

Prioritization of Instream PIT Tag Detection Systems for Requisite Monitoring of Steelhead and Spring-Summer Chinook Salmon Adult Abundance and Life History, Snake River Basin

Version: December 11, 2024



Snake River Instream PIT-tag Detection Systems Prioritization Workgroup

Primary Contributors: Michael W. Ackerman (NPT), Joseph Bumgarner (WDFW - Retired), Timothy Copeland (IDFG), Ethan Crawford (WDFW), Joseph W. Feldhaus (ODFW), Ryan Kinzer (NPT), Jason Vogel (NPT)

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Suggested Citation:

Snake River Instream PIT-tag Detection Systems Prioritization Workgroup (SR IPTDS PW). 2024. Prioritization of Instream PIT Tag Detection Systems for Requisite Monitoring of Steelhead and Spring-Summer Chinook Salmon Adult Abundance and Life History, Snake River Basin. BPA Project # 2010-057-00.

BACKGROUND

Numerous Instream PIT Tag Detection Systems (IPTDS) have been installed throughout the Snake, upper Columbia, and John Day River basins to support habitat action effectiveness and status and trends monitoring initiatives developed under the Integrated Status and Effectiveness Monitoring Project (ISEMP: BPA project number 2013-007-00). However, when ISEMP was largely defunded in 2017, comanagers identified a subset of IPTDS for which continued operation was of high priority, including in the Snake River basin. Thus, the Integrated IPTDS Operations and Maintenance (O&M) project (BPA project number 2018-002-00) was created to assume O&M responsibilities for a subset of these recommended IPTDS sites. Related, it has not always been clear which IPTDS (i.e., which management, monitoring, or research objectives) should be prioritized and managed under the IPTDS O&M project. Since 2017, numerous additional IPTDS systems have been installed, and more are planned, and thus, an annual process of updating prioritization and direction for the IPTDS O&M project is warranted. Therefore, a group of representatives from the fisheries comanagers in the Snake River basin was convened to address this issue within the basin.

Objectives

Our goal is to provide clarity on research, monitoring, and evaluation (RM&E) objectives and to provide annual recommendations on the direction and application of continued funding of the IPTDS O&M project throughout the Snake River basin, to be continued under Bonneville Power Administration (BPA) project number 2018-002-00 (Project). Here, the primary goal for prioritization and selection of IPTDS is to obtain requisite status and trends information for summer-run steelhead and spring/summer run Chinook salmon populations in the basin, including high-precision monitoring in at least one population per major population group (MPG) following the recommendations of the Anadromous Salmonid Monitoring Strategy (ASMS; CBCAMW 2010). We recognize the importance that all individual IPTDS have and their individual objectives to answer specific fish monitoring and research questions. However, it was the objective of this workgroup to develop a prioritization process to ensure adequate IPTDS throughout the Snake River basin required to obtain adult abundance and life history high-level indicators¹ (HLI; PNAMP 2009), and to recommend them for continued or improved O&M through project 2018-002-00. Ultimately, our aim is to provide a transparent framework to identify the following recommendations and/or outcomes for IPTDS now and into the future:

- 1) Review of existing site locations to ensure adequate ICTRT population monitoring (regardless of funding source),
- 2) Annual review of funding of O&M for IPTDS currently managed under Project 2018-002-00, and recommend changes in funding, if necessary,
- 3) Recommendations for transferring existing sites, not funded under 2018-002-00, to the IPTDS O&M Project whose operation support Project objectives,
- 4) Recommend additional IPTDS to address data gaps or to increase cost-savings,
- 5) Upgrades or modifications to existing sites to improve site reliability or detection probabilities,
- 6) Recommendations for decommissioning, removal of sites, or alternatively, transferring sites not required for adult status and trends population monitoring to other projects whose objectives they support.

¹ HLIs are intended to communicate complex information in easily understood terms. HLIs for salmon include abundance of wild and hatchery spawners, among others (PNAMP 2009). After NOAA's monitoring guidance was completed (e.g., Crawford and Rumsey 2009) it was intended that additional HLIs, e.g., to convey life history information, would be identified for salmon and steelhead.

An intended outcome of this process is to create efficiencies in the O&M of IPTDS (both within and across all projects) while also addressing requisite population monitoring for adult status and trends evaluations. Although recommendations of the workgroup could result in a change in the number of IPTDS operated and/or maintained under the Project, the goal is that overall changes to IPTDS infrastructure and O&M across the landscape remains budget-neutral across a portfolio of projects due to efficiencies in streamlining O&M under the Project.

