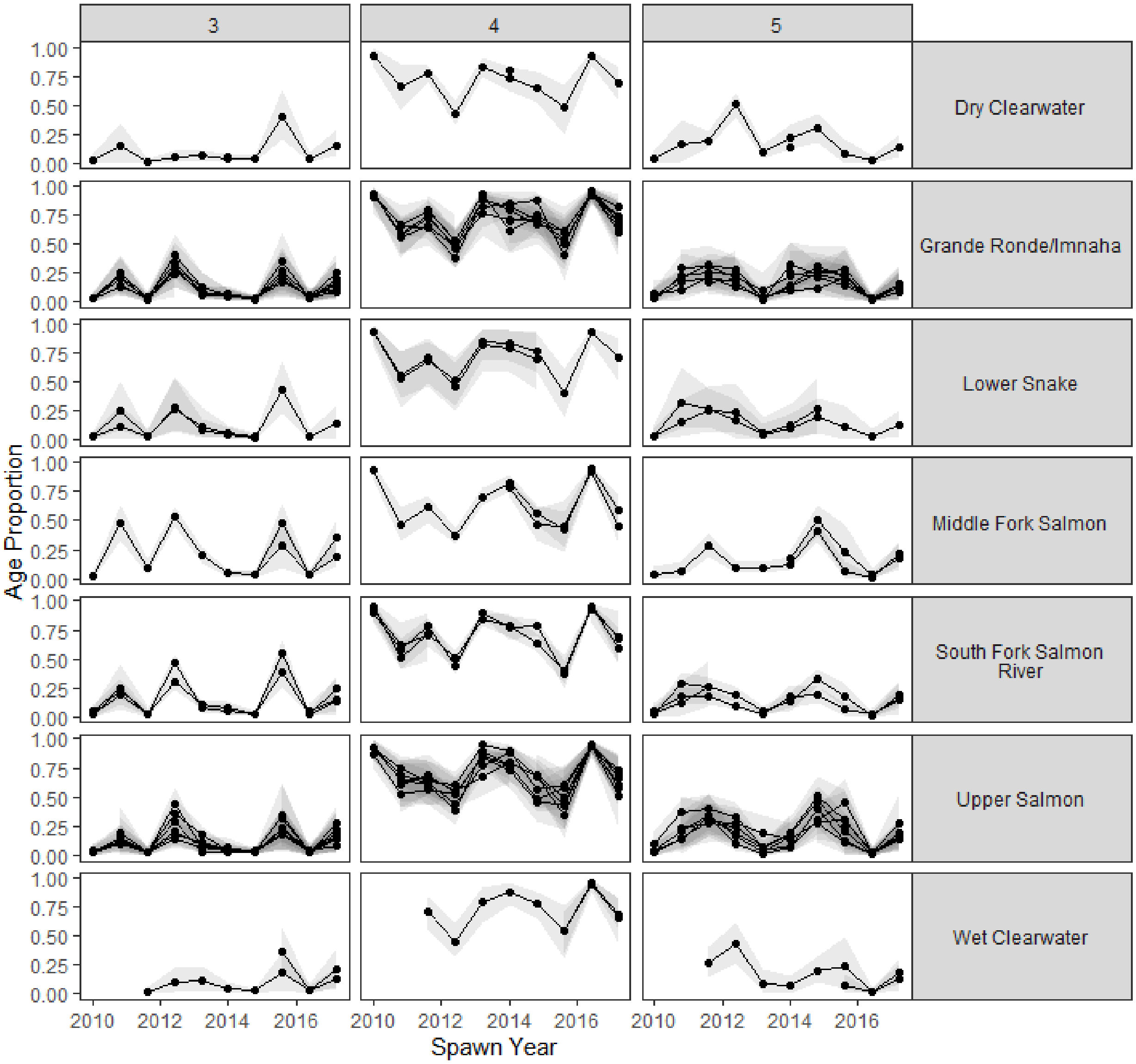

Figure 20. High synchronicity observed in natural-origin spring/summer Chinook Salmon age proportions throughout ICTRT populations (lines) as estimated from PIT tag detections at instream arrays (IPTDS 2020; grey bands represent 95% CI). Populations are grouped by ICTRT major population designations (right vertical axis).

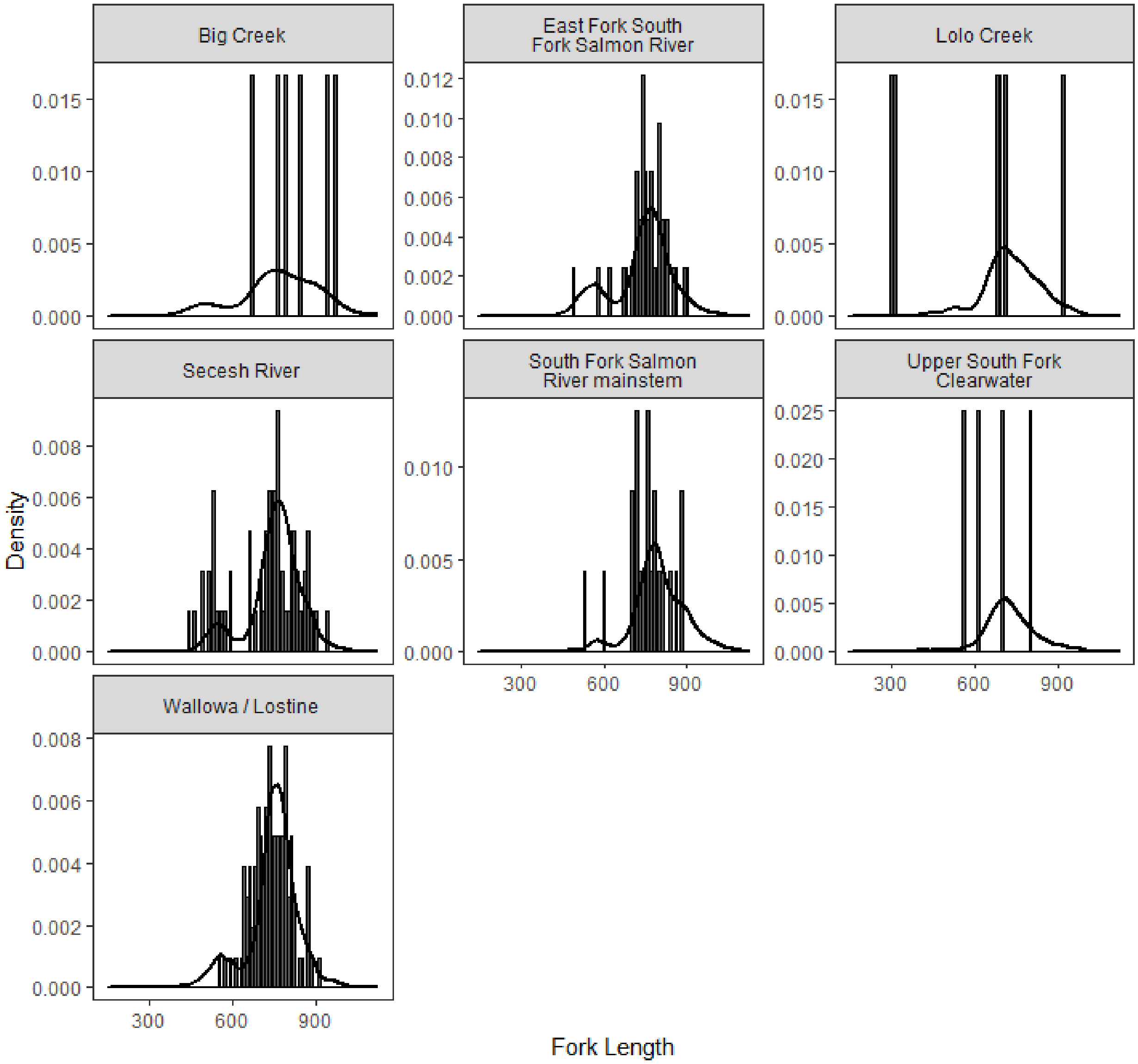

Figure 21. Fork length distributions of natural- and hatchery-origin spring/summer Chinook salmon carcasses collected from Nez Perce Tribe surveyed ICTRT populations during 2019 spawning ground surveys (line) as compared to all carcasses collected for the last 10-years.

