Encounter Rates and Catch-and-Release Mortality of Steelhead in the Snake River Basin

A Thesis

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Abstract

Steelhead *Oncorhynchus mykiss* are ecologically, economically, culturally, and recreationally important throughout the Pacific Northwest. The potential influence of recreational fisheries on wild steelhead is poorly understood and is a function of the abundance of wild fish, how many are encountered by anglers (i.e., encounter rate), and the mortality of fish that are caught and released. In Idaho, estimates of wild steelhead encounter rates are derived using the number of wild and hatchery steelhead passing Lower Granite Dam, the number of hatchery steelhead harvested, and the number of hatchery steelhead caught and released. Currently, managers assume hatchery and wild steelhead have equal encounter rates and apply a 5% catch-and-release mortality rate to the portion of the wild steelhead population caught by anglers. I sampled, tagged, and released 1,277 spawn-year 2020 (SY2020) and 2,072 spawn-year 2021 (SY2021) adult steelhead at Lower Granite Dam with T-bar anchor tags and passive integrated transponder (PIT) tags to apply novel methods to estimate hatchery steelhead encounter rates and catch-and-release mortality. Tagged fish moved into fisheries where 312 SY2020 and 639 SY2021 fish were caught and reported by anglers. Estimated encounter rates were 30.2% (95% confidence interval; 22.2, 39.5) for wild fish and 57.4% (20.7, 87.4) for adipose-clipped fish in SY2020. In SY2021, encounter rates were 37.0% (31.9, 43.6) for wild fish and 52.4% (44.9, 59.9) for adipose-clipped fish. Differences in survival of caught steelhead and those not reported as caught were evaluated using detections at various locations (e.g., PIT arrays, weirs). Based on this analysis, catch-and-release mortality of wild fish tagged with high reward tags (i.e., US $100 and $200 tags) was 3.9% (95% credible interval; 0.2, 16.0) and averaged 3.8% (± SE; ± 8.1%) across all reward values. Results of my research provide important information that will be useful in guiding management of hatchery and wild steelhead in Idaho and the region.

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Dedication

This work is dedicated to my parents, Victoria and William Lubenau.

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Thesis Organization

This thesis contains one chapter that addresses encounter rates and catch-and-release mortality of steelhead of the Snake River basin in the northwestern United States.

Introduction

Pacific salmonids *Oncorhynchus* spp. have a complex relationship with their environment and humans (Quinn 2005). The variety of habitat that Pacific salmonids require to complete their life cycle makes them particularly difficult to manage. Anadromous Pacific salmonids cross multiple political boundaries when emigrating to the ocean and returning to freshwater streams to spawn. As a result, state, tribal, and federal agencies must collaborate for management purposes (IDFG 2019). The fact that Pacific salmonids spend a large portion of their life in the ocean further complicates management. Some salmonids are targeted for commercial and recreational harvest, and many are federally protected under the Endangered Species Act (ESA). Conservation of Pacific salmonids is a priority in the Northwest; correspondingly, extensive research has been conducted on their ecology and management.

Steelhead *Oncorhynchus mykiss* are anadromous Rainbow Trout that were once distributed throughout Pacific coastal drainages from northwest Mexico to the Kuskokwim River in Alaska, and spanned into inland systems throughout the Columbia and Snake river basins (MacCrimmon 1971; Busby et al. 1996; Thorpe 1998). The southern extent of their distribution has moved northward, but they remain in much of the Columbia and Snake river basins (Behnke 2002). Variability in anadromy, reproductive biology, and independence of life history execution between generations highlights the notion that *O. mykiss* exhibits the most diverse array of life history strategies of any salmonid. Anadromy allows steelhead to exhibit a growth rate that is much faster than what is typical for resident Rainbow Trout (Robards and Quinn 2002); consequently, the large size of steelhead has made them a popular sport fish in North America.

In 1994, a petition was received by the National Marine Fisheries Service that sought protection for 178 populations of steelhead under the ESA (Busby et al. 1996). The ESA allows for the listing of individual populations if they represent an evolutionary significant unit (ESU) of the species. To qualify as an ESU, the population must be "substantially reproductively isolated" and contribute considerably to the ecological or genetic diversity of the species. When an ESU is identified, factors associated with population abundance are then considered before the listing is warranted. Wild steelhead in the Snake River basin are listed as a distinct population segment, which is similar to an ESU, but indicates protection from the ESA is only designated to the anadromous form of the species (NMFS 1997). Wild steelhead in Idaho, southeast Washington, and northeast Oregon are part of the Snake River basin distinct population segment and receive protection as threatened under the ESA (Busby et al. 1996; NMFS 1997).

The Columbia River basin encompasses over 650,000 km^2 and drains much of the northwestern United States and a portion of British Columbia (USACE 2012). The largest tributary to the Columbia River is the Snake River, which drains 240,765 km^2 or about 36% of the area of the Columbia River basin. The Snake River is believed to have once produced more than half of all steelhead in the Columbia River drainage (Mallet 1974).

All steelhead in the Snake River basin are summer steelhead because they enter the system during the summer months (Robards and Quinn 2002; Copeland et al. 2017). Steelhead in the Snake River basin are classified as either A- or B-run fish (B-run steelhead are typically larger than A-run steelhead; Robards and Quinn 2002; Copeland et al. 2017). Historically, runs have been distinguished by timing of passage over Bonneville Dam (Copeland et al. 2017). Fish that passed Bonneville Dam on or before August 25 were assigned to the A-run category. Fish that passed Bonneville Dam after August 25 were placed in the B-run category; B-run steelhead spawned in select tributaries of the Snake

River (e.g., Clearwater River) in Idaho. Most steelhead in the Columbia River basin are classified as A-run. More recently, the run timing of A- and B-run steelhead at Bonneville Dam has converged, making it difficult to distinguish between the two runs based on passage date alone (Copeland et al. 2017). Significant genetic structure exists in Snake River steelhead populations, although steelhead are not organized by A- and B- run management designations (Nielsen et al. 2011). As such, genetic analyses and fork length have been used to distinguish the two runs in recent years (Copeland et al. 2017).

The Snake River basin is well known for having populations of trophy-sized steelhead, which attracts anglers from around the world. Steelhead must navigate eight dams before reaching Idaho, where they are targeted by anglers in the Clearwater, Salmon, and Snake river systems. Fisheries focus on hatchery steelhead that are released to mitigate negative effects from hydrosystem development and operation (Knoth et al. 2018). Hatchery steelhead are reared at Dworshak National Fish Hatchery, Clearwater Fish Hatchery, Magic Valley Fish Hatchery, Hagerman National Fish Hatchery, and Niagara Springs Fish Hatchery. Additional assistance with trapping and spawning comes from Oxbow, Pahsimeroi, and Sawtooth fish hatcheries. The majority of steelhead produced by hatchery facilities are permanently marked by removal of the adipose fin prior to release as smolts. Returning adults without an adipose fin (i.e., adipose clipped) can be harvested in season; fish with an intact-adipose fin (i.e., wild fish, adipose-intact hatchery fish) must be immediately released.

Catch-and-release angling has become a common practice for many anglers globally (Arlinghaus et al. 2007). Catch-and-release angling can be voluntary because an angler enjoys the recreational act of catching fish without the intention of harvesting fish (Isermann and Paukert 2010). Catch and release can also be regulatory and used as a tool to protect individual populations or to manipulate the quality (e.g., fish size, catch rates) of a fishery. Regulations mandating the release of fish are only effective if the mortality rates of caught-and-released fish are low (Isermann and Paukert 2010; Lamansky and Meyer 2016). Hatchery and wild steelhead are often caught and released by anglers in Idaho. With wild steelhead populations declining in many areas of North America and their current protected status under the ESA, understanding the significance of catch-and-release mortality of steelhead in Idaho is important.

The primary goal of the Idaho Department of Fish and Game (IDFG) regarding steelhead fisheries is to manage and conserve steelhead runs to benefit all users (IDFG 2019). The IDFG is permitted through federal agencies (i.e., National Marine Fisheries Service) to manage fisheries targeting hatchery steelhead such that "impact rates" on wild, Snake River basin steelhead are minimized. As such, IDFG must monitor and report the influence recreational fisheries have on wild steelhead populations to federal agencies. The estimated "impact rates" from recreational fisheries are currently reported at the major population group (MPG) scale. Major population groups in the Snake River basin include steelhead from the lower Snake River, Clearwater River, Grande Ronde River, Salmon River, Imnaha River, Umatilla River, and Walla Walla River. Many wild and hatchery stocks are contained in the MPGs of the Snake River basin (Stark et al. 2021). Reduced runs of steelhead in recent years have heightened concern among some groups about the potential negative effects of angling on wild fish. Threatened litigation from organizations in Idaho and neighboring states regarding the protection of wild steelhead has generated increased attention on wild steelhead and management of the fishery. Thus, developing a better understanding of how recreational steelhead fisheries influence conservation goals associated with wild steelhead populations is critical.

The potential influence of recreational fisheries on wild steelhead populations is a function of the abundance of wild fish, how many are caught by anglers (i.e., encounter rate), and the mortality rate of fish directly resulting from being caught and released. Encounter rates are derived from a series of calculations using the number of wild and hatchery steelhead passing Lower Granite Dam, the number of hatchery steelhead harvested, and the number of hatchery steelhead caught and released (Marshall 2001). To estimate harvest of hatchery fish, IDFG conducts a phone-mail-internet survey (i.e., off-site survey) of anglers following both the autumn and spring steelhead fishing seasons. Ideally, anglers participating in the phone-mail-internet survey have documented records of their seasonal fishing success (i.e., a required harvest permit) readily available for reference when they complete the survey. However, McCormick et al. (2015) found that the off-site survey provided erroneous estimates of steelhead harvest. The proportion of the hatchery steelhead population encountered by anglers (i.e., encounter rate) is estimated by combining the number of hatchery fish harvested (i.e., from the off-site survey) with an estimate of the number of hatchery fish caught and released (i.e., from creel surveys). The IDFG currently assumes that wild and hatchery steelhead have an equal encounter rate; therefore the estimate of the angler-hatchery steelhead encounter rate is applied as the angler-wild steelhead encounter rate (Marshall 2001). This assumption has not been explicitly investigated; however, research on the Clearwater River has shown that anglers overlap much less with the distribution of wild steelhead than with hatchery fish (Feeken et al. 2019). Whether this pattern is consistent in other steelhead fisheries in Idaho remains unknown. After the encounter rate is applied, managers estimate the number of wild steelhead that have died from angling. National Marine Fisheries Service noted in its 4(d) rules for steelhead that research conducted on catch-and-release mortality of steelhead in the northwestern United States and British Columbia showed an average mortality rate below 5% (Marshall 2001). A recent study that used angler-caught steelhead for hatchery broodstock found that angling-related mortality was only 3% in the Clearwater River (Whitney et al. 2019). As such, IDFG incorporates a conservative 5% catch-and-release mortality rate for wild steelhead into their current management plan (Marshall 2001; IDFG 2010).