GENERAL APPROACH

Four general parameters form the key to evaluating a population's viability status: abundance, productivity, spatial structure, and diversity (McElhany et al. 2000). The ASMS recommends the following general guidelines, *among others*, to assess these Viable Salmonid Population (VSP) criteria (CBCAMW 2010):

Abundance

- Annual adult status and trend data should be collected at high intensity monitoring (precision) for *at least* one population per life history type (spring versus summer run) per MPG. This adult monitoring should be invested in populations with high intensity juvenile and smolt abundance monitoring.
- Annual adult status and trend data should be collected at lower intensity monitoring for every population within an MPG.
- Adult monitoring should report abundance and precision (confidence intervals [CI's]) on a yearly basis in a manner that will allow abundance (and certainty levels) to be aggregated at larger spatial scales (e.g., MPG or ESU/DPS).

Productivity

- Annual estimates of adult:adult productivity² and CI's for each population.
- Annual estimates of juvenile and smolt migrants and CI's for at least one population per MPG. Juvenile and smolt monitoring should be done in populations with high intensity adult monitoring to calculate smolts per female (or smolts per spawner).
- For VSP analysis the adult:adult productivity estimate is a higher priority than the adult:juvenile (smolt) productivity estimate.

Spatial Structure

- Periodic surveys of adult and juvenile distribution at the population and/or MPG scale to allow an assessment of the spatial structure and changes.

Diversity

- Periodic sampling of populations for genetic diversity. Sample wild populations on a rotating five-year basis to maintain genetic baselines for genetic stock identification and to evaluate genetic population structure and diversity.
- Periodic monitoring of population phenotypic diversity (e.g., juvenile outmigration timing, adult run timing, spawn timing, age distribution, age at maturity, fecundity, sex ratio, size, and weight).

IPTDS throughout the Snake River basin can be used to monitor adult abundance and productivity directly, as well as spatial structure and diversity, indirectly (supported by genetic and age data collected at Lower

² Examples of adult:adult productivity include adult recruits per adult spawner or lifetime reproductive success.

Granite Dam or elsewhere). As such, we considered these ASMS guidelines for adult monitoring within the following prioritization framework. Juvenile survival and emigration monitoring using IPTDS is currently not considered within the framework.

PRIORITIZATION FRAMEWORK

1. First, we evaluated existing adult status and trends monitoring activities within each Snake River spring/summer Chinook salmon and steelhead population to determine areas with current insufficient monitoring (i.e., data gaps), or with low- or high-precision monitoring (see blue boxes in Figure 1). Descriptions of each are as follows:
 - a. **Data Gap:** Population lacks low-precision or high-precision monitoring activities to calculate HLIs, i.e., the population lacks adult abundance estimates with precision in most years.
 - b. **Low-Precision Monitoring:** Population includes monitoring activities that lack information necessary to calculate HLI precision, the 5-year average coefficient of variation (CV) is $> 15\%$, or the monitoring occurs at a spatial/temporal scale that excludes some fish returning to major spawning areas within the population. Examples of low-precision monitoring include spawning ground surveys, and picket weirs or IPTDS operated upstream of some major spawning areas³.
 - c. **High-Precision Monitoring:** Population includes monitoring activities that provide the necessary information to calculate HLI precision, maintain a 5-year average CV of $\leq 15\%$, and occur at a spatial/temporal scale that includes all fish returning to major spawning areas within the population. Fish returning to minor spawning areas may be excluded. Examples of high-precision adult monitoring include weirs/traps in combination with spawning ground surveys or IPTDS operated downstream of all spawning areas.
2. Next, depending on the current adult monitoring activities within each population (none, low-precision, or high-precision), additional questions were considered to determine an “outcome” (Figure 1). Questions considered whether other populations within the same MPG were monitored using high-precision monitoring, whether IPTDS was the sole monitoring method within the population, whether low-precision monitoring was an option, and/or whether redundancy in monitoring was desired or necessary. Each set of questions and answers leads to an “outcome” (Figure 1). Questions for each population given current levels of monitoring include:
 - a. **Data Gap:** The ASMS suggests that low-intensity monitoring should be conducted for every population within an MPG. Thus, populations identified as a “data gap” should be considered as a candidate for IPTDS monitoring and/or other low-precision monitoring methods.
 - b. **Low-Precision Monitoring:** For populations with current low-precision adult monitoring, we consider up to three questions:

³ Genetic-based effective population size monitoring (e.g., Bowersox et al. 2022, Hargrove et al. 2022, Ackerman et al. 2017) is another potential example of low- or high-resolution monitoring; however, estimates of effective population size or effective number of breeders must be converted to abundance which is still a relatively new and unvalidated technique.