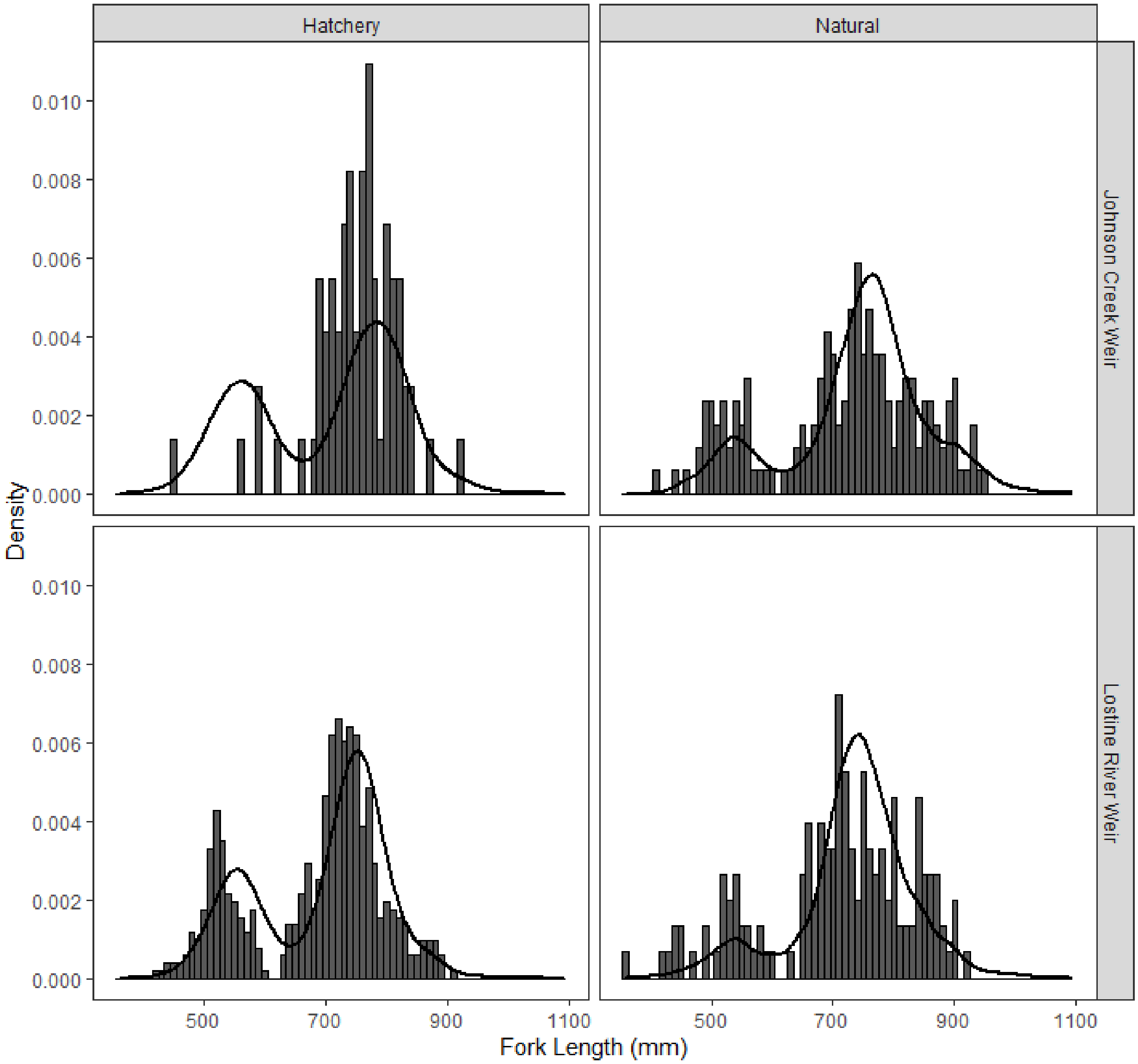

Figure 22. Fork length distributions of natural- and hatchery-origin spring/summer Chinook Salmon trapped at Johnson Creek and Lostine River weirs during spawn year 2019 (bars) indicated slightly smaller returning fish as compared to fish collected during the last 10-years (line).

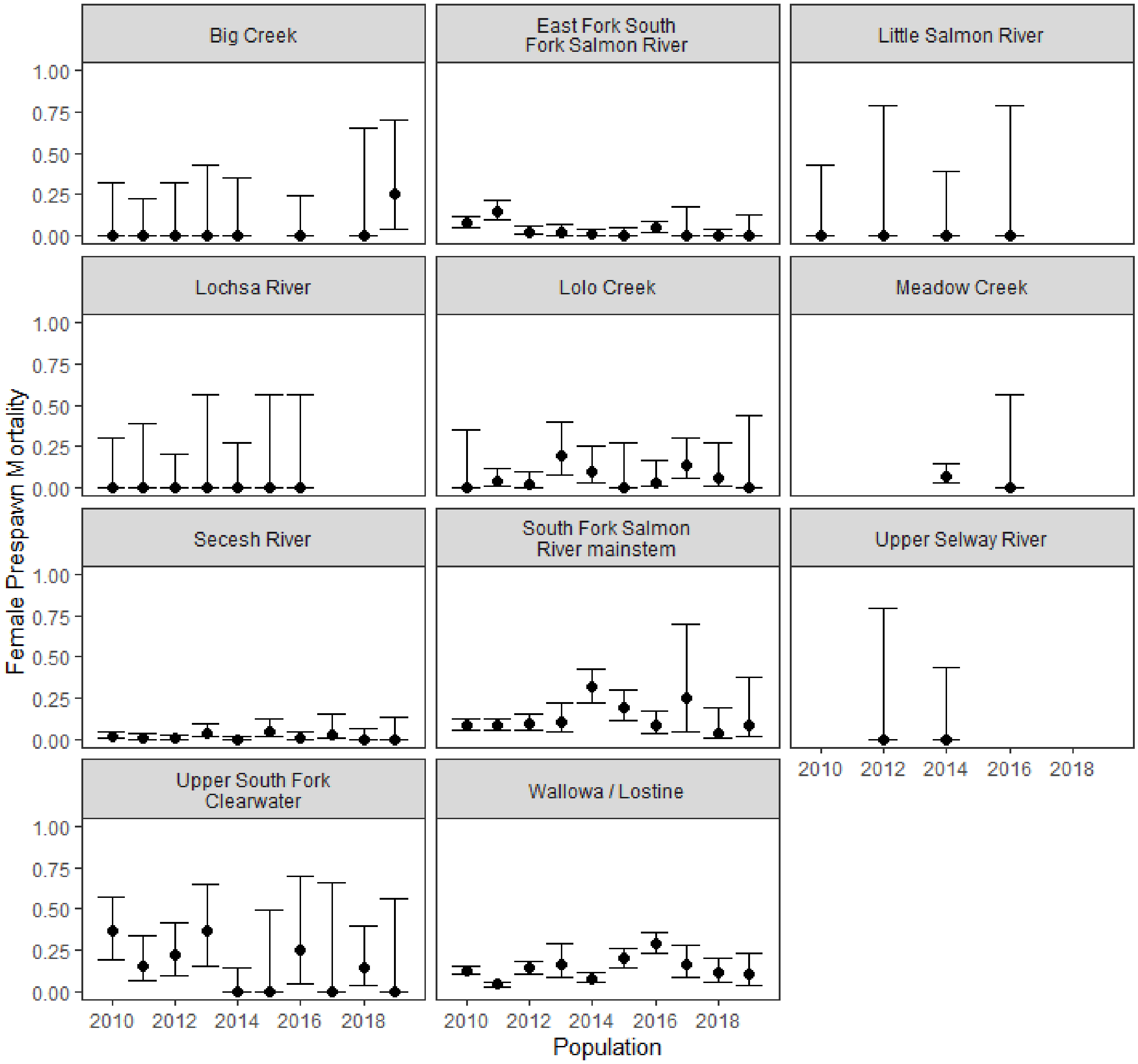

Figure 23. Prespawn mortality of natural- and hatchery-origin spring/summer Chinook Salmon combined in each Nez Perce Tribe surveyed ICTRT population by spawn year (error bars show 95% CIs).