Current methods for estimating wild steelhead encounter rates and catch-and-release mortality potentially contain multiple sources of error. This research was defined by the National Marine Fisheries Service as an alternative method to validate the encounter rates and catch-and-release mortality rates used to calculate the impact rate of wild steelhead in Idaho (NMFS 2019). To meet management objectives, understanding the influence, or lack thereof, recreational fisheries have on wild steelhead is crucial. Hence, the purpose of my research was to directly estimate angler-wild steelhead encounter rates, discern spatial and temporal patterns in angler-wild steelhead encounters, and estimate the subsequent mortality occurring from catch-and-release steelhead angling in Idaho. This research provides information for the management of recreational steelhead fisheries while enhancing conservation activities for wild steelhead.

Study Area

My research focused on steelhead fisheries in Idaho, including the Clearwater, Snake, and Salmon rivers (Figure 1). However, as a result of the steelhead run composition passing Lower Granite Dam, my work expanded into eastern Oregon and Washington and included the Grande Ronde and Imnaha rivers. The Clearwater River is considered a trophy steelhead fishery and is located entirely in the state of Idaho (NPCC 2003). The Clearwater River from its mouth upstream to the Memorial Bridge of U.S. Highway 12 in Lewiston is open to steelhead fishing from July to April, with July being catch and release only. The Clearwater River upstream of Memorial Bridge, South Fork Clearwater River, and Middle Fork Clearwater River are also open to steelhead fishing from July to April, but the catch-and-release period extends from July to October. The North Fork of the Clearwater River is open to steelhead fishing from September to April without a period limited to catch and release. Portions of the upper Clearwater River drainage are managed as wild steelhead refugia and are closed to angling. The Clearwater River has five distinct wild populations of steelhead and one hatchery stock (Table 1; Copeland et al. 2015).

An important component of the Clearwater River system is the presence and operation of Dworshak Dam. Dworshak Dam was completed in 1973 on the North Fork Clearwater River and lacks fish passage (USFWS 2018). Cold water from Dworshak Reservoir is released from the dam throughout the year. In the summer months, discharge from Dworshak Reservoir serves to reduce temperatures in downstream habitats (i.e., Clearwater River, Snake River) and provides thermal refugia for steelhead and Pacific salmon (Clabough et al. 2006). Many of the steelhead that seek thermal refugia in the Clearwater River are not Clearwater River stocks. As such, populations destined for systems in Washington and Oregon are vulnerable in Idaho fisheries (Feeken et al. 2019).

The Salmon and Little Salmon rivers are managed primarily by the IDFG and are popular steelhead fisheries. The Salmon River from its mouth to the Sawtooth Fish Hatchery is open to steelhead fishing and the Little Salmon River is open from its mouth to the Highway 95 bridge. On both rivers, steelhead seasons open in August and harvest is not allowed until September. Seasons allowing harvest continue through March, April, or May, depending on location. Large portions of the Salmon River drainage (e.g., Middle Fork Salmon River and tributaries) are managed as wild steelhead refugia and are closed to angling. The Salmon River basin has 12 distinct populations of wild steelhead, and six hatchery stocks are released in the basin (Table 1; Copeland et al. 2015).

The Snake River forms a portion of the Idaho border with Washington and Oregon, resulting in cooperative management of its fisheries by the IDFG, tribal agencies, Washington Department of Fish and Wildlife (WDFW), and Oregon Department of Fish and Wildlife (ODFW). Construction of Hells Canyon Dam in 1967 eliminated access to upper reaches and tributaries of the Snake River by anadromous fishes. The Snake River downstream of Hells Canyon Dam to the confluence with the Clearwater River is open to steelhead fishing from August to April. The month of August is limited to catch-and-release angling. The lower Snake River has two wild stocks and two hatchery stocks of steelhead (Table 1; Copeland et al. 2015). Hells Canyon has one hatchery stock that presents an opportunity for anglers to harvest steelhead downstream of Hells Canyon Dam. Wild and hatchery steelhead that spawn in neighboring states (e.g., Grande Ronde River, Imnaha River) must migrate through a portion of the Snake River where they can be encountered by anglers in Idaho.

The Imnaha River is primarily managed by ODFW and the Grande Ronde River is co-managed by ODFW and WDFW. The Imnaha River from its mouth to Big Sheep Creek is open to steelhead angling from September to April and harvest of hatchery steelhead is permitted throughout the season. The Grande Ronde River from the Oregon-Washington border is also open to steelhead angling from September to April and harvest is permitted throughout the season. The Grande Ronde River from its mouth to the Oregon-Washington border is open to steelhead angling from August through April. From its mouth to County Road Bridge, the Grande Ronde River is limited to catch-and-release angling from August to December and harvest is permitted from January to April. Harvest is permitted from August through April from County Road Bridge to the Oregon-Washington border. Hatchery stocks in the Imnaha system include Imnaha, Big Sheep Creek, and Little Sheep Creek steelhead (Table 1; Copeland et. al 2015). Cottonwood, Grande Ronde, and Wallowa hatchery stocks are present in the Grande Ronde system (Table 1; Copeland et. al 2015).

Methods

Fish sampling

Steelhead used in this research were sampled at Lower Granite Dam (Figure 1) using the adult anadromous salmonid trap. Construction of Lower Granite Dam was completed in 1975 at river kilometer 695 from the mouth of the Columbia River (Harmon 2003). Lower Granite Dam is the farthest upstream dam in the Snake River drainage that is passable by anadromous fishes, and has a trap that was built as an integral part of the fish ladder that allows for sampling and handling of adult anadromous salmonids. The Idaho Department of Fish and Game currently uses the trap to obtain representative samples from the steelhead run (Camacho et al. 2018). Run timing data from previous spawn years were used to estimate the proportion of the steelhead population that had passed Lower Granite Dam at a given time. These data were used to prescribe tagging rates. Sampling of spawn-year 2020 (SY2020) steelhead occurred from July 1, 2019, to November 3, 2019, ceased due to winter conditions, and recommenced from March 3, 2020, to March 24, 2020. Sampling protocols restricted the handling of adult anadromous salmonids when water temperatures reached or exceeded approximately 21°C. As a result, trapping did not occur at Lower Granite Dam from September 7 to September 12, 2019. Additionally, SY2020 sampling was designed to occur into April, but concluded early because the trap was closed in response to COVID-19 restrictions and protocols. Spawn-year 2021 (SY2021) sampling occurred from July 2 to November 12, 2020, ceased because of winter conditions, and recommenced from March 3 to April 30, 2021. Aside from periods when winter weather prevented the trap from operating, sampling occurred continuously in SY2021. In both spawn years, steelhead were generally sampled in proportion to the number of steelhead passing Lower Granite Dam daily (Figure 2).

In addition to efforts at Lower Granite Dam, steelhead were sampled with hook-and-line then tagged to ensure the study contained fish that were caught and released at least once. Specifically, a sample of wild steelhead was obtained via hook-and-line sampling in lower river reaches of the Clearwater and Snake rivers. Angling was conducted by project coordinators and technicians using standard techniques.

Fish processing

All steelhead sampled at Lower Granite Dam and by hook-and-line sampling were processed in the same manner. Steelhead were anesthetized using standard methods by project personnel at the start of the processing procedure (Camacho et al. 2018). After the fish were anesthetized, they were initially classified as hatchery or wild based on the presence or absence of an adipose fin. Next, they were examined for external marks, scars, injuries, and external tags. Steelhead were then scanned for internal tags (i.e., passive integrated transponder [PIT] tag, coded wire tag) and fork length was measured. Ten genetically distinct steelhead populations pass over Lower Granite Dam (Copeland et al. 2015). Understanding which stocks received tags and were encountered by anglers in Idaho was important; therefore, a tissue sample was then taken from each fish for stock identification and post hoc genetic analysis to identify origin (Camacho et al. 2018). After biological data were collected, steelhead had one or two T-bar anchor tags affixed to the dorsal pterygiophores (Floy FD-94, Floy Tag Inc., Seattle, Washington; Pine et al. 2012). Tag specifications were modified such that the monofilament portion of the tag was increased to 32 mm and streamer length was decreased to 45 mm. Reward tags and non-reward tags were used in the study to provide an estimate of the reporting rate of tagged steelhead (Nichols et al. 1991; Meyer et al. 2012). Approximately 20% of steelhead were double tagged to estimate tag retention using only non-reward tags (McCormick and Meyer 2018). T-bar anchor tags were labeled with a unique identifying number, the phone number for IDFG's Tag-You're-It (TYI) hotline (Meyer and Schill 2014), and the address for the TYI website. Reward tags were marked with a dollar amount of US$25, $50, $100, or $200. Non-reward tags were not marked with a dollar amount. All tags were used in a manner consistent with the TYI program. After inserting the T-bar anchor tag, the final component of processing was inserting a 12.5 mm 134.2 kHz, full-duplex PIT tag into the pelvic girdle of the fish (Prentice et al. 1990). Some fish already had a PIT tag from other research activities in the basin and did not receive an additional PIT tag. Following the completion of processing, steelhead were placed in a recovery tank and then released to continue their upstream migration.

Tag recaptures

Anglers were the primary source of tag captures and reports. Anglers had the option to report an encountered tag online (https://idfg.idaho.gov/fish/tag/add), by phone (toll free: 1-866-258-0338), or in person at an IDFG office. Information for reporting encounter events was distributed to anglers by creel clerks, and was available at regional IDFG offices and several vendors that issue state fishing licenses. Furthermore, project personnel wrote several articles that were published on the IDFG Wild Salmon and Steelhead Webpage. The articles informed the public of the study and provided regular updates of study progress. Project articles were also shared by IDFG on social media platforms (i.e., Facebook, Instagram). Tagged steelhead were encountered outside of Idaho; therefore, Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife directed anglers to IDFG's tag reporting system. When an angler reported a recovered tag through the TYI system, the angler's contact information, date of capture, number of tags on the fish, and location of where the fish was caught was gathered.

Select angling guides were provided with PIT readers to use when angling for steelhead. The PIT readers were pre-programmed to record a timestamp of detected tags. Angling guides also recorded information on the location of captured steelhead and provided comments on fish condition as needed. Guide-caught fish provided insight on multiple capture events because after fish were caught, processed, and released with a tag, they could be caught a second time and reported by an angler. Close contact with angling guides was maintained to retrieve data from PIT readers on a regular basis.