- i. Does any other population within the same MPG receive high-precision monitoring?
 - ii. Is the population monitored using only IPTDS?
 - iii. Is an alternate low-precision monitoring method feasible?
- c. **High-Precision Monitoring:** For populations with current high-precision adult monitoring, we consider up to five questions:
- i. Is the population currently monitored using IPTDS?
 - ii. Does any other population within the same MPG receive high-precision monitoring?
 - iii. Is IPTDS the only high-precision monitoring method used in the population?
 - iv. Is an alternate low-precision monitoring method feasible?
 - v. Is redundancy of two high-precision methods necessary e.g., for method validation, fish-handling, etc.?

Depending on the “Yes/No” answers to each of these questions, there are four possible “outcomes” illustrated and described in Figure 1 and Table 1.

Table 1. Potential population-level outcomes resulting from the initial step of the prioritization framework. *Red* = IPTDS(s) within population is candidate for decommissioning, removal, or transfer from project 2018-002-00; *yellow* = further considerations needed; *green* = IPTDS should be operated under project 2018-002-00.

Outcome	Description
Consider IPTDS for decommissioning, removal, or transfer from O&M project; keep other monitoring method	Outcome is for populations that either a) occur within an MPG in which another population is monitored using a high-precision method, high-precision monitoring is not desired, AND is monitored using another low-precision method, or b) is monitored using two redundant, high-precision methods including IPTDS and redundancy is not necessary. This outcome can also occur for populations where IPTDS are currently not operated, and thus, no action is needed.
Population is candidate for IPTDS O&M project	Outcome is for populations with currently no monitoring (i.e., data gaps) or for a population within an MPG that includes no populations with high-precision monitoring. ⁴
Keep IPTDS or consider an alternative low-precision method	Outcome is for populations that currently experience high-precision IPTDS monitoring but occur within an MPG in which two or more populations are monitored using high-precision methods.
Include necessary IPTDS on O&M project	The population should continue to be monitored using IPTDS funded under the Integrated IPTDS O&M project. Three paths in Figure 1 lead to this outcome. In general, this outcome is for populations in which current IPTDS are necessary for either low-precision or high-precision monitoring.

⁴ For spring/summer Chinook salmon, annual adult status and trend data should be collected at high-intensity monitoring for at least one population per run-type (spring versus summer-run) within each MPG (CBCAMW 2010).