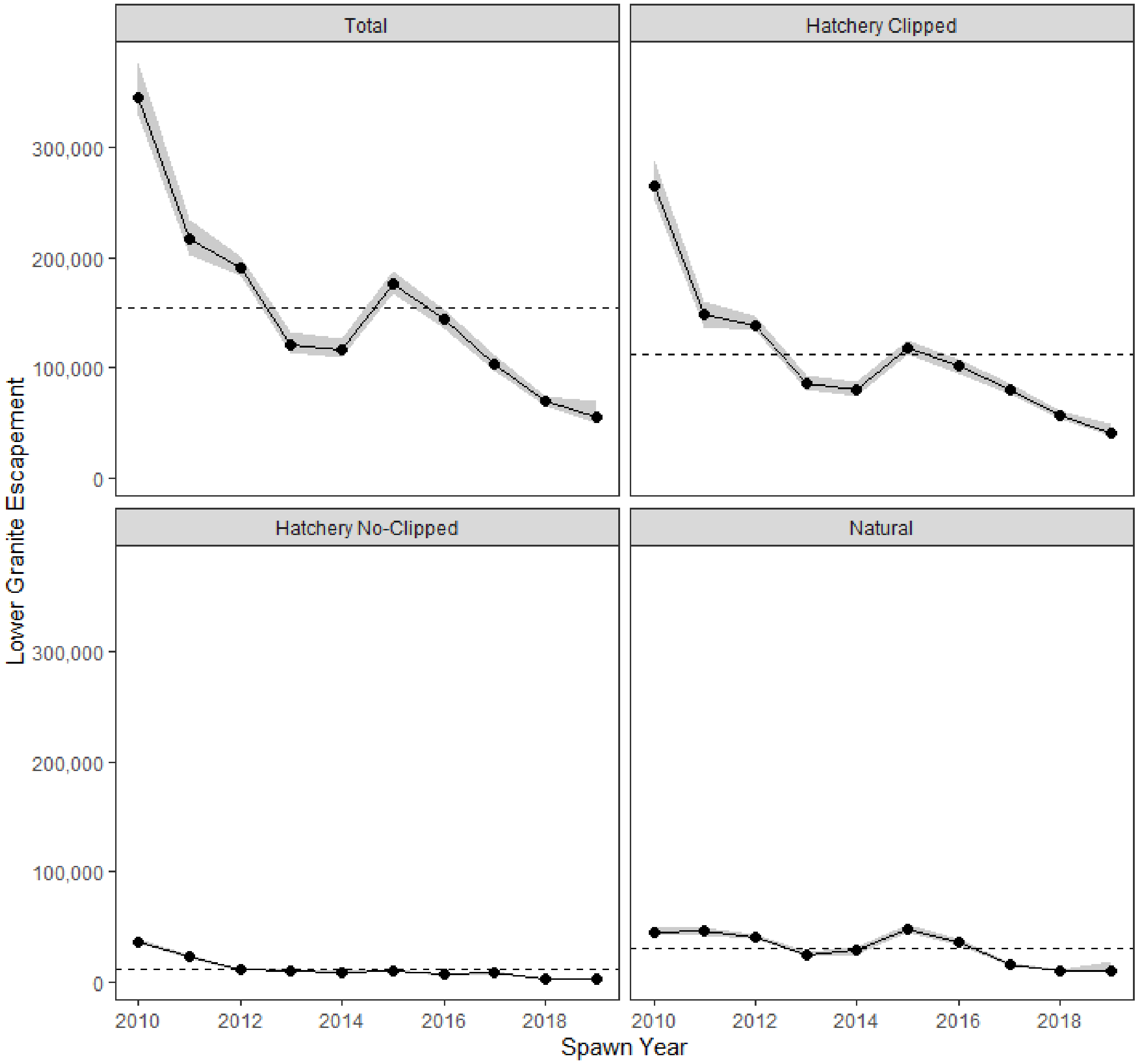

Figure 24. Summer steelhead escapement past Lower Granite Dam (IPTDSW 2020; grey bands represent 95% CIs). A decreasing trend is observed across origins over the last 10 years with spawn year 2019 returns falling below the 10-year average (dashed line).

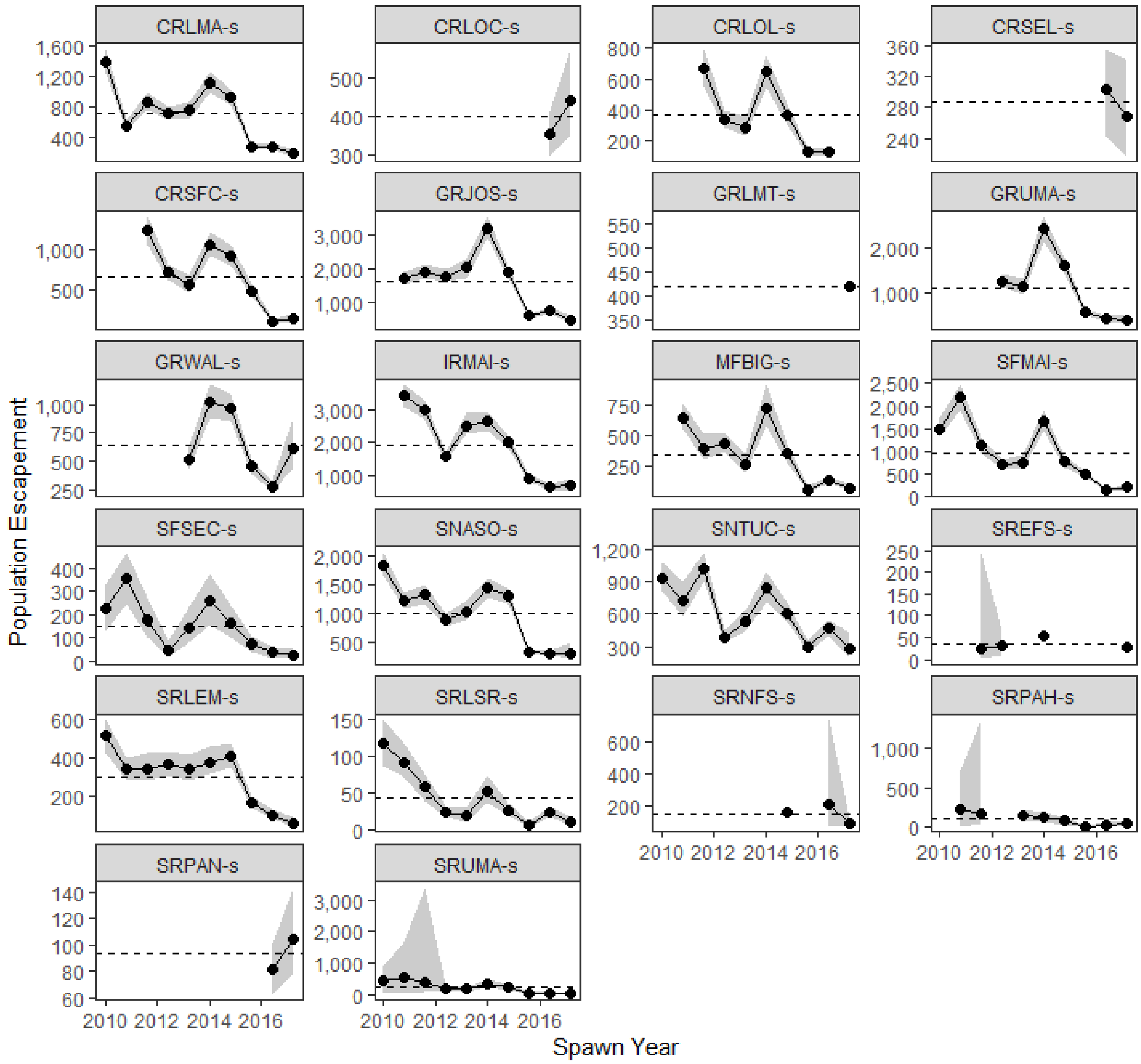

Figure 25. Natural-origin summer steelhead escapement into ICTRT populations (IPTDSW 2020; grey bands represent 95% CI).