Passive integrated transponder tags in conjunction with in-stream PIT arrays, Snake River and Columbia River dam PIT arrays, weirs, and hatchery traps provided information used for estimating catch-and-release mortality. In-stream PIT arrays are present in most of the spawning tributaries used by steelhead in the Snake River basin. Furthermore, state and tribal agencies operate weirs and hatchery traps in many locations in the Snake River basin to collect hatchery broodstock and monitor wild steelhead populations. Hatchery personnel and those operating weirs examined all individuals for a T-bar tag, interrogated fish for a PIT tag, and reported any tags to project personnel. Detections of tags by various mechanisms were used to assign a single fate (e.g., survived, kelt, unknown) to each study fish. Caught fish that were detected after being reportedly encountered by an angler were designated as survived. Fish not reported as caught that were detected in the basin were also classified as “survived”. All fish that were detected at a Snake River or Columbia River dam in the spring were assumed to be moving downstream and were classified as “kelts”. All fish that failed to be detected after being processed and released at Lower Granite Dam were classified as having an unknown fate; the “unknown” fate encompassed mortalities and fish that were not detected in the basin. Steelhead reported by an angler as harvested were classified as such.

Some rivers (e.g., South Fork Clearwater River, upper Salmon River) have steelhead fisheries that occur upstream of the uppermost PIT arrays in the system. In such fisheries, caught fish were less likely to be detected after capture because they already moved upstream of most detection mechanisms. Additionally, fish could successfully spawn in many locations where headwater fisheries occur. As such, all fish that were detected at designated PIT arrays before being caught were classified as uncaught and assigned a survived fate for the catch-and-release mortality component of the study.

Data analysis

Reporting rates of tagged fish often vary among locations and species (Meyer et al. 2012). Hence, the study was designed to estimate reporting rates for various reward tags specifically for steelhead in the study region. All adipose-intact hatchery-origin steelhead were excluded from analysis. Foundationally, for a tagged fish to be reported as caught, two things must happen: (1) the fish needs to be encountered and (2) the angler needs to report the tag. As such, the encounter rate can be separated into two probabilities. The first is the probability of encountering a tagged fish (h) and the second is the conditional probability of reporting a tag given the fish was encountered (λ; i.e., reporting rate). Therefore, the joint probability of both encountering and reporting a tagged fish (π) for a particular batch of tags (i) can be described as $\pi_i = h\lambda_i$. The likelihood function for a model of the probability of encountering and reporting a tagged fish is

$$L(\theta) = \prod_{i=1}^{n} \binom{t_i}{y_i} \pi_i^{y_i} (1 - \pi_i)^{t_i - y_i}$$

where n represents the number of reward tag batches released, t_i and y_i denote the number of tagged and reported fish in the i-th batch of tags (i.e., different reward values), respectively, and $\pi_1, \pi_2, \ldots, \pi_n$ are each a specified function of the parameter vector θ. As described previously, each π_i can be separated in to h and λ_i, which are either elements or functions of θ. All tags encountered in fisheries were not likely reported, but reward tags of $100 or more have been shown to elicit a near 100% reporting rate (Nichols et al. 1991; Meyer et al. 2012). Therefore, as the reward value increased, the reporting rate approached one such that

$$\lambda_i = \frac{1}{1 + e^{-(\delta_0 + \delta_1 r_i)}},$$

where λ_i is the reporting rate given a fish was caught, δ_0 and δ_1 are parameters to be estimated, and r_i is the reward amount. Varying reward values were used in the study to provide insight on the relationship between reporting incentive and reporting rate. Additionally, reporting rates for wild fish and adipose-clipped fish were estimated independently, but were assumed to be consistent across MPGs.

Encounter rates (h) of steelhead were estimated on the basin-wide scale and at the MPG scale. When estimating encounter rates at the basin scale, data for all MPGs were pooled and modeled as

$$g(h) = \gamma_0,$$

where g is the natural logarithm of the odds and γ_0 is subsequently the natural logarithm of the odds of encounter, or

$$\log\left(\frac{h}{1-h}\right) = \gamma_0 \text{ and } \; h = \frac{1}{1+e^{-\gamma_0}}.$$

To estimate encounter rates specific to each steelhead MPG (h_j) in the Snake River basin, data were isolated for the Clearwater MPG, Salmon River MPG, and Lower Snake River MPG. Data from Imnaha River and Grande Ronde River stocks were pooled to develop a single encounter rate estimate for both stocks. The model used for basin-wide estimates was generalized to allow for differences in the encounter rate between each MPG, such that

$$g(h_j) = \gamma_0 + \gamma_1 x_{j1} + \gamma_2 x_{j2} + \gamma_3 x_{j3},$$

where j represents a specific MPG, and x_{j1}, x_{j2}, x_{j3} are indicator variables for whether the j-th observation is from the Grande Ronde River and Imnaha River MPGs, Salmon River MPG, or Lower Snake River MPG, respectively. As such,

$$g(h_i) = \begin{cases} \gamma_0, & \text{if the } j\text{-th observation is from the Clearwater River MPG,} \\ \gamma_0 + \gamma_1, & \text{if the } j\text{-th observation is from the Grande Ronde or Imnaha MPG,} \\ \gamma_0 + \gamma_2, & \text{if the } j\text{-th observation is from the Salmon River MPG,} \\ \gamma_0 + \gamma_3, & \text{if the } j\text{-th observation is from the Lower Snake River MPG,} \end{cases}$$

where γ_0, $\gamma_0 + \gamma_1$, $\gamma_0 + \gamma_2$, and $\gamma_0 + \gamma_3$ are the natural logarithm of the odds of the encounter probabilities for the Clearwater River MPG, Grande Ronde and Imnaha River MPGs, Salmon River MPG, and Lower Snake River MPG, respectively. The **bbmle** package (Bolker and R Development Core Team 2020) for R (R Core Team 2020) was used to estimate all parameters of the models described above using maximum likelihood. Standard errors for model parameters and linear functions of the model parameters were based on the inverse of the Hessian matrix.

Encounter and reporting rates were adjusted for tag loss and tagging mortality (McCormick and Meyer 2018). To estimate tag loss, approximately 20% of the fish tagged with non-reward tags were double tagged. When anglers reported a tagged fish, they were asked if their catch contained one or two tags. Tag loss data were pooled for SY2020 and SY2021 fish to develop a tag loss rate for the average days at large (98 days) of steelhead across the duration of the study. The tag loss rate (Tag_l) was estimated as:

$$Tag_l = \frac{n_{DT1}}{(n_{DT1} + 2 \times n_{DT2})},$$

where n_{DT1} is the number of double tagged fish that were encountered and reported as only having one tag, and n_{DT2} is the number of fish encountered and reported as having two tags (McCormick and Meyer 2018). In total, of 617 fish were double tagged across spawn years. Of the double tagged fish, 160 were caught and reported as having both tags intact and 22 were reported as having one tag. Tag loss was 6.4% for the average days at large (~98 days) when data were pooled across spawn years. Given the reduced abundance of Snake River steelhead in recent years, in addition to stringent handling regulations, tagging mortality could not be directly estimated. However, average tagging mortality from proper use of T-bar anchor tags has been shown to be less than 1% in hatchery and wild-origin Rainbow Trout (Meyer and Schill 2014). Therefore, I assumed a tagging mortality rate of 1%, which is likely conservative since steelhead seem to be more robust than their non-anadromous counterparts.

Passive integrated transponder arrays and weirs documented survival to upstream reaches and allowed me to compare the fates of wild steelhead not reported as caught to those that were reported as caught and released in fisheries. To obtain an estimate of catch-and-release mortality for steelhead, detection data were pooled across spawn years. Catch-and-release survival (S_{CR}) was estimated as:

$$S_{CR} = \frac{(N_{CR-D} \times N_{NC})}{(N_{CR} \times N_{NC-D})},$$

where N_{CR-D} is the number of fish that were reported as caught by anglers that were subsequently detected at PIT arrays or weirs, N_{NC} is the total number of tagged fish that were not reported as caught, N_{CR} is the total number of fish tagged that were reported as caught, and N_{NC-D} is the total number of fish that were not reported as caught and were subsequently detected at PIT arrays, weirs, or hatcheries. Catch-and-release survival was converted to mortality by subtracting survival estimates from one. An important assumption of this model is that caught and uncaught fish have the same probability of being detected in the basin. Catch-and-release mortality is typically viewed as a fixed parameter for a species. As such, catch-and-release mortality data were pooled across spawn years to develop a single, robust estimate. The innate bias in estimates resulting from non-reporting of tags was examined by independently estimating catch-and-release mortality for each group of fish tagged with a specific reward value. Adipose-clipped steelhead are subject to direct harvest and were excluded from catch-and-release mortality analysis.

Results

In total, 3,351 steelhead were tagged with T-bar anchor tags of various reward levels at Lower Granite Dam over two spawn years (Table 2). In SY2020, 1,277 steelhead were tagged; 2,072 steelhead were tagged in SY2021. Fork lengths of tagged fish varied from 49 cm to 87 cm in SY2020 and from 48 cm to 93 cm in SY2021. Of the SY2020 fish sampled, 872 were wild, 190 were adipose-intact hatchery-origin fish, and 215 were adipose-clipped hatchery-origin fish. Preliminary analysis of SY2020 data suggested an increase in the sample size of adipose-clipped fish was needed to produce better estimates of reporting and encounter rates. In SY2021, 842 of the tagged steelhead were wild fish, 183 were adipose-intact hatchery-origin fish, and 1,034 were adipose-clipped hatchery-origin fish. Tagged wild fish in both spawn years consisted of 10 genetically distinct stocks including Lower Snake River, Lower Clearwater River, South Fork Clearwater River, Upper Clearwater River, Lower Salmon River, South Fork Salmon River, Middle Fork Salmon River, Upper Salmon River, Grande Ronde River, and Imnaha River steelhead. Two adipose-intact SY2020 fish and 13 adipose-intact SY2021 fish were excluded from the analysis because they could not be genotyped. Tagged adipose-clipped fish consisted of 22 hatchery releases from two release years (2016 and 2017) in SY2020 and 24 hatchery releases from three release years (2016, 2017, and 2018) in SY2021.

In total, 312 SY2020 steelhead were caught and reported (204 wild fish, 56 adipose-intact hatchery fish, and 52 adipose-clipped fish). In SY2021, 639 fish were caught and reported (237 wild fish, 66 adipose-intact hatchery fish, and 333 adipose-clipped fish). An additional three adipose-intact fish of unknown origin were encountered by anglers in SY2021. In both spawn years, all wild stocks represented in tagging efforts were encountered in the fishery. In SY2020, 19 of the 24 adipose-clipped hatchery stocks tagged were encountered by anglers. Similarly, 19 of the 22 adipose-clipped hatchery stocks tagged in SY2021 were encountered by anglers. The highest numbers of wild and adipose-clipped fish were reported as caught in the Snake, Salmon, and Clearwater rivers (Figure 3). Approximately 76% of reported wild steelhead in SY2020 and 59% of reported wild steelhead in SY2021 were encountered in the Snake River between Lower Granite Dam and Hells Canyon Dam, and in the Clearwater River downstream of Orofino Bridge. More specifically, the highest numbers of wild fish were encountered in the Snake River from the Idaho-Washington border to the Salmon River in SY2020 (32% of the total wild fish reported), and in the Clearwater River from its mouth to Memorial Bridge in SY2021 (20% of the total wild fish reported).