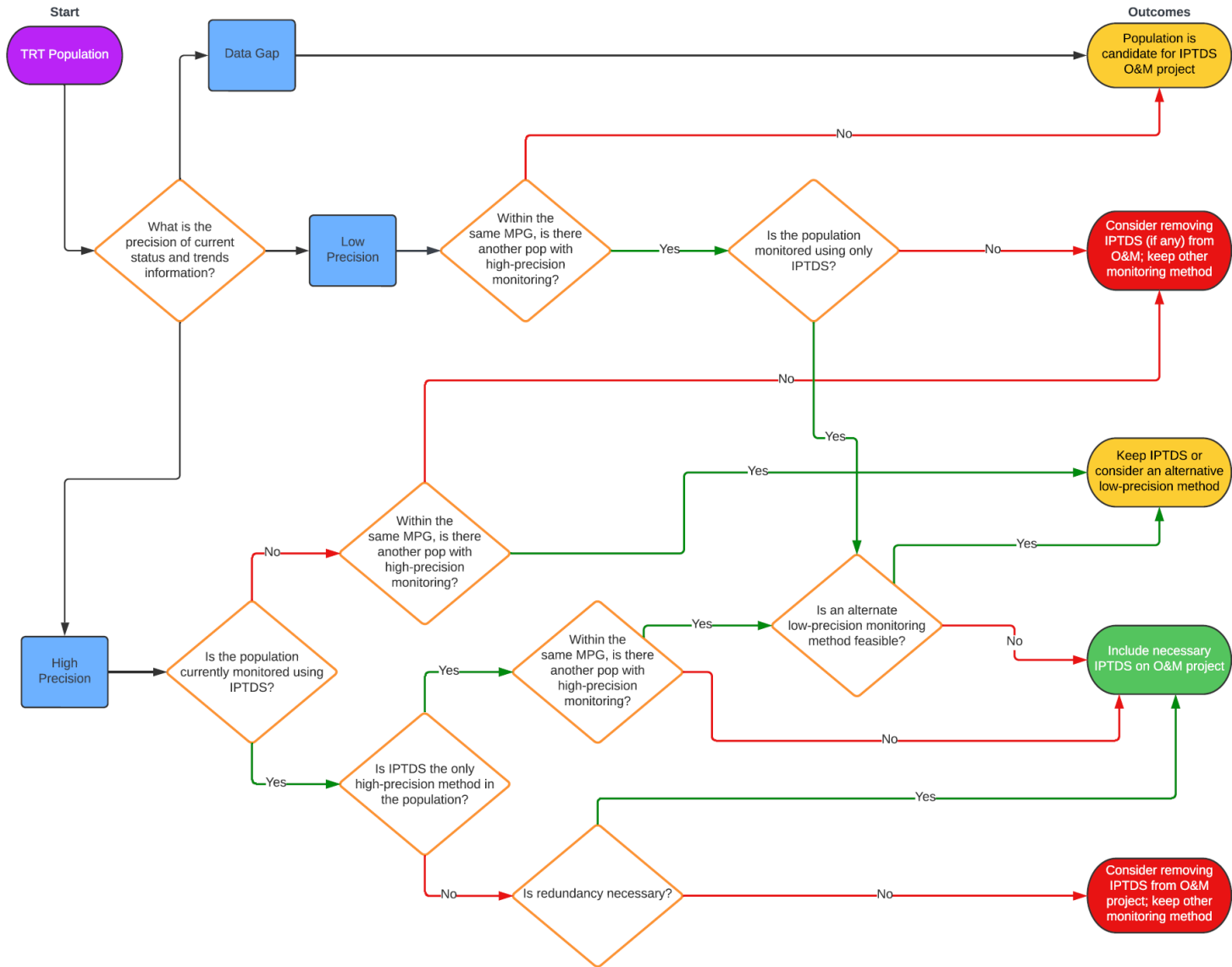


Figure 1. Flowchart to determine monitoring needs for each Snake River spring/summer Chinook salmon and steelhead population, and whether IPTDS in each population should be considered for inclusion in BPA project 2018-002-00. Outcome colors are as follows: **Red** = IPTDS(s) within population is candidate for decommissioning, removal, or transfer from project 2018-002-00; **yellow** = further considerations needed; **green** = IPTDS should be operated under project 2018-002-00.

3. Finally, for each extant population, we further considered which IPTDS site(s) within the population are necessary for status and trends monitoring (low- or high-precision) and recommended for inclusion in project 2018-002-00 (Figure 2). Definitions and descriptions in Table 2 are provided to aid in interpretation of Figure 2.

Table 2. Definitions or descriptions that may be useful for interpretation of Figure 2.

Term	Definition or Description
Nodes	A node is made up of a single, or group of, antenna(s) that form an independent PIT-tag detection location, oftentimes an array, and can be ordered in reference to other nodes in the stream network.
Unbiased / Independent	IPTDS sites and/or nodes are independent if the probability of detecting a tag at one location is independent of detection at another site or node. For example, two nodes (e.g., arrays) within a short distance of each other (e.g., less than 50 meters) may not be independent if marked fish are not mixing with unmarked fish between the nodes.
Reliable	The site has operated continuously (or near continuously) through the adult migration period for each of the last five years for spring/summer Chinook salmon and steelhead. Here, we define “reliable operation” of a node as its antennas operating or detecting virtual test tags for greater than 75% of the steelhead and/or spring/summer Chinook salmon spawning run, averaged across antennas. However, project proponents may need to re-evaluate criteria for reliable operations, and criteria may vary by species and location.