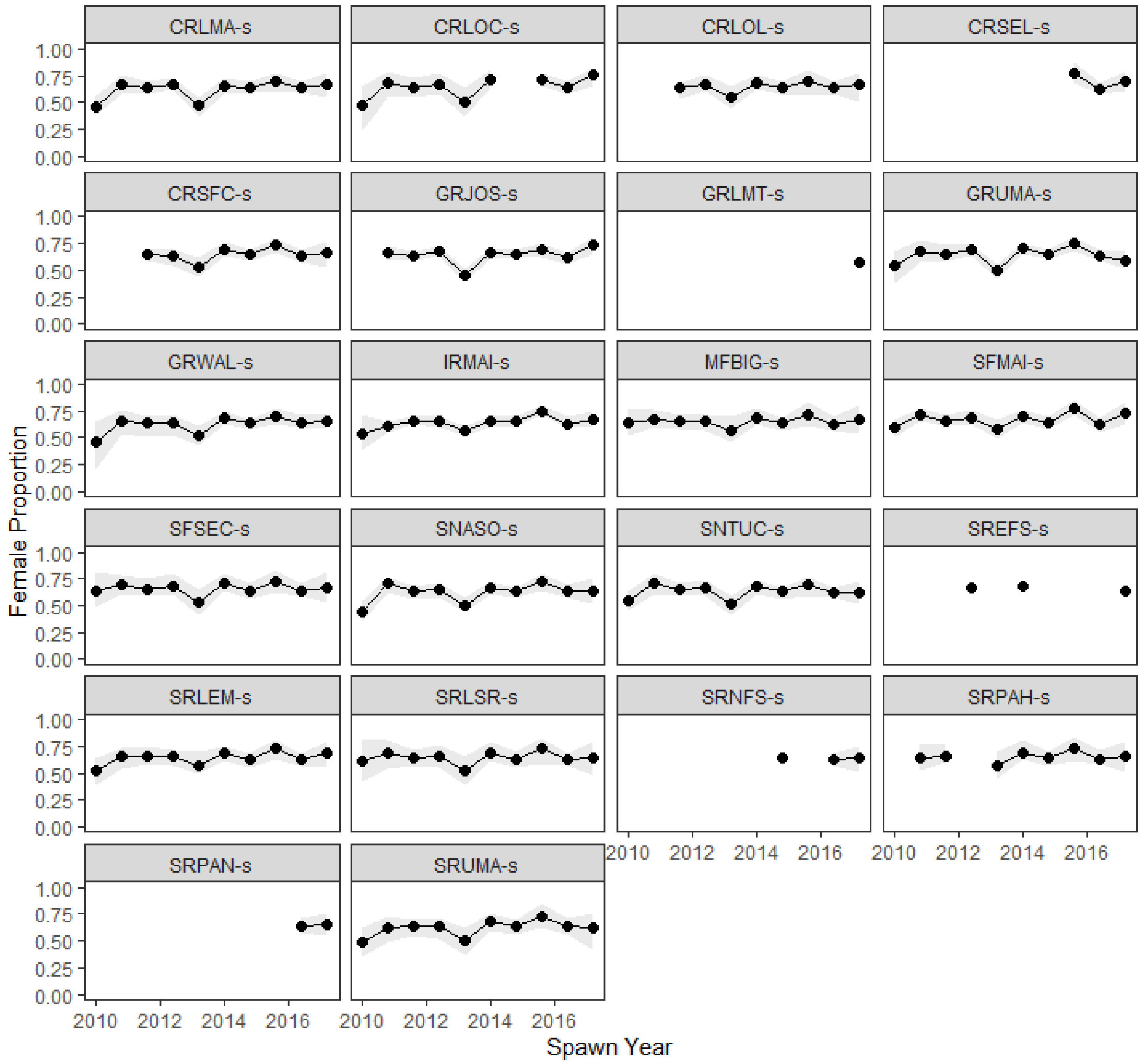

Figure 26. Female proportion of natural-origin summer steelhead in ICTRT populations estimated from PIT tag detections at instream arrays (IPTDSW 2020; grey bands represent 95% CIs).

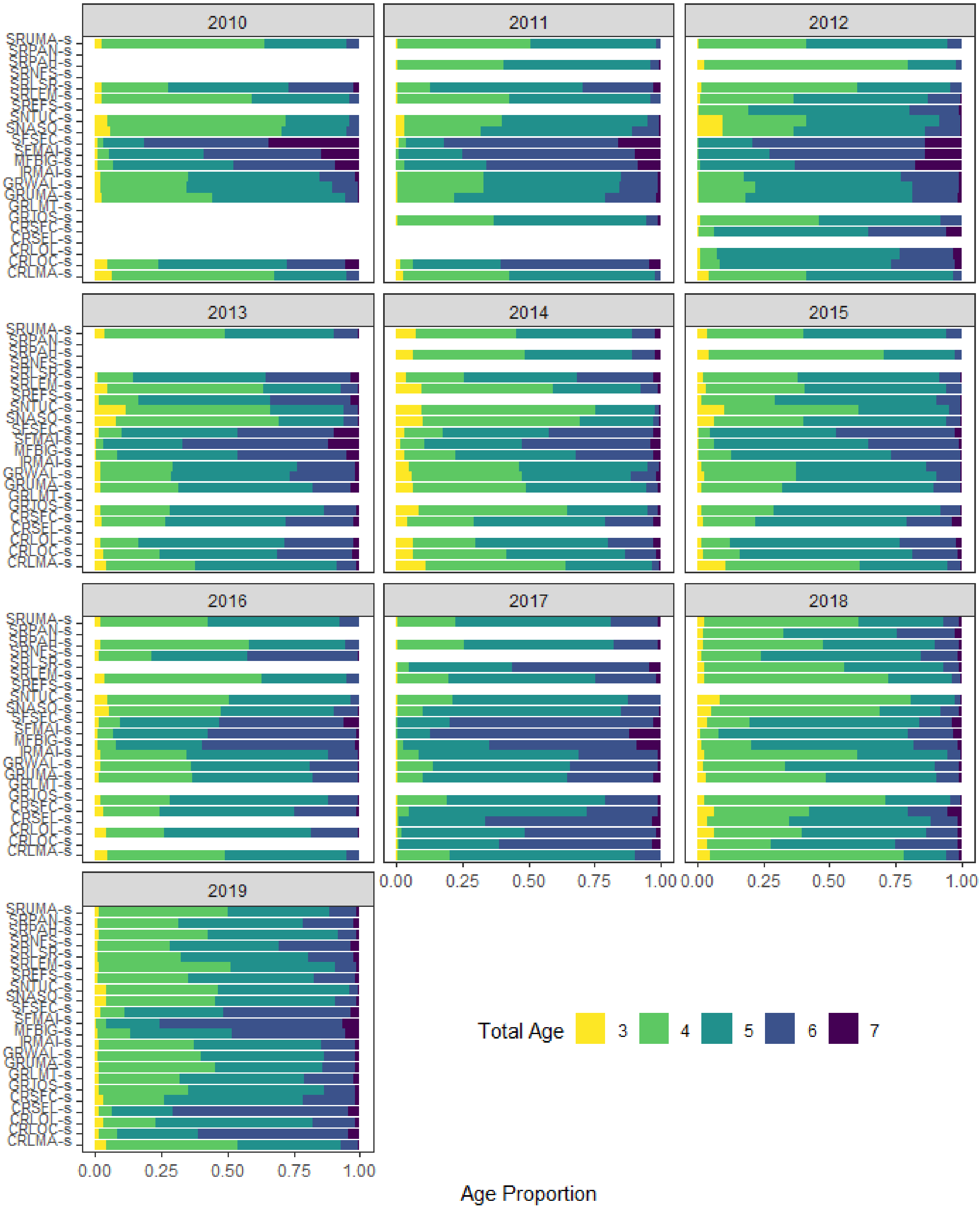

Figure 27. Age proportions of natural-origin summer steelhead in ICTRT populations estimated from PIT-tag detections at instream arrays (IPTDSW 2020; grey bands represent 95% CIs).