Estimated non-reward tag reporting rates for Snake River basin steelhead were 67.9% (95% confidence interval; 53.1, 79.8) for wild fish and 48.1% (39.7, 56.7) for adipose-clipped fish when data were pooled across spawn years (Table 2). Independent estimates of non-reward tag reporting rates in SY2020 were 70.9% (44.9, 88.0) for wild fish and 34.6% (15.2, 61.1) for adipose-clipped fish. Similar rates for non-reward tag reporting were estimated in SY2021 for wild fish (69.7%; 52.2, 83.0). Reporting rates for adipose-clipped fish were higher in SY2021 (50.7%; 41.5, 59.9) than in SY2020 (34.6%; 15.2, 61.1).

Encounter rates were estimated for wild and adipose-clipped fish at multiple scales (Figure 4). Across spawn years, encounter rates were 34.9% (95% confidence interval; 29.0, 41.2) for wild fish and 52.8% (45.1, 60.3) for adipose-clipped fish. Encounter rates were

30.2% (22.2, 39.5) for wild fish and 57.4% (20.7, 87.4) for adipose-clipped fish in SY2020, and 37.0% (31.9, 43.6) for wild fish and 52.4% (44.9, 59.9) for adipose-clipped fish in SY2021. Based on the model that allowed variation in encounter rates by MPG, encounter rates for all wild steelhead MPGs in the basin were similar when data were pooled across spawn years and estimated independently by spawn year (Figure 4). Encounter rates for SY2020 adipose-clipped fish MPGs could not be estimated due to the small sample size. In SY2021, adipose-clipped fish encounter rates by MPG notably varied from 46.7% (36.7, 56.9) for the Salmon River to 62.0% (50.8, 72.8) for the Clearwater River. Likely because SY2021 fish composed much of the adipose-clipped data, MPG-specific encounter rates when data were pooled for adipose-clipped fish across spawn years were similar to those of SY2021.

Excluding harvested fish, all wild study fish that were used to estimate encounter and reporting rates were used in the catch-and-release mortality component of the study. In general, fates of steelhead reported as caught and those not reported as caught were similar between spawn years (Table 3). However, in both spawn years, a higher percentage of caught fish (65.7% in SY2020, 71.5% in SY2021) were known to have survived compared to those not reported as caught (62.1% in SY2020, 66.6% in SY2021). Nearly half of the adipose-clipped fish that were encountered in SY2020 and approximately 80% of the adipose-clipped fish encountered in SY2021 were reported as harvested. Therefore, adipose-clipped fish were excluded from further analysis. Catch-and-release mortality of wild fish tagged with high reward tags (i.e., $100 and $200 tags) was 3.9% (95% credible interval; 0.2, 16.0) and averaged 3.8% (± SE; ± 8.1%) across all reward values. Catch-and-release mortality estimates were similar for fish tagged with non-reward, $25, and $50 reward tags (Figure 5).

Angled steelhead released with a T-bar anchor tag could potentially be caught, released, and reported more than once. Angling guides, the public, and project personnel caught and released 88 steelhead in SY2020 and 78 steelhead in SY2021 with an intact T-bar anchor tag. Angling guides involved in the study encountered more tagged fish in SY2020 (62 fish) than in SY2021 (28 fish). Additionally, more steelhead were caught and reported twice in SY2020 (22 fish) than in SY2021 (15 fish). One wild steelhead was documented as caught three times in SY2021. No fish were documented as caught more than three times across spawn years. When data were pooled across spawn years, 71% of the steelhead caught twice were detected in the basin and known to have survived both encounters. Fates of steelhead caught twice were comparable to fish that were documented as only being caught once.

Discussion

The Idaho Department of Fish and Game currently uses a sequence of indirect methods to estimate wild steelhead “impact rates” resulting from recreational fisheries. Impact rates on wild fish are a function of angler-wild steelhead encounters and mortality occurring from catch-and release angling. Creel surveys are used to estimate the total number of adipose-clipped steelhead caught and released by anglers, and off-site surveys conducted in the autumn and spring are used to estimate the total number of adipose-clipped steelhead harvested. Surveys results are combined and expanded to estimate an encounter rate for adipose-clipped steelhead in a given spawn year. The encounter rate for wild steelhead is assumed to be equal to the encounter rate of adipose-clipped steelhead. After an encounter rate for wild fish is estimated, IDFG applies a 5% catch-and-release mortality rate to the proportion of the wild steelhead population encountered by anglers. The percentage of the wild steelhead population that died as a result of being caught and released is the estimated impact rate to the wild steelhead population that resulted from a recreational fishery. Several issues are present in the current methodology. First, anglers participating in off-site surveys are assumed to reference a required harvest permit and subsequently provide accurate harvest data. However, McCormick et al. (2015) evaluated the accuracy of angler reporting in off-site surveys by comparing data recorded on harvest permits (i.e., observed during creel surveys) to those reported by the same individuals in the off-site survey. The authors found that anglers who participated in the autumn steelhead fishery overreported harvest by 24%, whereas anglers underreported steelhead harvest by 16% for the spring fishery. Data from creel surveys are notoriously messy and present potential source of error in steelhead encounter rate estimates. Fisheries for Chinook Salmon *Oncorhynchus tshawytscha* are typically short duration (days-weeks), spatially limited, and structured in a manner that promotes efficient monitoring. Nevertheless, McCormick et al. (2012) found that creel surveys in well-monitored Chinook Salmon fisheries in Idaho produce harvest estimates with substantial error. In comparison to Chinook Salmon fisheries, steelhead fisheries occur over a large spatial extent (hundreds of kilometers) and over a long period of time (9-10 months). Consequently, error from steelhead creel surveys is likely much higher than what has been observed for Chinook Salmon fisheries (McCormick et al. 2012). Another major assumption of current methods is that encounter rates of adipose-clipped steelhead and wild steelhead are equal. Feeken et al. (2019) evaluated the distribution of anglers in relation to the distribution of hatchery-origin and wild steelhead in the Clearwater River system. Steelhead were radio tagged and the distribution of anglers was evaluated using creel surveys. The authors identified little overlap in angler-wild steelhead distributions and substantial overlap between anglers and hatchery steelhead. Although the authors did not evaluate encounter rates, their results suggest unequal angler encounter rates for hatchery and wild steelhead. My research used well-established tagging techniques that provided a direct estimate of steelhead encounter rates at multiple scales. I found I could directly estimate encounter rates while accounting for known sources of error. I also showed that anglers encounter wild steelhead less frequently than adipose-clipped steelhead throughout the Snake River basin and that catch-and-release mortality was quite low for wild steelhead. Understanding how recreational fisheries influence wild steelhead allows managers to maximize angling opportunity while enhancing conservation activities for wild steelhead.

Encounter rates between anglers and hatchery steelhead were higher than encounter rates for wild steelhead across spawn years. Understanding wild and hatchery steelhead distributions is important because overlap could permit ecological interactions and lead to changes in fisheries management (Mackey et al. 2001). Several studies have evaluated distributions of hatchery and wild steelhead in river systems. Nelson et al. (2005) found that prespawn holding sites for hatchery- and wild-origin steelhead in the Vedder-Chilliwack River, British Columbia, did not differ even though spawning sites differed. Mackey at al. (2001) used radiotelemetry to evaluate spatial distribution of steelhead in Forks Creek, Washington, and found substantial overlap among wild and hatchery steelhead. As previously discussed, Feeken at al. (2019) observed high spatial and temporal variability in the distribution of hatchery and wild steelhead in the Clearwater River system. They reported minimal overlap in the distribution of anglers and wild steelhead across most of the steelhead season, in contrast to substantial overlap between hatchery steelhead and anglers. Furthermore, the authors described the Clearwater River as a “highly compartmentalized fishery” since anglers appeared to directly target steelhead in the North Fork Clearwater

River and near Dworshak National Fish Hatchery; both are areas where hatchery steelhead congregate. Although Feeken et al. (2019) focused on the Clearwater River, my results illustrate that anglers are ~20% more likely to encounter hatchery steelhead as wild steelhead across the entire fishery.

Encounter rates were relatively consistent across spawn years for wild and hatchery steelhead despite major differences in the structure of the fishery. Steelhead angling in the Clearwater River system was closed in SY2020 on September 29, 2019, and reopened on January 1, 2020. The fishery closure occurred because the number of hatchery steelhead forecasted to return to the Clearwater River was less than broodstock needs. Hatchery broodstock requirements were met late in 2019 and the fishery subsequently reopened to provide angling and harvest opportunity. In SY2021, all steelhead fisheries in the Snake River basin were open for typical durations because steelhead abundance increased. Despite changes in regulations, encounter rates of wild fish on the Clearwater River varied by less than 2% across spawn years. Though a slight increase in the basin-wide wild steelhead encounter rate was observed in SY2021, the difference between spawn years was actually quite low (~7%) across all MPGs. The small increase in wild steelhead encounter rates could be a product of increased angling effort or changes in angling behavior. Outdoor recreation was viewed as a safe activity during the COVID-19 pandemic. Hence, angling trips and the number of people participating in angling increased in response to the pandemic (Midway et al. 2021; IDFG unpublished information). The increase in steelhead abundance and angling opportunity, combined with the pandemic likely resulted in higher angling effort in SY2021 compared to a typical year.

Several studies have assessed the influence of angling on steelhead survival and found relatively low mortality rates. Whitney et al. (2019) evaluated the role of angling, specifically fight time and air exposure, on survival and reproduction of steelhead. Study fish were from an ongoing angler-caught hatchery broodstock program on the South Fork Clearwater River, Idaho. The authors reported that mortality resulting from angling was 3% and was not related to fight time or air exposure. In addition, there was no difference in reproductive success between angled fish and fish captured in a hatchery trap. Twardek et al. (2018) radio tagged steelhead from mid-September to early November that were angled in the Bulkley River, British Columbia, to evaluate how angling influenced movement, survival, and a variety of physiological characteristics. The authors reported a mortality rate of 4.5% three days after steelhead were caught and released, 6.0% mortality to the start of winter (several weeks after capture), and 10.5% mortality rate over winter (4-6 months after capture). Numerous studies (e.g., Taylor et al. 2001; Cooke et al. 2003; Aalbers et al. 2004; Vecchio and Wenner 2011) have shown that over 80% of mortality from angling occurs within 24 hours of capture, primarily from deep hooking and(or) damage to vital organs. Thus, short-term estimates (4.5-6.0%) from Twardek et al. (2018) are likely the most representative, but even those are likely biased high. Not only were control fish excluded from the study, it should be noted radio tags were externally attached. Externally mounting tags to steelhead resulted in handling periods beyond what is typical in a catch-and-release angling event. Hooten (1987) used angler-caught steelhead to assess prespawn mortality in the Keogh River, British Columbia. Average catch-and-release mortality was 5.1% for steelhead across gear types, including barbed and barbless hooks, bait, and artificial lures. Average catch-and-release mortality across reward groups in my study was 3.8%, which is a similarly low estimate compared to other studies that have evaluated catch-and-release mortality of steelhead. As such, the 5% assumed by IDFG remains an appropriately conservative mortality estimate for use in making management decisions.