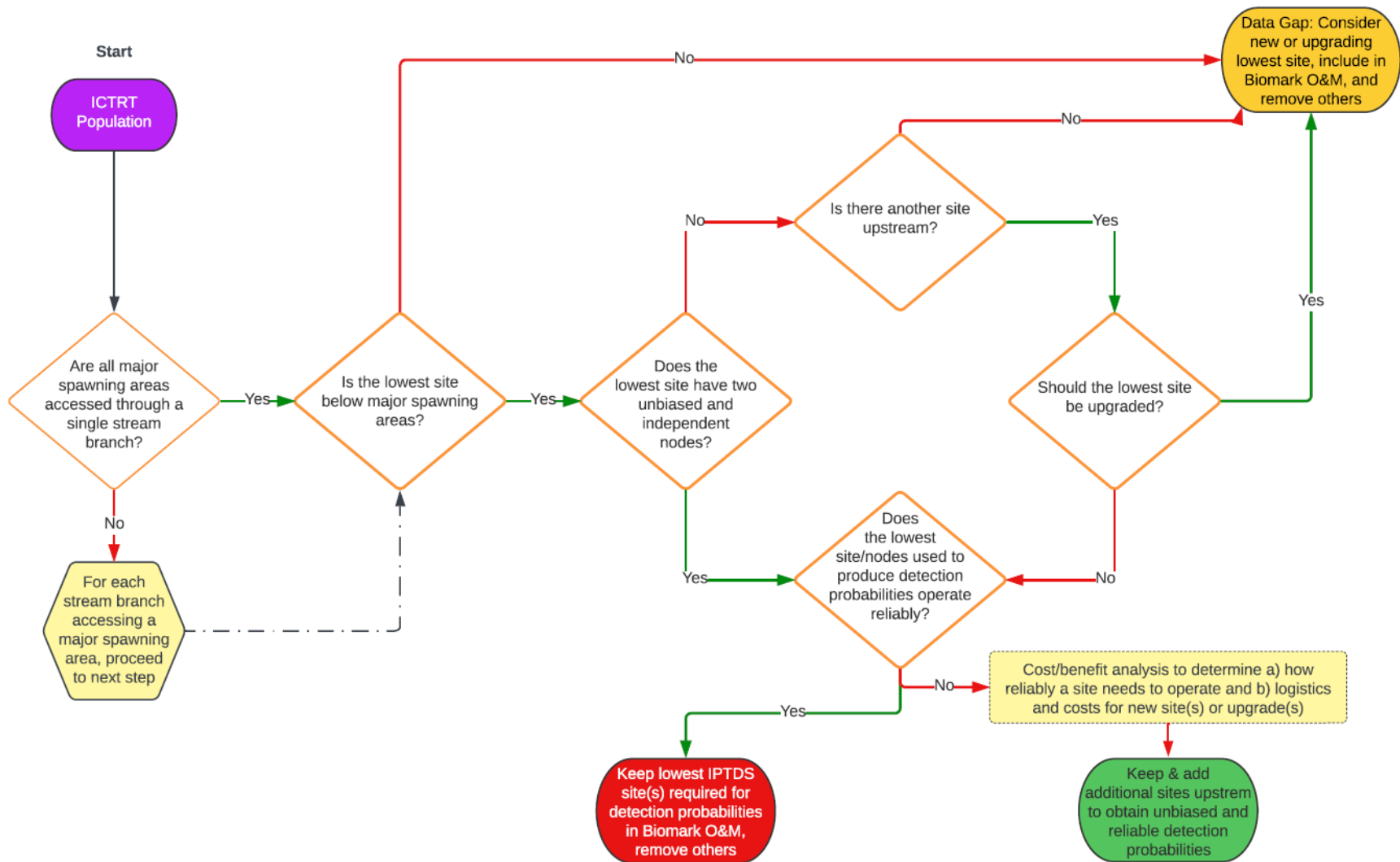


Figure 2. Flowchart demonstrating the decision-making process on which IPTDS(s) within a given population should be considered for inclusion in the IPTDS O&M project (BPA project 2018-002-00), and/or whether any IPTDS(s) within a population could be removed.

Additional Considerations

In addition to the prioritization framework outlined above which uses ASMS guidance (CBCAMW 2010), we also took into consideration the role or importance of each population according to the viable MPG recovery scenarios provided by NOAA (2017; APPENDIX B). For example, populations targeted for viability or high viability might be considered as a priority for high-precision monitoring over populations only targeted to be maintained. Also, steelhead populations considered B-run or with a high B-run component were considered for high-precision monitoring even if other populations within the MPG are being monitored with high-precision because B-run populations are of great conservation concern and influence downriver and in-river management decisions.

We also considered past information for each population the years in which IPTDS-based abundance estimates were considered “valid” and the coefficients of variation around those estimates (APPENDIX C), which collectively provided information on both populations where IPTDS are in operation and the precision of IPTDS-based abundance estimates.