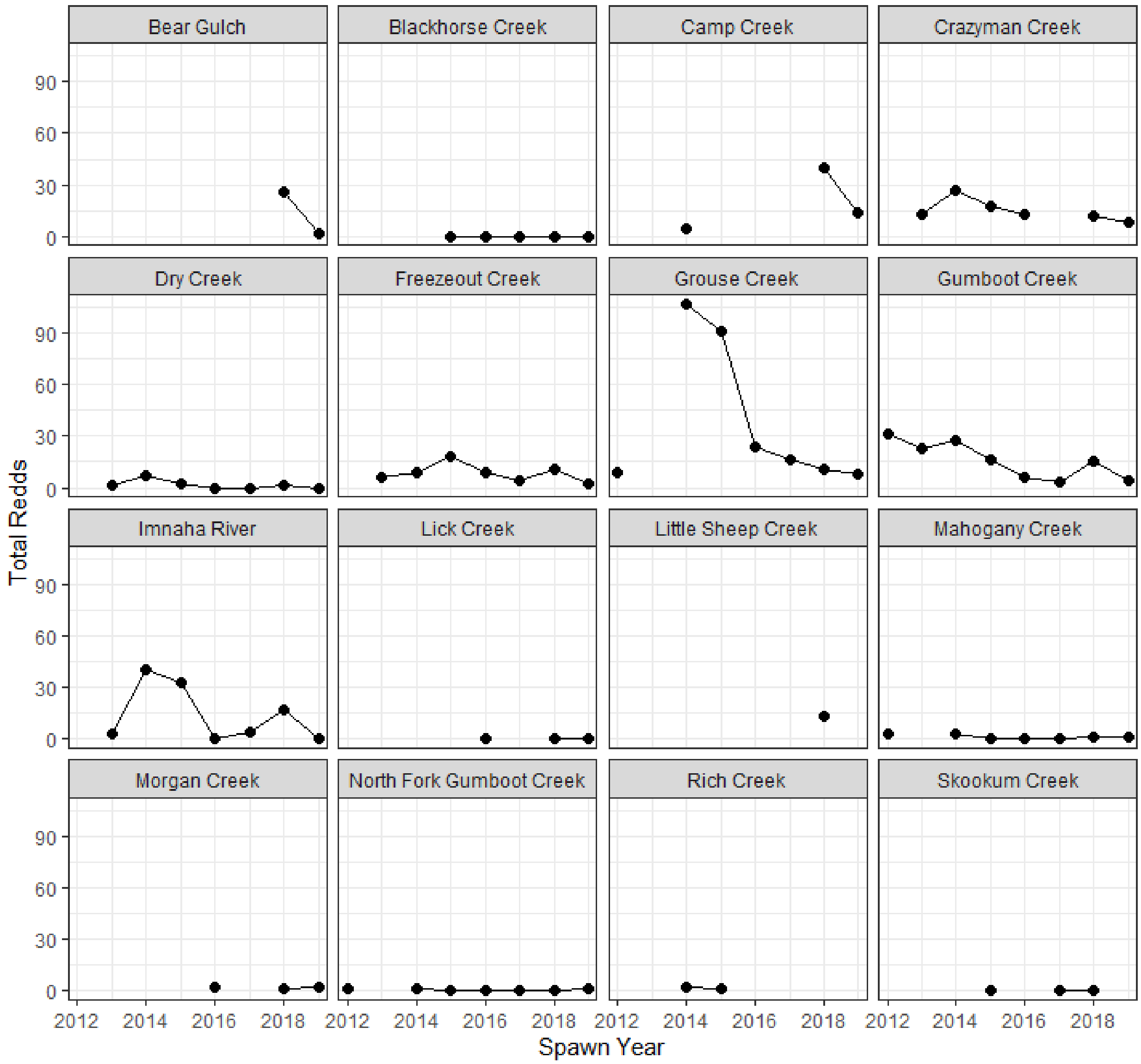

Figure 28. Total summer steelhead redds counted in the main stem Imanha River and tributaries during spawning ground surveys for spawn years 2012 through 2019.

Appendix

Appendix A. Spring/summer Chinook Salmon and summer steelhead escapement at Lower Granite Dam for spawn year 2019 with associated standard deviation and 95% CI (IPTDSW 2020).

Species	Origin-Clip	Escapement	SD	Lower CI	Upper CI
Spring/summer Chinook Salmon	Total	27,539	2,899	23,767	33,684
	Natural	4,668	611	3,942	6,090
	Hatchery Clipped	20,936	2,223	18,056	25,569
	Hatchery No-Clipped	1,913	212	1,593	2,390
Summer Steelhead	Total	54,770	5,848	49,446	70,329
	Natural	10,388	2,746	8,366	18,348
	Hatchery Clipped	41,138	3,280	37,600	49,583
	Hatchery No-Clipped	3,186	296	2,821	3,879

Appendix B. Spring/summer Chinook Salmon and summer steelhead escapement for spawn year 2019, major population group (MPG), and ICTRT population with associated SD and 95% CI (IPTDSW 2020).

Species	MPG	TRT	Escapement	SD	Lower CI	Upper CI
Chinook	Dry Clearwater	SCUMA	140	31.1	94	202
Chinook	Grande Ronde/Imnaha	GRCAT	101	19.7	68	140
Chinook	Grande Ronde/Imnaha	GRLOO	50	17.6	29	77
Chinook	Grande Ronde/Imnaha	GRUMA	14	9.8	2	36
Chinook	Grande Ronde/Imnaha	GRWEN	116	45.3	74	164
Chinook	Grande Ronde/Imnaha	IRBSH	8	6.9	0	22
Chinook	Grande Ronde/Imnaha	IRMAI	190	46.0	133	268
Chinook	Middle Fork Salmon	MFBEA	134	22.8	99	183
Chinook	Middle Fork Salmon	MFBIG	174	28.9	128	231
Chinook	South Fork Salmon River	SFEFS	188	49.5	127	265
Chinook	South Fork Salmon River	SFSEC	200	55.6	135	309
Chinook	South Fork Salmon River	SRLSR	5	2.2	2	9
Chinook	Upper Salmon	SRLEM	216	34.0	156	277
Chinook	Upper Salmon	SRLMA	3	3.4	0	10
Chinook	Upper Salmon	SRNFS	28	9.2	16	46
Chinook	Upper Salmon	SRPAH	64	20.8	28	108
Chinook	Upper Salmon	SRPAN	101	27.9	71	143
Chinook	Upper Salmon	SRUMA	37	15.0	14	68
Chinook	Upper Salmon	SRVAL	100	28.4	50	152
Chinook	Upper Salmon	SRYFS	25	10.4	8	46
Chinook	Wet Clearwater	CRLOC	134	30.1	94	197