Low catch-and-release mortality of steelhead in the Snake River basin may be attributed to active angling techniques used by steelhead anglers and the year-round presence of cold water in the lower Clearwater River (Bartholomew and Bohnsack 2005). Mixed results have been reported on the role of terminal tackle in catch-and-release mortality of fishes. Pauley and Thomas (1993) reported that natural bait led to higher mortality rates in Coastal Cutthroat Trout *Oncorhynchus clarkii clarkii* compared to artificial lures. Schisler and Bergerson (1996) found similar results in which natural baits resulted in higher catch-and-release mortality in Rainbow Trout when compared to artificial lures. However, Carline et al. (2021) evaluated hooking mortality for three species of trout in the Bald Eagle Creek Trout Tournament, Pennsylvania, and found terminal tackle had no influence on mortality. Regulations throughout the Snake River basin require steelhead anglers to use barbless hooks, which have been suggested to reduce mortality in non-anadromous trout (Taylor and White 1992) and Coho Salmon *O. kisutch* (Gjernes et al. 1993), likely through reduced handling time (Cooke et al. 2001). Most steelhead angling is active (e.g., drifting lures, angling with flies) and hook sets usually occur quickly; active angling techniques typically result in low deep hooking rates (Persons and Hirsch 1994; Twardek et al. 2017). Chiaramonte et al. (2018) found deep hooking rates were low (0-1%) in Idaho’s steelhead fisheries regardless of whether anglers were using bait or artificial lures. Catch-and-release mortality increases with water temperature. Taylor and Barnhardt (1997) found that 9.6% of steelhead caught and released in 8-23°C water from the Mad and North Fork Trinity rivers in

California died. Most of the reported mortalities (83%) occurred when water temperatures were above 21°C. Given the spatial and temporal expanse of steelhead fisheries in the Snake River basin, water temperatures and gear types could not be effectively monitored during my study. However, I conducted a post hoc analysis where I compared catch-and-release mortality of steelhead caught before (i.e., warmer water temps) October 15 to those caught after October 15 (when steelhead harvest is permitted throughout Idaho; cold-water conditions). Mortality estimates between the two periods differed by only 1%.

Some steelhead in this study were caught and released more than once. Thorstad et al. (2019) suggested that repeated captures may have consequences on survival. However, few studies have investigated the occurrence of multiple captures and the influence on survival. Thorstad et al. (2003) evaluated angling procedures and the effects of catch and release on Atlantic Salmon *Salmo salar* in the River Alta, Norway. The authors also addressed the occurrence of multiple captures and found that only 4% of fish marked with T-bar anchor tags were caught more than once in a season. Similar to my research, the authors noted that only one fish was caught three times. Webb (1998) suggested recapture rates for angled Atlantic Salmon in the Aberdeenshire Dee, Scotland, were 5-20% and were similar to the probability of initial capture. Runde at al. (2020) addressed the survival probabilities of four species of marine reef fish after repeated catch-and release. The probability of surviving a catch-and-release event actually increased after the second capture for three of the four species. In my study, 20% of tagged fish caught and released were reported to have been encountered a second time across spawn years. Furthermore, fates of fish caught once and fish caught more than once were nearly identical; 70% of fish caught once were known to have survived and 71% or fish caught more than once were known to have survived. As such, my work suggests steelhead do not experience a drastic increase in mortality as a result of being caught and released more than once.

My research provides valuable information for management of steelhead in the Snake River basin, including popular steelhead fisheries in Washington, Oregon, and Idaho. The method I used provides a direct, reliable estimate of encounter rate across multiple scales. Interestingly, encounter rates were not equal with wild steelhead being encountered at a lower rate than hatchery fish. Also, mortality from catch and release angling is low, suggesting current estimates used by managers are appropriate. The results of this study are widely applicable to other steelhead fisheries and the approach provides a framework for similar research in other systems.

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Tables and Figures

Table 1. Hatchery stocks and wild steelhead populations in the Snake River basin by major population group. Hatchery releases are marked with [u] for unclipped steelhead releases and [c] for clipped steelhead releases.

Wild population	Hatchery broodstock
Lower Snake	
Tucannon River	Tucannon endemic[u], Tucannon[c]
Asotin Creek	
Grande Ronde River	
Lower Grande Ronde	Grande Ronde, Cottonwood AP[c]
Joseph Creek	
Wallowa River	Wallowa[c]
Upper Grande Ronde	
Imnaha River	
Imnaha River	Imnaha, Big Sheep Cr., Little Sheep Cr.[c]
Clearwater River	
Lower Mainstem Clearwater River	Dworshak[c,u],
Lolo Creek	Dworshak[u]
South Fork Clearwater River	Dworshak[c,u], South Fork Clearwater[c,u]
Lochsa River	
Selway River	
Salmon River	
Little Salmon River	Pahsimeroi[c], Upper Salmon B[c], Oxbow[c], Dworshak[c]
South Fork Salmon River	
Secesh River	
Chamberlain Creek	
Lower Middle Fork Salmon River	
Upper Middle Fork Salmon River	
Panther Creek	Pahsimeroi[u]
North Fork Salmon River	
Lemhi River	Pahsimeroi[c]
Pahsimeroi River	Upper Salmon B[u], Dworshak[u], Pahsimeroi[c]
East Fork Salmon River	East Fork Natural[u], Sawtooth[c]
Upper Mainstem Salmon River	Upper Salmon B[u,c], Sawtooth[c], Dworshak[c,u]
Hells Canyon	
Hells Canyon (extirpated)	Oxbow[c]

Table 2. Summary of steelhead tagged at Lower Granite Dam per reward value in spawn year (SY) 2020 and SY2021 and corresponding reporting rates including and excluding fish encountered by angling guides.

Reward value (US$)	Tagged	Tags reported	Reporting rate (%) (95% CI)
SY2020 wild fish			
0	345	71	70.9 (44.9, 88.0)
25	240	53	86.5 (24.8, 99.2)
50	203	60	94.3 (9.6, 100.0)
100	46	6	99.1 (1.0, 100.0)
200	38	14	100.0 (0.1, 100.0)
SY2020 adipose-clipped fish			
0	85	15	34.6 (15.2, 61.1)
25	55	14	42.0 (15.4, 74.2)
50	57	15	53.2 (16.1, 87.1)
100	9	4	73.7 (16.0, 97.6)
200	9	4	94.5 (14.2, 99.9)
SY2021 wild fish			
0	342	82	69.7 (52.2, 83.0)
25	171	45	79.2 (44.0, 94.9)
50	180	60	88.1 (38.6, 98.9)
100	70	24	96.5 (25.9, 100.0)
200	79	26	99.7 (8.0, 100.0)
SY2021 adipose-clipped fish			
0	413	101	50.7 (41.5, 59.9)
25	205	64	64.9 (52.2, 75.9)
50	217	81	77.4 (60.9, 88.3)
100	98	46	92.2 (74.7, 97.9)
200	101	44	99.3 (91.0, 99.9)

Table 3. Summary of the fates assigned to steelhead reported as caught and those not reported as caught by origin and spawn year (SY). Fish detected at a Snake River or Columbia River dam in the spring of 2020 and 2021 were assumed to be moving downstream and were classified as kelts. The unknown fate encompasses mortalities and fish that were not detected after being tagged.

	Not reported as caught		Reported as caught	
Fate	Number	Percent	Number	Percent
Wild fish SY2020				
Detected at an array, weir, or hatchery	259	38.6	85	42.3
Kelt	158	23.5	47	23.4
Harvested	0	0.0	0	0.0
Unknown	254	37.9	69	34.3
Adipose-clipped fish SY2020				
Detected at an array, weir, or hatchery	72	43.4	9	18.4
Kelt	13	7.8	2	4.1
Harvested	0	0.0	22	44.9
Unknown	81	48.8	16	32.7
Wild fish SY2021				
Detected at an array, weir, or hatchery	270	44.2	108	46.8
Kelt	137	22.4	57	24.7
Harvested	0	0.0	3	1.3
Unknown	204	33.4	63	27.3
Adipose-clipped fish SY2021				
Detected at an array, weir, or hatchery	317	44.2	13	4.1
Kelt	31	4.3	4	1.3
Harvested	0	0.0	255	80.4
Unknown	369	51.5	45	14.2

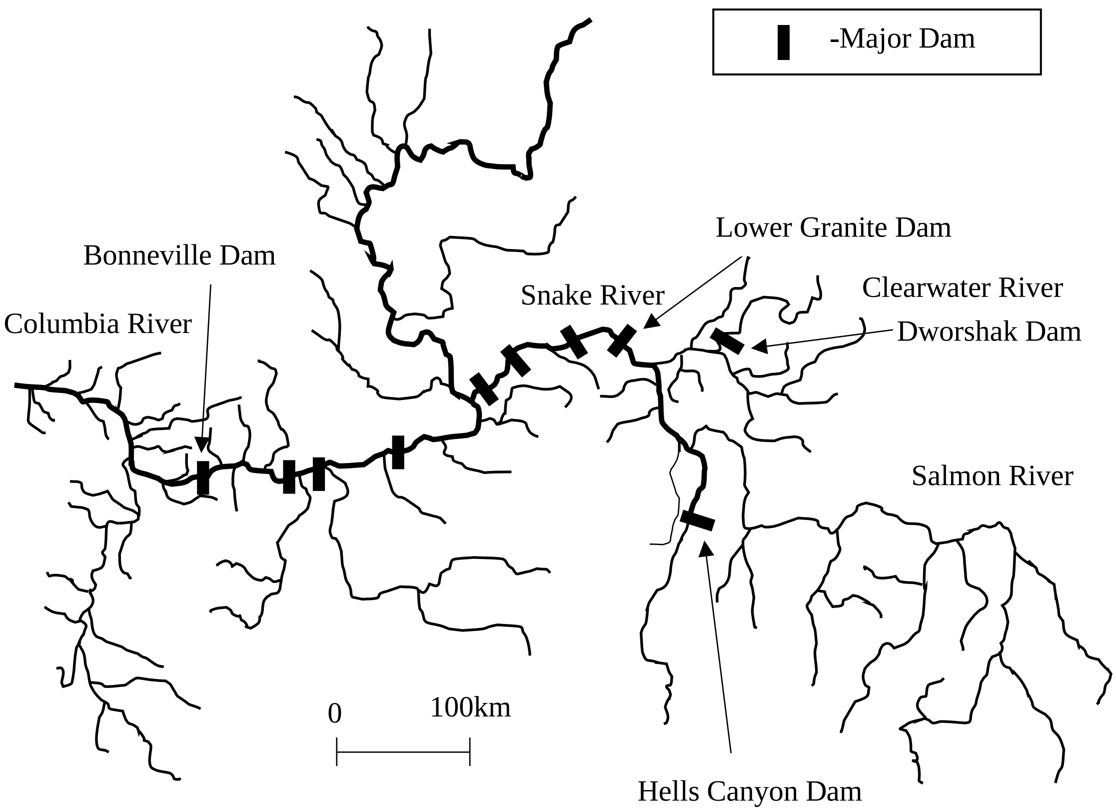

Figure 1. Map of the Columbia and Snake River basins including major dams. The included tributaries to the Salmon and Clearwater rivers currently have an operational passive integrated transponder (PIT) array, weir, or both to monitor steelhead. This map excludes some tributaries with PIT arrays and weirs located in Washington and Oregon.