The goal of our site prioritization framework is to make recommendations as transparent as possible. However, for some MPGs, populations, and/or IPTDS sites, “gray areas” inevitably exist, and professional judgement must occasionally be made which considers population priorities, logistics, costs, site reliability, past decisions, etc. Further, some recommendations for Snake River steelhead inevitably must consider spring/summer Chinook salmon, or vice-versa, and so both species were considered during the process. However, we do recognize that greater logistical constraints historically occur for monitoring returning steelhead adults, and so in instances, some additional weight is given towards steelhead population monitoring. Considerations and recommendations for Snake River steelhead and spring/summer Chinook salmon, by MPG and population, are provided in APPENDIX A.

RESULTS

Synopsis

After considering each MPG, population, and IPTDS site for both steelhead and spring/summer Chinook salmon, sites were lumped into one of four categories: 1) site recommended for continued funding under the Project, 2) existing sites, currently under another project, recommended for funding under the IPTDS O&M project, 3) proposed new sites to be managed under the Project, or 4) candidates for decommissioning, removal, or transfer from the IPTDS O&M project to an appropriate project. Recommendations are summarized in Table 3 with specific summaries for sites currently funded under the Project, existing sites to transfer to the Project, or proposed new sites summarized in Table 4. An [interactive leaflet map](#) has also been created to view IPTDS across the Snake River basin, which includes a layer to summarize recommendations in this report.

Table 3. Summary of recommendations for IPTDS in the Snake River basin.

Category	Number of Sites
IPTDS Currently Funder Under Project:	32
Candidates for Decommissioning, Removal, or Transfer from Project:	-9
Existing IPTDS Recommended for Funding Under Project:	10
New IPTDS Sites Proposed:	4
Potential IPTDS to be Funded Under Project:	37

Table 4. Summary of recommendation for IPTDS in the Snake River basin for each site currently funded under the Integrated IPTDS O&M project, proposed for transfer under the project, or for locations where IPTDS are proposed.

Site Code	O&M Site	Steelhead Pop ID	Chinook Pop ID	Recommendation	Notes
Upper Salmon					
VC2	Yes	SRUMA-s	SRVAL	Continue funding	Collectively, VC2 and YFK would provide monitoring for 2 of 5 major spawning areas in SRUMA-s. Prior to YFK, CVs for IPTDS-based estimates for SRUMA-s exceeded 15%; since YFK was installed CVs have been <15% in 6 of 11 years. If transferring YFK to the project is not desired, an IPTDS in the mainstem Salmon River near the lower boundary of the SRUMA-s population could be considered.
YFK	No	SRUMA-s	SRYFS	Candidate to transfer to project	
-	-	SREFS-s	SREFS	Add IPTDS (2)	No IPTDS-based monitoring within the SREFS-s population is currently funded under the project. An IPTDS near the lower boundary of SREFS-s (downstream of Morgan Creek or near Challis, ID) along with an IPTDS near the lower boundary of SRUMA-s (near Clayton, ID), both on the Salmon River, would improve monitoring of the SRUMA-s, SREFS-s, and SRPAH-s populations. Alternately, an IPTDS in the lower East Fork Salmon River could be considered. USI, at its current location, is not necessary for population status and trends monitoring, and could be decommissioned or moved to support proposed recommendations.
USE	Yes	SRPAH-s	SRLMA	Continue funding	
USI	Yes	SRPAH-s	SRLMA	Decommission, remove, or transfer from project	
LLR	Yes	SRLEM-s	SRLEM	Continue funding	Long-term, LLR could be considered for consolidation to a single-pass array, especially if upgraded to a IS1001 MC.
HYC	Yes	SRLEM-s	SRLEM	Continue funding	
LRW	Yes	SRLEM-s	SRLEM	Continue funding	
BHC	Yes	SRLEM-s	SRLEM	Decommission, remove, or transfer from project	Not necessary for population status and trends monitoring.
LLS	Yes	SRLEM-s	SRLEM	Decommission, remove, or transfer from project	
BTL	Yes	SRLEM-s	SRLEM	Decommission, remove, or transfer from project	
CAC	Yes	SRLEM-s	SRLEM	Decommission, remove, or transfer from project	
NFS	Yes	SRNFS-s	SRNFS	Continue funding	-
PCA	No	SRPAN-s	SRPAN	Candidate to transfer to project	If transferring PCA to the project is not desired, ensure long-term funding of the site.
Middle Fork Salmon					
-	-	SRCHA-s	SRCHA	Add IPTDS	An IPTDS should be added within the SRCHA-s and SRCHA populations. Ideally, the site would be located near the lower end of Chamberlain Creek, the only major spawning area within both populations. Secondary options include upper Chamberlain Creek (near the airstrip), or in one of the five