Species	MPG	TRT	Escapement	SD	Lower CI	Upper CI
Chinook	Wet Clearwater	SEUMA/SEMEA/SEMOO	167	37.6	102	228
Chinook	Grande Ronde/Imnaha	GRLOS/GRMIN	403	60.8	310	512
Chinook	Grande Ronde/Imnaha	GRLOS	192	33.5	133	259
Steelhead	Clearwater	CRLMA-s	190	29.7	146	247
Steelhead	Clearwater	CRLOC-s	444	69.1	352	576
Steelhead	Clearwater	CRSEL-s	269	35.2	217	340
Steelhead	Clearwater	CRSFC-s	150	26.2	114	208
Steelhead	Grande Ronde River	GRJOS-s	478	67.1	366	618
Steelhead	Grande Ronde River	GRLMT-s	421	70.7	342	566
Steelhead	Grande Ronde River	GRUMA-s	401	48.1	330	502
Steelhead	Grande Ronde River	GRWAL-s	624	150.6	446	888
Steelhead	Imnaha	IRMAI-s	698	124.0	524	925
Steelhead	Lower Snake	SNASO-s	300	103.3	196	502
Steelhead	Lower Snake	SNTUC-s	279	73.5	186	430
Steelhead	Salmon River	MFBIG-s	80	15.8	58	114
Steelhead	Salmon River	SFMAI-s	196	30.0	151	253
Steelhead	Salmon River	SFSEC-s	28	11.8	10	53
Steelhead	Salmon River	SREFS-s	28	12.1	11	51
Steelhead	Salmon River	SRLEM-s	63	15.1	45	91
Steelhead	Salmon River	SRLSR-s	11	5.2	6	17
Steelhead	Salmon River	SRNFS-s	91	17.1	70	124
Steelhead	Salmon River	SRPAH-s	36	13.5	13	66
Steelhead	Salmon River	SRPAN-s	105	17.9	78	143
Steelhead	Salmon River	SRUMA-s	38	14.4	18	70

Appendix C. Spring/summer Chinook Salmon and summer steelhead escapement at Snake River Basin in-stream PIT tag detection system sites for spawn year 2019 with associated SD and 95% CI.

Species	Site	Escapement	SD	Lower CI	Upper CI
Chinook	BRC	134	22.3	93	178
Chinook	BSC	8	6.4	0	21
Chinook	CATHEW	101	21.1	66	146
Chinook	ESS	185	41.7	123	266
Chinook	ESS_bb	60	18.9	33	102
Chinook	FISTRP	7	6.3	0	21
Chinook	GRANDW	14	9.9	2	35
Chinook	HYC	78	18.8	43	117
Chinook	IML	134	28.6	87	184
Chinook	IR1	195	36.1	139	257
Chinook	IR1_bb	12	7.9	0	28
Chinook	IR3	173	33.4	119	230
Chinook	IR3_bb	28	10.5	10	51
Chinook	IR4	144	30.3	99	200
Chinook	IR5	75	19.6	43	112
Chinook	IR5_bb	75	19.6	43	112
Chinook	JOHNSC	123	30.4	78	181
Chinook	KRS	150	37.2	93	223
Chinook	LAKEC	9	6.7	1	24
Chinook	LC1	616	198.0	266	1017
Chinook	LLR	216	30.6	161	280
Chinook	LLR_bb	56	15.7	30	89
Chinook	LOOKGC	51	13.1	30	76
Chinook	LOSTIW	100	20.4	64	139
Chinook	LRL	134	25.2	88	185
Chinook	LRW	80	17.7	48	117
Chinook	LRW_bb	80	17.7	48	117
Chinook	LTR	32	9.4	18	51
Chinook	Main_bb	838	199.6	458	1234
Chinook	MTR	29	9.2	13	46
Chinook	NFS	28	8.3	15	46
Chinook	PAHH	63	18.8	33	104

Species	Site	Escapement	SD	Lower CI	Upper CI
Chinook	PCA	100	18.7	72	137
Chinook	RAPH	5	2.5	2	10
Chinook	RFL	7	5.7	0	18
Chinook	SC1	139	28.2	93	198
Chinook	SFG	542	103.3	410	737
Chinook	SFG_bb	4	5.0	0	16
Chinook	STL	36	14.0	13	64
Chinook	STR	50	17.1	23	82
Chinook	SW1	168	32.1	118	236
Chinook	TAY	174	26.4	127	226
Chinook	TUCH	20	7.7	8	36
Chinook	UGR	142	25.4	100	194
Chinook	UGR_bb	25	12.4	1	48
Chinook	USE	609	93.6	461	785
Chinook	USI	238	50.9	150	346
Chinook	USI_bb	3	3.8	0	11
Chinook	UTR	25	8.7	12	43
Chinook	VC2	100	26.4	53	153
Chinook	WEN	116	22.9	79	164
Chinook	WR1	398	50.1	302	487
Chinook	WR1_bb	209	32.4	153	277
Chinook	WR2	189	30.1	140	249
Chinook	WR2_bb	186	36.5	116	255
Chinook	YFK	25	10.8	6	47
Chinook	ZEN	202	44.6	133	285
Steelhead	ACB	135	53.3	64	241
Steelhead	ACB_bb	91	39.9	42	175
Steelhead	ACM	243	89.7	156	442
Steelhead	ACM_bb	52	29.9	14	116
Steelhead	AFC	41	22.1	12	88
Steelhead	ALPOWC	32	17.3	16	66
Steelhead	ASOTIC	145	58.0	70	258
Steelhead	BHC	14	7.7	3	30
Steelhead	BSC	197	45.9	127	289
Steelhead	CATHEW	36	14.5	12	65

Species	Site	Escapement	SD	Lower CI	Upper CI
Steelhead	CMP	17	14.0	1	48
Steelhead	COC	19	8.2	11	35
Steelhead	CZY	26	13.8	7	56
Steelhead	ESS	103	21.1	66	145
Steelhead	ESS_bb	103	21.1	66	145
Steelhead	FISTRP	21	11.8	4	47
Steelhead	FREEZC	9	8.1	0	26
Steelhead	GEORGC	46	25.2	12	99
Steelhead	GRANDW	94	23.4	54	142
Steelhead	HLM	9	4.2	2	16
Steelhead	HLM_bb	9	4.2	2	16
Steelhead	HYC	11	6.8	1	24
Steelhead	IML	64	22.6	28	110
Steelhead	IR1	677	122.4	518	916
Steelhead	IR1_bb	182	44.9	122	276
Steelhead	IR3	240	53.2	162	348
Steelhead	IR3_bb	126	35.9	70	201
Steelhead	IR4	73	25.2	32	125
Steelhead	IR5	54	19.5	22	92
Steelhead	IR5_bb	54	19.5	22	92
Steelhead	JOC	477	68.0	386	615
Steelhead	JUL	11	4.6	6	20
Steelhead	JUL_bb	2	2.8	0	8
Steelhead	KEN	14	7.5	3	29
Steelhead	KRS	67	17.6	36	102
Steelhead	LAP	177	38.2	133	233
Steelhead	LAP_bb	92	26.6	54	138
Steelhead	LBS	5	4.3	0	14
Steelhead	LC1	2047	786.6	964	3535
Steelhead	LLR	62	14.6	44	91
Steelhead	LLR_bb	11	7.0	0	24
Steelhead	LOOKGC	46	12.7	33	70
Steelhead	LOSTIW	28	14.7	8	60
Steelhead	LRL	448	67.7	341	581
Steelhead	LRW	9	6.5	2	23