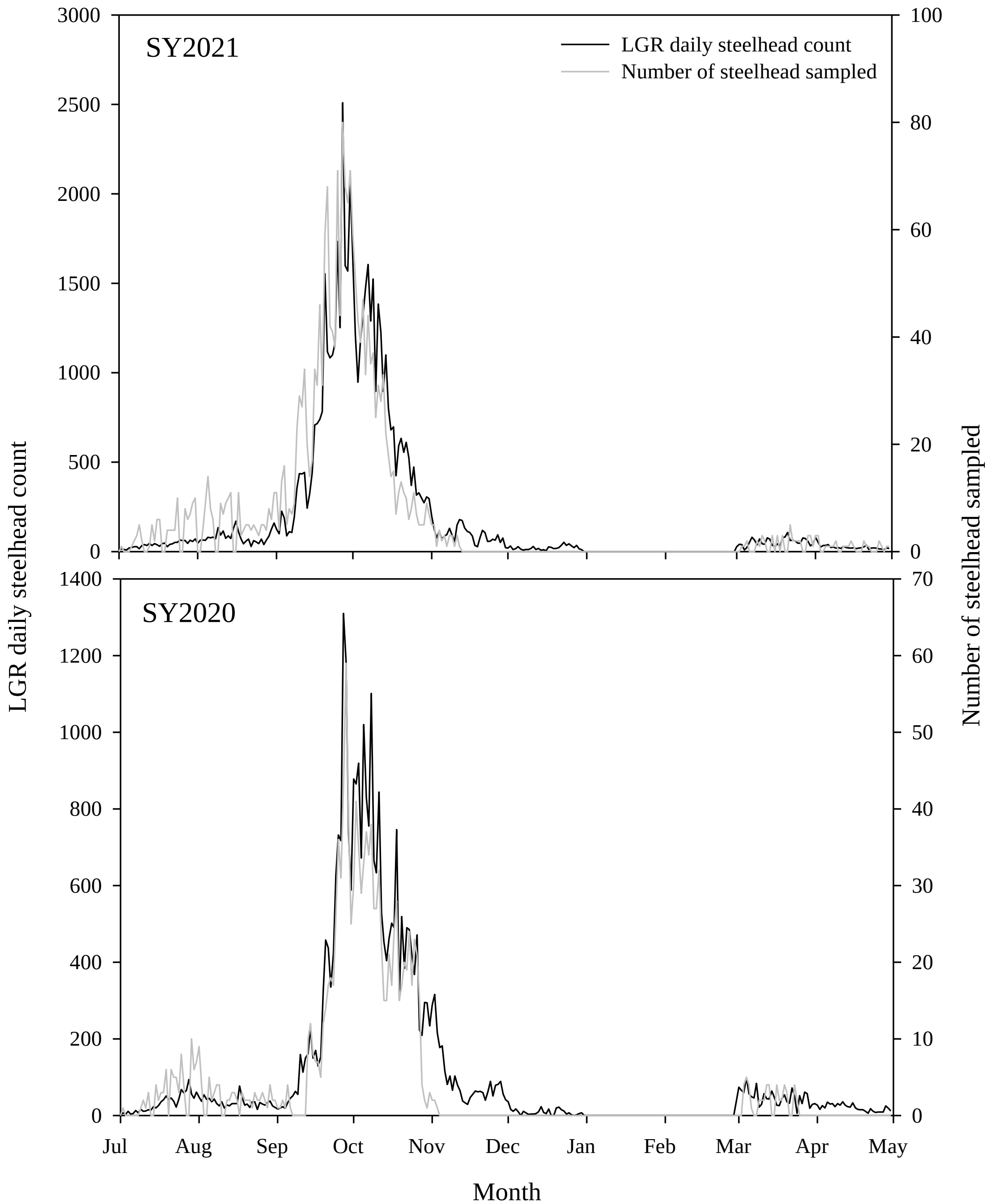

Figure 2. Daily steelhead passage at Lower Granite Dam (black line) and number of steelhead sampled daily (grey line) for spawn year (SY) 2020 (top panel) and SY2021 (bottom panel). Daily steelhead count corresponds to the primary y-axis and number of steelhead sampled daily corresponds to the secondary y-axis.

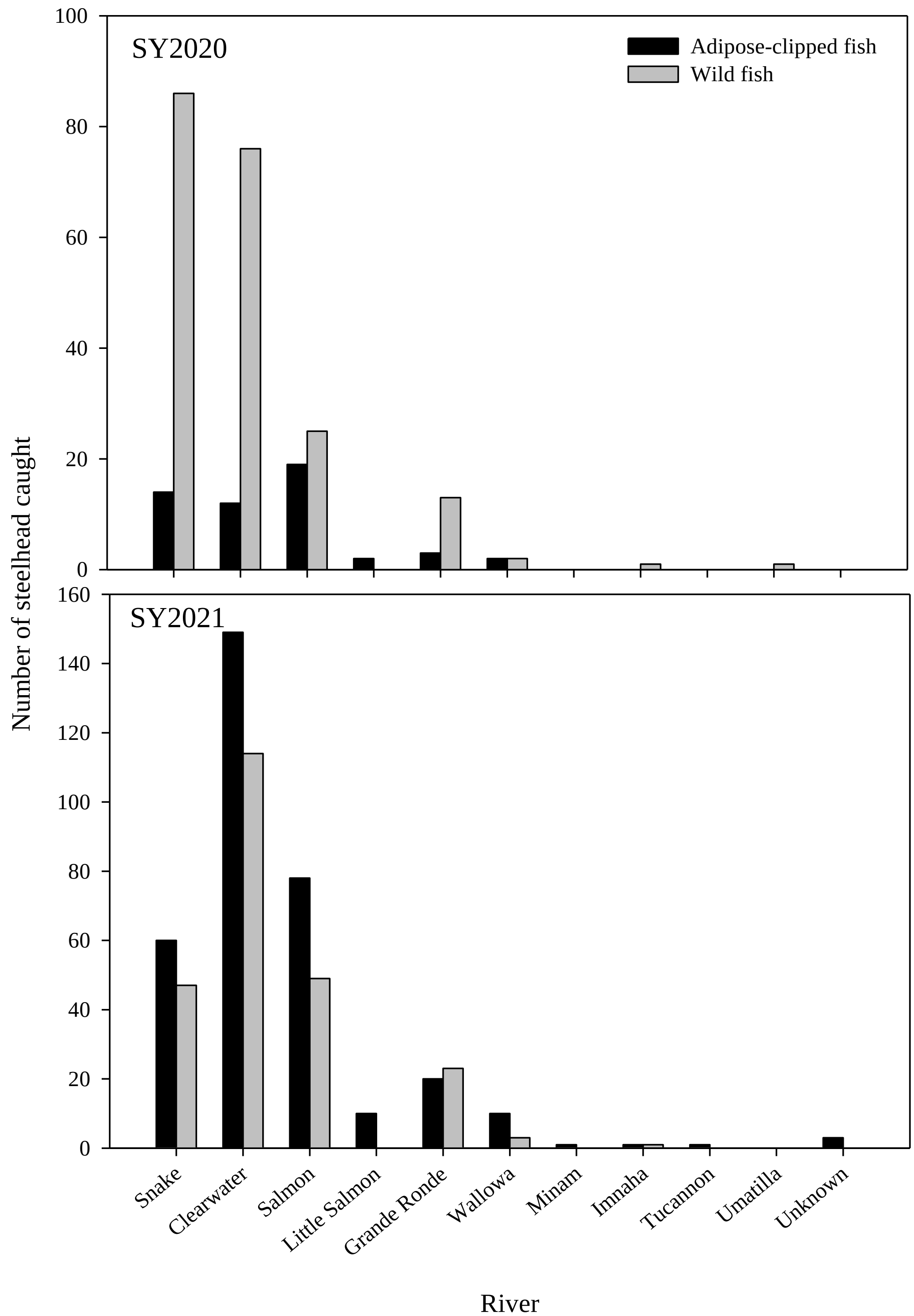

Figure 3. Number of tagged wild steelhead (grey bars) and adipose-clipped steelhead (black bars) caught and reported by river in spawn year (SY) 2020 (top panel) and SY2021 (bottom panel).