Site Code	O&M Site	Steelhead Pop ID	Chinook Pop ID	Recommendation	Notes
					steelhead minor spawning areas (Sabe, Bargamin, Warren, Crooked, or Sheep creeks).
MAR	Yes	MFUMA-s	MFMAR	Continue funding	-
TAY	Yes	MFBIG-s	MFBIG	Continue funding	-
South Fork Salmon					
SFG	Yes	SFMAI-s	SFSMA	Decommission, remove, or transfer from project	KRS, ESS, and ZEN combined cover all major spawning areas for both species.
KRS	Yes	SFMAI-s	SFSMA	Continue funding	SFMAI-s and SFSEC-s are the only two populations within the MPG with a high B-run component, and thus, high-precision monitoring is desired.
ESS	Yes	SFMAI-s	SFEFS	Continue funding	
ZEN	Yes	SFSEC-s	SFSEC	Continue funding	
-	-	SRLSR-s	SRLSR	Add IPTDS	An IPTDS should be considered within the SRLSR-s and SRLSR populations. Ideally, the site would be in the lower Little Salmon River. Secondary options include Slate or Whitebird creeks.
Middle Fork Clearwater					
SW1	No	CRSEL-s	SEUMA / SEMEA / SEMOO	Candidate to transfer to project	Strong candidates to be transferred to the project; the CRSEL-s population is only monitored using IPTDS and the population contains a high B-run component. If feasible, SW2 could be moved to the end of the Selway Road which would allow parsing of the SEMOO and SEUMA populations from SEMEA.
SW2	No	CRSEL-s	SEUMA / SEMEA / SEMOO	Candidate to transfer to project	
LRL	Yes	CRLOC-s	CRLOC	Continue funding	-
LRU	Yes	CRLOC-s	CRLOC	Continue funding	
South Fork Clearwater					
SC1	Yes	CRSFC-s	SCUMA	Continue funding	Recommended to move SC1 or SC2 to the lower boundary of the CRSFC-s population, where Hwy 13 crosses the South Fork Clearwater River. The new location could then be a two-pass configuration (with sufficient distance between arrays), or alternately, one of SC3 or SC4 could be funded to allow an estimate of a detection probability at the new site (in spawn years 2022 and 2023, CRA only detected one steelhead in each year). Additionally, funding was previously provided to the Project to operate CRA, its operation should be continued.
SC2	Yes	CRSFC-s	SCUMA	Continue funding	
SC3	No	CRSFC-s	SCUMA	Candidate to transfer to project	
SC4	No	CRSFC-s	SCUMA	Candidate to transfer to project	
CRA	Yes	CRSFC-s	SCUMA	Continue funding	
Lower Clearwater					
LC1	Yes	CRLOL-s	CRLOL	Continue funding	Alternate locations for LC2 could be considered to reduce O&M time and costs. LC2 could either be moved down with LC1 (assuming arrays could be spaced sufficiently to ensure independent detections) or it could be moved upstream (but still below core spawning areas).
LC2	Yes	CRLOL-s	CRLOL	Continue funding	

Site Code	O&M Site	Steelhead Pop ID	Chinook Pop ID	Recommendation	Notes
LAP	No	CRLMA-s	CRLAP	Candidate to transfer to project	An existing IPTDS site within the CRLMA-s population (e.g., LAP or JUL) should be funded under the project. LAP would be preferable given the existing time-series of adult abundance estimates.
Imnaha					
IR1	Yes	IRMAI-s	IRMAI	Continue funding	Because IRMAI-s is the only steelhead population in the MPG, high-precision monitoring is required. IR1 provides the greatest coverage for both species. In addition, one upstream site should be funded to ensure adequate detections to estimate abundance at IR1. IR3 would be preferred over BSC as it receives more detections, on average, for both species; further, estimates of abundance from IR1 and IR3, combined, could be used to estimate abundance for the IRBSH Chinook salmon population. COC is not needed for status and trends monitoring as it only provides coverage for a steelhead minor spawning area.
IR2	Yes	IRMAI-s	IRMAI	Decommission, remove, or transfer from project	
IR3	Yes	IRMAI-s	IRMAI	Continue funding	
COC	Yes	IRMAI-s	IRMAI	Decommission, remove, or transfer from project	
BSC	Yes	IRMAI-s	IRBSH	Decommission, remove, or transfer from project	
Grande Ronde					
UGR	Yes	GRUMA-s	GRCAT / GRUMA	Continue funding	-
WR1	Yes	GRWAL-s	GRLOS	Continue funding	WR1 should continue to be funded under the project. A two-pass array at MR1 would allow an estimate of a detection probability at both WR1 and the lower array at MR1 and allow parsing of abundance among steelhead major spawning areas and spring/summer Chinook populations. However, estimates of detection probabilities at WR1 have been found to be biased due to Minam and Wallowa adults "sorting" by the time they arrive to WR1. Therefore, a single-pass array at WR2 should also be funded under the project to ensure unbiased detection probability estimates.
WR2	No	GRWAL-s	GRLOS	Candidate to transfer to project	
MR1	No	GRWAL-s	GRMIN	Candidate to transfer to project	
WEN	No	GRLMT-s	GRWEN	Candidate to transfer to project	An IPTDS site below a major spawning area within the GRLMT-s population is necessary to ensure low-precision monitoring. If transferring WEN to the project is not desired, ensure long-term funding of the site.
JOC	Yes	GRJOS-s	NA	Continue funding	-
Lower Snake					
ACM	No	SNASO-s	SNASO	Candidate to transfer to project	If transferring ACM to the project is not desired, ensure long-term funding of the site.