Species	Site	Escapement	SD	Lower CI	Upper CI
Steelhead	LRW_bb	4	4.4	0	12
Steelhead	LSHEEF	38	16.8	14	74
Steelhead	LTR	276	75.9	190	413
Steelhead	Main_bb	3588	466.2	2953	4480
Steelhead	MIS	54	17.5	26	86
Steelhead	MTR	263	72.7	172	392
Steelhead	NFS	91	15.9	67	122
Steelhead	PAHH	35	13.3	13	63
Steelhead	PCA	105	18.5	78	141
Steelhead	PENAWC	17	6.1	10	29
Steelhead	RAPH	11	4.1	6	19
Steelhead	SALEFT	28	12.1	9	52
Steelhead	SC1	150	29.4	112	207
Steelhead	SFG	222	29.7	182	290
Steelhead	SFG_bb	24	10.7	5	46
Steelhead	STL	14	8.4	2	31
Steelhead	STR	33	22.4	0	76
Steelhead	SW1	269	39.9	211	341
Steelhead	SWT	30	14.1	8	57
Steelhead	TAY	80	15.9	58	110
Steelhead	TENMC2	6	3.3	3	13
Steelhead	TUCH	59	23.5	24	106
Steelhead	UGR	351	46.8	280	438
Steelhead	UGR_bb	221	36.4	166	300
Steelhead	USE	231	34.9	176	301
Steelhead	USI	109	29.0	56	166
Steelhead	USI_bb	3	3.7	0	11
Steelhead	UTR	146	48.2	81	238
Steelhead	VC2	10	6.7	1	24
Steelhead	WALH	10	8.5	0	28
Steelhead	WEN	421	73.7	326	551
Steelhead	WR1	632	131.0	466	898
Steelhead	WR1_bb	266	64.2	168	394
Steelhead	WR2	366	81.3	254	534
Steelhead	WR2_bb	563	120.6	396	800

Species	**Site**	**Escapement**	**SD**	**Lower CI**	**Upper CI**
Steelhead	YFK	13	8.3	3	32
Steelhead	ZEN	27	11.3	11	54

Appendix D. Spring/summer Chinook Salmon and summer steelhead detection probabilities (Det. p) at Snake River Basin in-stream PIT tag detection system nodes for spawn year 2019 with associated SD and 95% CI.

Species	Node	Obs. Tags	Det. p	SD	CV	Lower CI	Upper CI
Chinook	BRC	30	1.00	0.00	0.00	1.00	1.00
Chinook	BSCA0	1	0.63	0.25	0.39	0.19	1.00
Chinook	BSCB0	1	0.62	0.25	0.41	0.16	0.99
Chinook	CATHEW	21	0.86	0.07	0.08	0.72	0.98
Chinook	CCWA0	24	0.97	0.04	0.04	0.89	1.00
Chinook	CCWB0	24	0.97	0.04	0.04	0.88	1.00
Chinook	ESSA0	47	0.95	0.03	0.03	0.88	0.99
Chinook	ESSB0	45	0.91	0.04	0.05	0.82	0.98
Chinook	FISTRP	1	1.00	0.00	0.00	1.00	1.00
Chinook	HYCA0	17	0.91	0.07	0.08	0.76	1.00
Chinook	HYCB0	18	0.96	0.05	0.05	0.84	1.00
Chinook	IMLA0	33	0.88	0.05	0.06	0.77	0.97
Chinook	IMLB0	34	0.90	0.05	0.05	0.80	0.98
Chinook	IMNAHW	24	0.64	0.07	0.12	0.51	0.81
Chinook	IR1	49	0.97	0.03	0.03	0.91	1.00
Chinook	IR2	48	0.95	0.03	0.03	0.88	0.99
Chinook	IR3A0	23	0.50	0.07	0.14	0.37	0.64
Chinook	IR3B0	46	0.99	0.02	0.02	0.94	1.00
Chinook	IR4A0	37	0.94	0.04	0.04	0.85	0.99
Chinook	IR4B0	37	0.93	0.04	0.04	0.84	0.99
Chinook	IR5A0	21	0.97	0.04	0.04	0.87	1.00
Chinook	IR5B0	18	0.83	0.08	0.09	0.67	0.96
Chinook	JOHNSC	33	1.00	0.00	0.00	1.00	1.00
Chinook	KRS	38	0.95	0.04	0.04	0.87	1.00
Chinook	LAKEC	2	1.00	0.00	0.00	1.00	1.00
Chinook	LC1	9	0.11	0.35	3.31	0.01	0.95
Chinook	LLRA0	49	0.97	0.03	0.03	0.91	1.00
Chinook	LLRB0	50	0.99	0.02	0.02	0.94	1.00
Chinook	LOOKGC	11	1.00	0.00	0.00	1.00	1.00
Chinook	LOSTIW	25	1.00	0.00	0.00	1.00	1.00
Chinook	LRL	16	0.53	0.10	0.19	0.35	0.72
Chinook	LRU	21	0.70	0.10	0.15	0.50	0.90

Species	Node	Obs. Tags	Det. p	SD	CV	Lower CI	Upper CI
Chinook	LRWA0	19	0.97	0.04	0.04	0.86	1.00
Chinook	LRWB0	16	0.82	0.09	0.10	0.63	0.95
Chinook	LTR	7	0.91	0.10	0.12	0.66	1.00
Chinook	MTR	7	0.92	0.10	0.10	0.69	1.00
Chinook	NFSA0	6	0.89	0.12	0.13	0.63	1.00
Chinook	NFSB0	6	0.89	0.13	0.14	0.59	1.00
Chinook	PAHH	16	1.00	0.00	0.00	1.00	1.00
Chinook	PCAA0	25	0.97	0.04	0.04	0.89	1.00
Chinook	PCAB0	25	0.97	0.03	0.04	0.89	1.00
Chinook	RAPH	1	1.00	0.00	0.00	1.00	1.00
Chinook	RFL	1	1.00	0.00	0.00	1.00	1.00
Chinook	SC1	18	0.58	0.11	0.20	0.34	0.78
Chinook	SC2B0	14	0.45	0.10	0.23	0.26	0.66
Chinook	SFG	61	0.43	0.04	0.10	0.34	0.51
Chinook	STL	9	1.00	0.00	0.00	1.00	1.00
Chinook	STR	13	1.00	0.00	0.00	1.00	1.00
Chinook	SW1	27	0.74	0.12	0.17	0.50	0.95
Chinook	SW2	7	0.20	0.07	0.36	0.09	0.35
Chinook	TAYA0	29	0.66	0.09	0.13	0.49	0.81
Chinook	TAYB0	30	0.68	0.08	0.12	0.52	0.83
Chinook	TUCH	6	1.00	0.00	0.00	1.00	1.00
Chinook	UGR	24	0.74	0.07	0.10	0.59	0.87
Chinook	UGSA0	2	0.67	0.23	0.34	0.24	1.00
Chinook	UGSB0	1	0.40	0.23	0.57	0.04	0.85
Chinook	USE	66	0.44	0.06	0.14	0.33	0.57
Chinook	UTR	6	0.79	0.13	0.17	0.50	0.97
Chinook	VC1	15	0.57	0.09	0.16	0.40	0.74
Chinook	VC2	26	0.97	0.04	0.04	0.89	1.00
Chinook	WENA0	22	0.87	0.07	0.09	0.71	0.99
Chinook	WENB0	19	0.75	0.08	0.11	0.58	0.90
Chinook	WR1	64	0.65	0.05	0.07	0.55	0.74
Chinook	WR2A0	40	0.84	0.05	0.06	0.74	0.93
Chinook	WR2B0	28	0.59	0.07	0.11	0.47	0.73
Chinook	YFKA0	6	0.90	0.10	0.11	0.67	1.00
Chinook	YFKB0	5	0.77	0.15	0.19	0.48	0.99