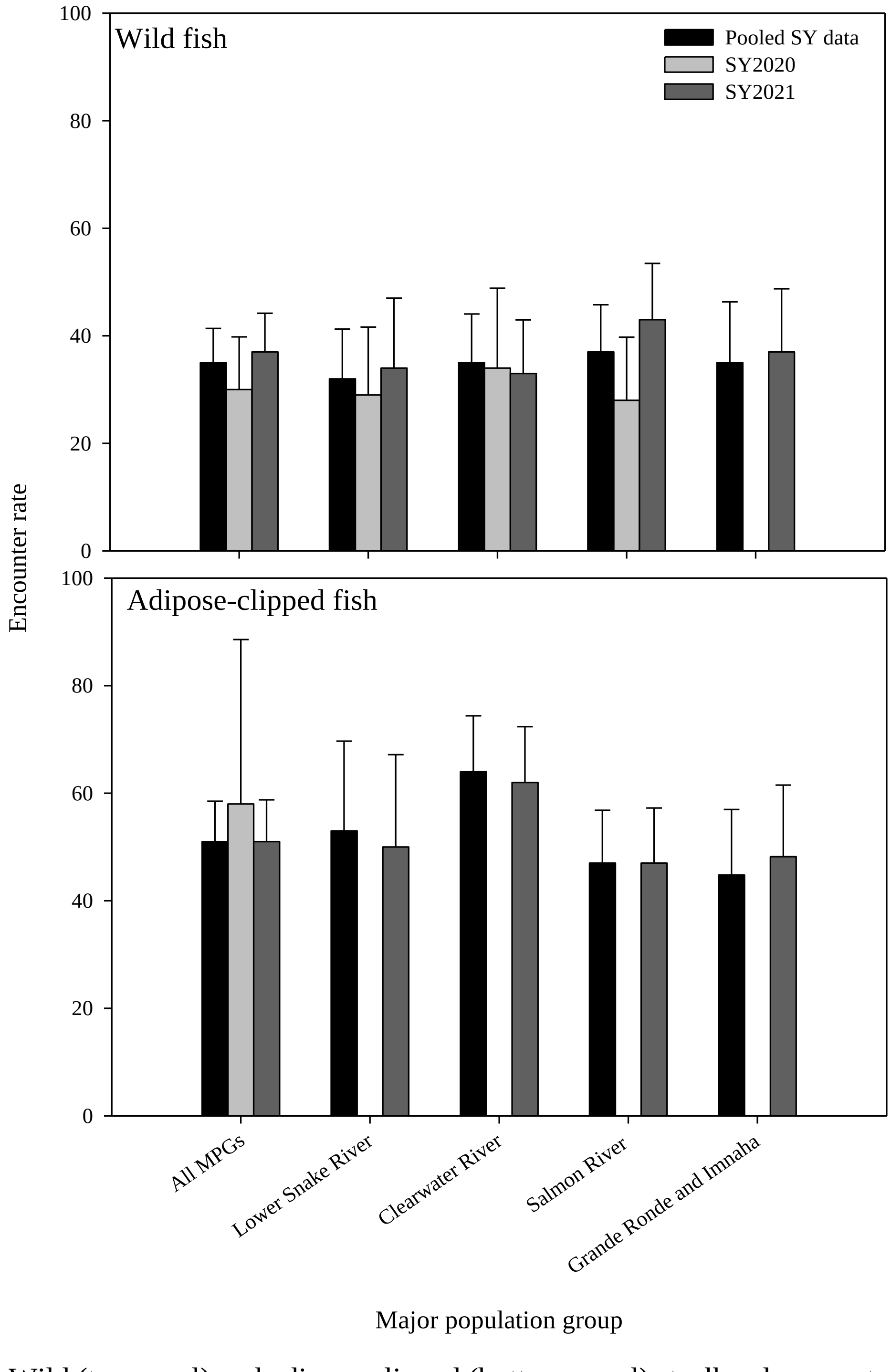

Figure 4. Wild (top panel) and adipose clipped (bottom panel) steelhead encounter rates by pooled spawn year (SY; black bars), SY2020 (light grey bars), and SY2021 (dark grey bars). Error bars represent 95% confidence intervals. Major population group estimates could not be calculated for SY2020 adipose-clipped fish or SY2020 stocks from the Grande Ronde and Imnaha Rivers.

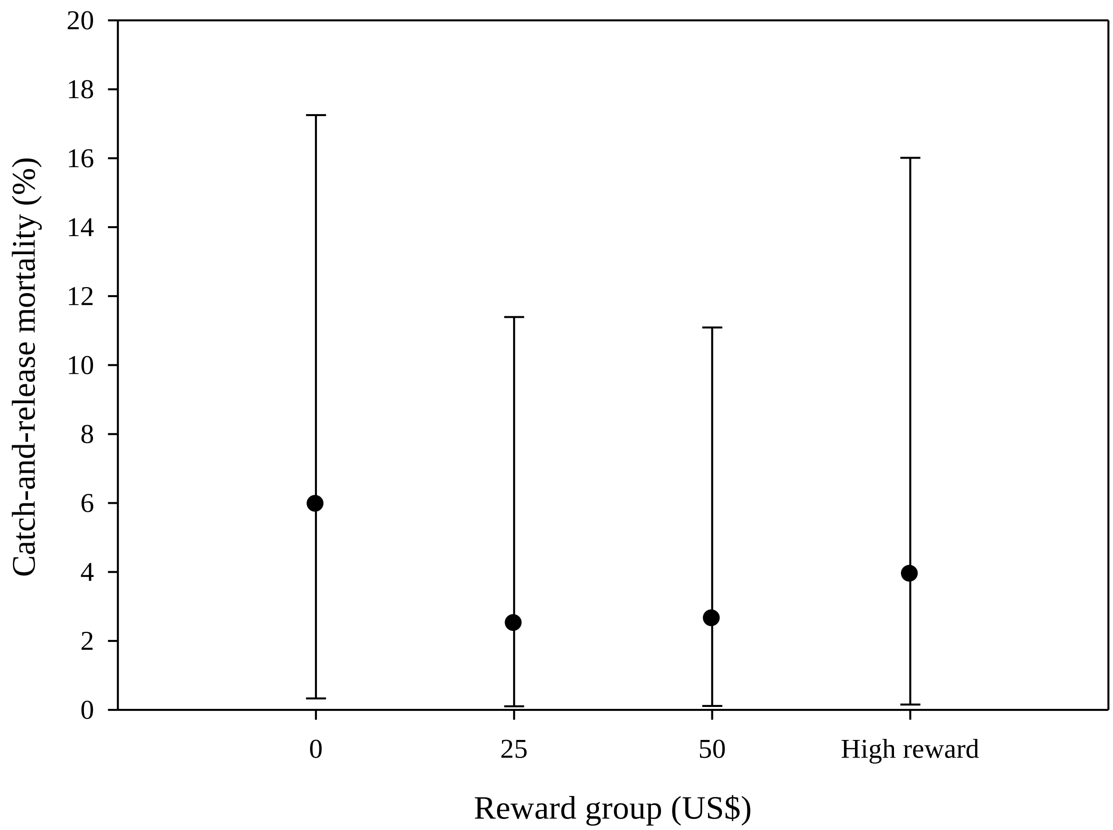

Figure 5. Catch-and-release mortality estimates for wild steelhead in the Snake River basin by reward group using pooled data from spawn year (SY) 2020 and SY2021. The estimate for the high reward group was produced using pooled US $100 and $200 tag data. Error bars represent 95% credible intervals.

Appendices

Appendix A. Number of encounters of wild steelhead in spawn year (SY) 2020 by Idaho Department of fish and Game steelhead management river code, genetic stock identification (GSI) assignment, and month (July 2019 through May 2020). The percentage of the total fish caught by GSI assignment for each value in the table is presented in parenthesis. For example, if a cell in the table is marked as 1 (0.3), then 1 fish was encountered and that individual represents 0.3% of the total fish encountered for the corresponding GSI assignment. The Snake River at its confluence with the Clearwater River and downstream of the Clearwater River was labeled as river code 0. River code 3 (i.e., lower Clearwater River) was subdivided into three smaller sections (i.e., 3A, 3B, 3C). River code 3A extends from the mouth of the Clearwater River to Memorial Bridge, 3B extends from Memorial Bridge to Cherry Lane Bridge, and 3C extends from Cherry Lane Bridge to Orofino Bridge. “SF” represents South Fork and “MF” represents Middle Fork.

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					July						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	1(0.3)	0	1(0.1)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	1 (0.3)	0	1(0.1)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					August						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	1(0.6)	0	0	0	0	0	0	3(1.9)	4(1.3)	0	8(0.9)
3B	0	0	0	0	0	0	1(2.3)	2(1.3)	6(1.9)	1(1.6)	10(1.1)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	1(0.6)	0	0	0	0	0	1(2.3)	5(3.2)	10(3.2)	1(1.6)	18(2.1)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					September						
0	0	0	0	0	0	0	0	0	0	0	0
1	1(0.6)	0	0	0	1(7.1)	0	1(2.3)	0	1(0.3)	0	4(0.5)
2	0	0	0	0	0	0	0	0	0	0	0
3A	3(1.9)	1(2.4)	0	0	0	0	0	1(0.6)	2(0.6)	0	7(0.8)
3B	1(0.6)	0	1(2.1)	0	0	0	0	1(0.6)	4(1.3)	0	7(0.8)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	5 (3.2)	1(2.4)	1(2.1)	0	1(7.1)	0	1(2.3)	2(1.3)	7(2.3)	0	18(2.1)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					October						
0	0	0	0	0	0	0	0	0	0	0	0
1	6(3.8)	0	0	0	0	0	1(2.3)	4(2.5)	10(3.2)	2(3.2)	23(2.6)
2	0	0	0	0	0	1(9.1)	0	1(0.6)	2(0.6)	0	4(0.5)
3A	0	0	0	0	0	0	0	1(0.6)	2(0.6)	1(1.6)	4(0.5)
3B	2(1.3)	0	1(2.1)	1(3.2)	0	0	0	0	1(0.3)	0	5(0.6)
3C	0	0	0	1(3.2)	0	0	0	0	0	0	1(0.1)
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	2(1.3)	1(0.3)	0	3(0.3)
11	3(1.9)	0	0	0	0	0	0	0	0	0	3(0.3)
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	1(9.1)	0	0	0	0	1(0.1)
16	0	0	0	0	0	0	1(2.3)	0	0	0	1(0.1)
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	1(0.6)	0	0	0	1(7.1)	0	0	1(0.6)	5(1.6)	0	8(0.9)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	12(7.6)	0	1(2.1)	2(6.5)	1(7.1)	2(18.2)	2(4.5)	9(5.7)	21(6.8)	3(4.8)	53(6.1)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by River code
					November						
0	0	0	0	0	0	0	0	0	0	0	0
1	4(2.5)	0	0	1(3.2)	0	0	2(4.5)	3(1.9)	15(4.9)	3(4.8)	28(3.2)
2	1(0.6)	0	0	0	0	0	0	1(0.6)	0	0	2(0.2)
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
12	0	0	0	0	0	0	1(2.3)	0	0	0	1(0.1)
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	1(3.2)	0	0	0	0	0	0	1(0.1)
15	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
16	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	3(0.9)	0	3(0.3)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	5(3.2)	0	0	2(6.5)	0	0	3(6.8)	7(4.5)	18(5.8)	3(4.8)	38(4.3)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					December						
0	0	0	0	0	0	0	0	0	0	0	0
1	1(0.6)	0	0	0	0	0	0	0	2(0.6)	3(4.8)	6(0.7)
2	1(0.6)	0	0	0	0	0	0	2(1.3)	2(0.6)	1(1.6)	6(0.7)
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	1(0.3)	0	1(0.1)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	2(1.3)	0	0	0	0	0	0	2(1.3)	5(1.6)	4(6.3)	13(1.5)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					January						
0	0	0	0	0	0	0	0	0	0	0	0
1	1(0.6)	0	0	1(3.2)	0	0	0	0	1(0.3)	0	3(0.3)
2	2(1.3)	0	0	0	0	0	0	1(0.6)	4(1.3)	0	7(0.8)
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	1(2.4)	3(6.3)	0	0	0	0	0	2(0.6)	0	6(0.7)
3C	4(2.5)	1(2.4)	3(6.3)	3(9.7)	0	0	0	1(0.6)	0	0	12(1.4)
4	0	0	0	1(3.2)	0	0	0	0	0	0	1(0.1
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1(2.1)	0	0	0	0	0	0	0	1(0.1)
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1(2.3)	1(0.6)	1(0.3)	0	3(0.3)
11	1(0.6)	0	0	0	0	0	0	0	0	0	1(0.1)
12	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	1(2.4)	0	0	0	0	0	0	0	0	1(0.1)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
Total	8(5.1)	3(7.3)	7(14.6)	5(16.1)	0	0	1(2.3)	5(3.2)	8(2.6)	0	37(4.2)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					February						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1(7.1)	0	0	0	0	0	1(0.1)
2	0	0	0	0	0	0	0	0	1(0.3)	1(1.6)	2(0.2)
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	6(12.5)	2(6.5)	0	0	0	0	0	0	8(0.9)
4	0	1(2.4)	0	0	0	0	0	0	0	0	1(0.1)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	1(1.6)	1(0.1)
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	1(2.4)	6(12.5)	2(6.5)	1(7.1)	0	0	1(0.6)	1(0.3)	2(3.2)	14(1.6)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					March						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	1(0.3)	0	1(0.1)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	1(0.6)	0	1(2.1)	0	0	0	0	0	0	0	2(0.2)
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	1(0.6)	0	0	0	0	0	0	0	0	0	1(0.1)
15	0	0	0	0	0	0	0	2(1.3)	0	0	2(0.2)
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	1(0.3)	0	1(0.1)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	2(1.3)	0	1(2.1)	0	0	0	0	2(1.3)	2(0.6)	0	7(0.8)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					April						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	2(1.3)	0	0	2(0.2)
20	0	0	0	0	0	0	0	1(0.6)	0	0	1(0.1)
Grande Ronde	1(0.6)	0	0	0	0	0	0	0	0	0	1(0.1)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	1(0.3)	0	1(0.1)
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	1(0.6)	0	0	0	0	0	0	3(1.9)	1(0.3)	0	5(0.6)

SY2020	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					May						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0

Appendix B. Number of encounters of wild steelhead in spawn year (SY) 2021 by Idaho Department of fish and Game steelhead management river code, genetic stock assignment (GSI) assignment, and Month (July 2020 through May 2021). The percentage of the total fish caught by GSI assignment for each value in the table is presented in parenthesis. For example, if a cell in the table is marked as 1 (0.3), then 1 fish was encountered and that individual represents 0.3% of the total fish encountered for the corresponding GSI assignment. The Snake River at its confluence with the Clearwater River and downstream of the Clearwater River was labeled as river code 0. River code 3 (i.e., lower Clearwater River) was subdivided into three smaller sections (i.e., 3A, 3B, 3C). River code 3A extends from the mouth of the Clearwater River to Memorial Bridge, 3B extends from Memorial Bridge to Cherry Lane Bridge, and 3C extends from Cherry Lane Bridge to Orofino Bridge. "SF" represents South Fork and "MF" represents Middle Fork.

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					July						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					August						
0	0	0	0	0	0	0	0	0	1 (1.4)	0	1 (0.4)
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	3 (11.5)	0	0	0	0	0	4 (16.0)	3 (9.4)	9(13.0)	0	19 (8.0)
3B	1 (3.8)	0	0	0	0	0	0	1 (3.1)	5 (7.2)	1 (7.1)	8 (3.4)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	4 (15.4)	0	0	0	0	0	4 (16.0)	4 (12.5)	15(21.7	1 (7.1)	28 (11.8)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					September						
0	2 (7.7)	0	0	0	1 (9.1)	0	3 (12.0)	0	0	0	6 (2.5)
1	1 (3.8)	0	0	0	0	0	0	1 (3.1)	1 (1.4)	0	3 (1.3)
2	0	0	0	0	0	0	0	0	0	0	0
3A	1 (3.8)	2 (16.7)	0	0	3 (27.2)	0	3 (12.0)	5 (15.6)	7(10.1)	1 (7.1)	22 (9.3)
3B	1(3.8)	0	0	1 (4.3)	2 (18.1)	0	0	1 (3.1)	1 (1.4)	1 (7.1)	7 (3.0)
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	1 (9.1)	0	0	0	0	1 (0.4)
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	1 (1.4)	0	1 (0.4)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	5 (19.2)	2 (16.7)	0	1 (4.3)	6 (54.5)	1 (9.1)	6 (24.0)	7 (21.9)	10 (14.5)	2 (14.3)	40 (16.9)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					October						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	1 (4.3)	2 (18.1)	1 (9.1)	0	2 (6.3)	1 (1.4)	1 (7.1)	8 (3.4)
2	1 (3.8)	0	0	0	0	0	1 (4.0)	2 6.3)	1 (1.4)	0	5 (2.1)
3A	2 (7.7)	2 (16.7)	0	0	0	0	0	0	1 (1.4)	1 (7.1)	6 (2.5)
3B	0	1 (8.3)	2 (14.3)	2 (8.7)	0	0	0	1 (3.1)	0	0	6 (2.5)
3C	0	0	1 (7.1)	1 (4.3)	0	0	0	0	1 (1.4)	0	3 (1.3)
4	0	0	1 (7.1)	2 (8.7)	0	0	0	0	0	0	3 (1.3)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	2 (18.2)	1 (4.0)	1 (3.1)	0	0	4 (1.7)
11	1 (3.8)	0	0	0	1 (9.1)	0	1 (4.0)	1 (3.1)	2 (2.9)	0	6 (2.5)
12	0	0	0	0	0	0	1 (4.0)	0	0	0	1 (0.4)
13	0	0	0	0	0	0	0	1 (3.1)	0	1 (7.1)	2 (0.8)
14	0	0	0	0	0	2 (18.2)	2 (8.0)	1 (3.1)	0	0	5 (2.1)
15	1 (3.8)	0	0	0	0	0	0	0	1 (1.4)	0	2 (0.8)
16	1 (3.8)	0	0	0	0	0	0	0	0	0	1 (0.4)
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	1 (8.3)	0	0	1 (9.1)	0	0	1 (3.1)	4	1 (7.1)	8 (3.4)
Imnaha	0	0	0	0	0	0	0	0	1 (1.4)	0	1 (0.4)
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	6 (23.1)	4 (33.3)	4 (28.6)	6 (26.1)	4 (36.4)	5 (45.5)	6 (24.0)	10(31.3)	12 (17.4)	4 (28.6)	61

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					November						
0	1 (3.8)	0	0	0	0	0	0	0	0	1 (7.1)	2 (0.8)
1	0	0	0	2 (8.7)	0	0	0	0	5 (7.2)	0	7 (3.0)
2	0	0	0	0	0	0	0	0	1 (1.4)	0	1 (0.4)
3A	0	1 (8.3)	0	0	0	0	0	0	0	0	1 (0.4)
3B	1 (3.8)	0	0	0	0	0	0	1 (3.1)	0	0	2 (0.8)
3C	0	0	2 (14.3)	2 (8.7)	0	0	0	1 (3.1)	1 (1.4)	0	6 (2.5)
4	0	0	1 (7.1)	0	0	1 (9.1)	0	0	0	0	2 (0.8)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	1 (3.8)	0	0	0	0	0	0	2 (6.3)	0	0	3 (1.3)
11	0	0	0	0	0	0	1 (4.0)	0	1 (1.4)	0	2 (0.8)
12	0	0	0	0	0	2 (18.2)	0	0	0	0	2 (0.8)
13	0	0	0	0	0	1 (9.1)	0	0	1 (1.4)	0	2 (0.8)
14	1 (3.8)	0	0	0	0	0	2 (8.0)	0	1 (1.4)	0	4 (1.7)
15	0	0	0	0	0	0	2 (8.0)	0	0	0	2 (0.8)
16	0	0	0	0	0	0	0	1 (3.1)	1 (1.4)	0	2 (0.8)
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	6 (8.7)	1 (7.1)	7 (3.0)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	1 (7.1)	1 (0.4)
Total	4 (15.4)	1 (8.3)	3 (21.4)	4 (17.4)	0	4 (36.4)	5 (20.0)	5 (15.6)	17 (24.6)	3 (21.4)	46 (19.4)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					December						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	1 (9.1)	0	0	1 (3.1)	2 (2.9)	1 (7.1)	5 (2.1)
2	1 (3.8)	0	0	0	0	0	0	2 (6.3)	2 (2.9)	2 (14.3)	7 (3.0)
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	1 (3.8)	1 (8.3)	0	1 (4.3)	0	0	0	0	0	0	3 (1.3)
4	0	0	1 (7.1)	1 (4.3)	0	0	0	0	0	0	2 (0.8)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	2 (7.7)	1 (8.3)	1 (7.1)	2 (8.7)	1 (9.1)	0	0	3 (9.4)	4 (5.8)	3 (21.4)	17 (7.2)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					January						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	2 (2.9)	0	2 (0.8)
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	1 (3.8)	0	0	0	0	0	0	0	0	0	1 (0.4)
3C	1 (3.8)	2 (16.7)	0	3 (13.0)	0	0	0	0	0	0	6 (2.5)
4	0	0	0	2 (8.7)	0	0	0	0	0	0	2 (0.8)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	1 (4.3)	0	0	0	0	0	0	1 (0.4)
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	1 (4.0)	0	0	0	1 (0.4)
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	1 (3.8)	0	0	0	0	0	0	1 (3.1)	2 (2.9)	0	4 (1.7)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	1 (8.3)	0	0	0	0	0	0	0	0	1 (0.4)
Total	3 (11.5)	3 (25.0)	0	6 (26.1)	0	0	1 (4.0)	1 (3.1)	4 (5.8)	0	18 (7.6)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					February						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	1 (7.1)	1 (4.3)	0	0	0	0	1 (1.4)	0	3 (1.3)
4	0	1 (8.3)	1 (7.1)	0	0	0	0	0	0	0	2 (0.8)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1 (7.1)	1 (4.3)	0	0	0	0	0	0	2 (0.8)
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	2 (2.9)	1 (7.1)	3 (1.3)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	1 (8.3)	3 (21.4)	2 (8.7)	0	0	0	0	3 (4.3)	1 (7.1)	10 (4.2)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					March						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	1 (7.1)	0	0	0	0	0	0	0	1 (0.4)
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	2 (14.3)	1 (4.3)	0	0	0	0	0	0	3 (1.3)
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	1 (3.8)	0	0	0	0	0	1 (4.0)	0	0	0	2 (0.8)
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	1	1 (4.0)	0	0	0	2 (0.8)
14	0	0	0	0	0	0	1 (4.0)	1 (3.1)	0	0	2 (0.8)
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	1 (3.1)	0	0	1 (0.4)
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	1 (1.4)	0	1 (0.4)
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	3 (4.3)	0	3 (1.3)
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	1 (3.8)	0	3 (21.4)	1 (4.3)	0	1 (9.1)	3 (12.0)	2 (6.3)	4 (5.8)	0	15 (6.3)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					April						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	1 (3.8)	0	0	0	0	0	0	0	0	0	1 (0.4)
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	1 (4.3)	0	0	0	0	0	0	1 (0.4)
Total	1 (3.8)	0	0	1 (4.3)	0	0	0	0	0	0	2 (0.8)

SY2021	GSI assignment										
River code	Lower Snake	Lower Clearwater	SF Clearwater	Upper Clearwater	Lower Salmon	SF Salmon	MF Salmon	Upper Salmon	Grande Ronde	Imnaha	Total by river code
					May						
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3A	0	0	0	0	0	0	0	0	0	0	0
3B	0	0	0	0	0	0	0	0	0	0	0
3C	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
Grande Ronde	0	0	0	0	0	0	0	0	0	0	0
Imnaha	0	0	0	0	0	0	0	0	0	0	0
Umatilla	0	0	0	0	0	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0