Species	Node	Obs. Tags	Det. p	SD	CV	Lower CI	Upper CI
Chinook	ZENA0	46	0.84	0.05	0.06	0.74	0.92
Chinook	ZENB0	53	0.97	0.03	0.03	0.91	1.00
Chinook	AFCB0	0	0.51	0.28	0.56	0.06	1.00
Steelhead	ACBA0	12	0.69	0.10	0.15	0.49	0.88
Steelhead	ACBB0	11	0.62	0.10	0.17	0.40	0.80
Steelhead	ACMA0	15	0.54	0.09	0.17	0.37	0.72
Steelhead	ACMB0	4	0.15	0.07	0.44	0.05	0.29
Steelhead	AFCA0	5	1.00	0.00	0.00	1.00	1.00
Steelhead	ALPOWC	4	1.00	0.00	0.00	1.00	1.00
Steelhead	ASOTIC	14	0.78	0.10	0.12	0.59	0.94
Steelhead	BHCA0	3	0.82	0.18	0.22	0.42	1.00
Steelhead	BHCB0	3	0.81	0.17	0.20	0.46	1.00
Steelhead	BSCA0	34	0.98	0.03	0.03	0.91	1.00
Steelhead	BSCB0	34	0.98	0.03	0.03	0.91	1.00
Steelhead	CATHEW	6	0.79	0.13	0.16	0.52	0.98
Steelhead	CCWA0	7	0.92	0.11	0.12	0.66	1.00
Steelhead	CCWB0	7	0.92	0.10	0.11	0.68	1.00
Steelhead	CMPA0	2	0.72	0.23	0.31	0.25	1.00
Steelhead	CMPB0	2	0.72	0.22	0.30	0.28	1.00
Steelhead	COCA0	3	0.82	0.17	0.21	0.43	1.00
Steelhead	COCB0	3	0.81	0.18	0.22	0.41	1.00
Steelhead	CZYA0	4	0.86	0.16	0.19	0.48	1.00
Steelhead	CZYB0	4	0.85	0.15	0.18	0.49	1.00
Steelhead	ESSA0	21	0.92	0.06	0.06	0.80	1.00
Steelhead	ESSB0	17	0.76	0.09	0.12	0.57	0.89
Steelhead	FISTRP	3	1.00	0.00	0.00	1.00	1.00
Steelhead	FREEZC	1	1.00	0.00	0.00	1.00	1.00
Steelhead	GEORGC	5	1.00	0.00	0.00	1.00	1.00
Steelhead	HLMA0	2	1.00	0.00	0.00	1.00	1.00
Steelhead	HYCA0	2	0.75	0.21	0.28	0.31	1.00
Steelhead	HYCB0	2	0.76	0.20	0.27	0.33	1.00
Steelhead	IR1	103	0.89	0.03	0.03	0.83	0.94
Steelhead	IR2	99	0.86	0.03	0.04	0.79	0.92
Steelhead	IR3A0	22	0.54	0.08	0.14	0.40	0.68
Steelhead	IR3B0	33	0.80	0.06	0.07	0.67	0.89

Species	Node	Obs. Tags	Det. p	SD	CV	Lower CI	Upper CI
Steelhead	IR4A0	9	0.67	0.12	0.18	0.44	0.91
Steelhead	IR4B0	2	0.18	0.10	0.56	0.03	0.40
Steelhead	IR5A0	11	0.94	0.07	0.08	0.78	1.00
Steelhead	IR5B0	3	0.30	0.12	0.41	0.09	0.55
Steelhead	JOCA0	97	0.96	0.02	0.02	0.92	0.99
Steelhead	JOCB0	93	0.92	0.03	0.03	0.87	0.97
Steelhead	KENA0	3	0.81	0.17	0.21	0.43	1.00
Steelhead	KENB0	3	0.81	0.18	0.23	0.40	1.00
Steelhead	KRS	14	1.00	0.00	0.00	1.00	1.00
Steelhead	LAPA0	35	0.96	0.04	0.04	0.87	1.00
Steelhead	LAPB0	34	0.93	0.04	0.05	0.84	0.99
Steelhead	LBSA0	1	0.70	0.24	0.35	0.19	1.00
Steelhead	LBSB0	1	0.65	0.24	0.37	0.20	1.00
Steelhead	LC1	15	0.14	0.14	0.99	0.05	0.50
Steelhead	LC2	3	0.03	0.05	1.33	0.00	0.13
Steelhead	LLRA0	13	0.95	0.06	0.06	0.81	1.00
Steelhead	LLRB0	12	0.88	0.09	0.10	0.70	1.00
Steelhead	LOOKGC	10	1.00	0.00	0.00	1.00	1.00
Steelhead	LOSTIW	4	1.00	0.00	0.00	1.00	1.00
Steelhead	LRL	51	0.65	0.05	0.08	0.55	0.75
Steelhead	LRU	75	0.95	0.03	0.03	0.89	0.99
Steelhead	LRWA0	2	0.80	0.20	0.25	0.35	1.00
Steelhead	LRWB0	2	0.78	0.19	0.25	0.36	1.00
Steelhead	LSHEEF	6	1.00	0.00	0.00	1.00	1.00
Steelhead	LTR	31	0.73	0.07	0.09	0.59	0.85
Steelhead	MISA0	5	0.82	0.17	0.21	0.47	1.00
Steelhead	MISB0	3	0.51	0.18	0.35	0.16	0.84
Steelhead	MTR	39	0.94	0.04	0.04	0.86	1.00
Steelhead	NFSA0	21	0.97	0.04	0.04	0.86	1.00
Steelhead	NFSB0	21	0.97	0.05	0.05	0.86	1.00
Steelhead	PAHH	9	1.00	0.00	0.00	1.00	1.00
Steelhead	PCAA0	25	0.97	0.04	0.04	0.88	1.00
Steelhead	PCAB0	25	0.97	0.04	0.04	0.88	1.00
Steelhead	PENAWC	3	1.00	0.00	0.00	1.00	1.00
Steelhead	RAPH	2	1.00	0.00	0.00	1.00	1.00

Species	Node	Obs. Tags	Det. p	SD	CV	Lower CI	Upper CI
Steelhead	SALEFT	7	1.00	0.00	0.00	1.00	1.00
Steelhead	SC1	24	0.86	0.08	0.09	0.70	0.98
Steelhead	SC2B0	18	0.64	0.09	0.14	0.47	0.81
Steelhead	SFG	32	0.69	0.07	0.09	0.56	0.81
Steelhead	STL	3	1.00	0.00	0.00	1.00	1.00
Steelhead	SW1	46	0.88	0.05	0.06	0.76	0.96
Steelhead	SW2	37	0.71	0.06	0.09	0.59	0.83
Steelhead	SWTA0	11	0.94	0.08	0.08	0.75	1.00
Steelhead	SWTB0	11	0.94	0.08	0.08	0.76	1.00
Steelhead	TAYA0	17	0.96	0.05	0.06	0.83	1.00
Steelhead	TAYB0	16	0.91	0.07	0.08	0.76	0.99
Steelhead	TENMC2	1	1.00	0.00	0.00	1.00	1.00
Steelhead	TUCH	9	1.00	0.00	0.00	1.00	1.00
Steelhead	UGR	64	0.88	0.04	0.04	0.80	0.94
Steelhead	UGSA0	18	0.92	0.09	0.10	0.71	1.00
Steelhead	UGSB0	8	0.43	0.11	0.25	0.20	0.61
Steelhead	USE	23	0.45	0.10	0.21	0.28	0.65
Steelhead	UTR	21	0.92	0.09	0.10	0.71	1.00
Steelhead	VC1	1	0.49	0.22	0.44	0.12	0.89
Steelhead	VC2	2	0.81	0.20	0.24	0.38	1.00
Steelhead	WALH	1	1.00	0.00	0.00	1.00	1.00
Steelhead	WENA0	66	0.75	0.05	0.06	0.67	0.84
Steelhead	WENB0	81	0.91	0.04	0.04	0.84	0.97
Steelhead	WR1	57	0.54	0.05	0.09	0.44	0.63
Steelhead	WR2A0	46	0.75	0.05	0.07	0.64	0.85
Steelhead	WR2B0	54	0.88	0.04	0.05	0.79	0.95
Steelhead	YFKA0	2	0.62	0.20	0.33	0.20	0.94
Steelhead	YFKB0	3	0.84	0.15	0.18	0.49	1.00
Steelhead	ZENA0	4	0.70	0.17	0.24	0.35	0.96
Steelhead	ZENB0	5	0.86	0.15	0.17	0.53	1.00