DISCUSSION

The goal of this IPTDS site prioritization report is to develop a framework (i.e., decision-making process) which will assist in making recommendations transparent, and repeatable into the future, to ensure requisite and accurate adult abundance and life-history monitoring. However, we do acknowledge that for some MPGs, populations, and/or IPTDS sites, “gray areas” occasionally exist which must consider RM&E objectives as well as e.g., logistics, operational costs, site reliability, site feasibility, etc. For example, the CRLOL-s population could continue to be monitored using LC1 and LC2, as configured; however, LC2 is in a location difficult for O&M and so alternate configurations could be considered in Lolo Creek to reduce long-term costs. Additionally, two new sites (or move USI and add one additional site) are being proposed in the Upper Salmon subbasin to improve monitoring there; however, determining feasibility of proposed sites will be an essential next step and depending on findings, recommendations may need to be adjusted. These “gray areas” occur in a handful of locations and recommendations may be adjusted through conversations which consider feasibility, costs, etc.

In some cases, an estimate of abundance at a site funded by the Integrated IPTDS O&M project, or recommended for funding under the project, is reliant on detections at sites upstream not funded by the project. For example, an IPTDS-based abundance estimate to the GRUMA-s steelhead population is currently achieved using UGR. But estimating the detection probability at UGR, which is necessary to estimate abundance, is reliant on detections at upstream locations including CCU and CCW (and UGS prior to spawn year 2023). If arrays or sites upstream of key arrays used for population abundance estimates are considered for removal or decommissioning, or are operating unreliably, those actions should be taken into future consideration for prioritization, including consideration for future funding under the Integrated O&M project.

Recommendations include “transferring” some existing IPTDS funded by other projects to be instead funded under the IPTDS O&M project. But if some of those sites are reliably operated and the administrative agency would like to continue O&M, there is an option that sites could receive partial support by the Project e.g., remote site communications and uploads. During next steps, we will continue to evaluate whether some sites would be candidates for partial funding.

Our recommendations include IPTDS sites considered as candidates for decommissioning, removal, or transfer from the Integrated IPTDS O&M project. These sites don’t necessarily need to be removed in the short-term. Sites that are not necessarily required for population monitoring could be rather “naturally phased out” i.e., sites that are currently operating reliably at low cost could remain instream until equipment aging or failure or environmental conditions (e.g., high flows, debris removing antennas and/or arrays) results in unreliable data for RM&E. Until then, detections from those sites might assist adult escapement monitoring and/or other RM&E objectives. Further, the opportunity should be provided for other projects to take over funding of those sites if the IPTDS supports their objectives. Alternatively, the Integrated O&M project could maintain the funding and O&M of those sites, if it is deemed the IPTDS supports objectives that could be considered under the project, and O&M could be completed at reduced cost under the project. Finally, the Integrated IPTDS O&M project could consider adopting O&M for sites that are not necessary for adult status and trends monitoring if the site addresses other RM&E objectives; however, in those cases, appropriate funding should be provided to the Project to ensure that adequate staff and resources are available to perform the necessary O&M for those sites. For example, CRA is not necessary for requisite adult monitoring in the South Fork Clearwater River, but additional funding was provided to the Project at the time of its adoption to ensure its O&M.

The IPTDS prioritization framework recommends funding and O&M for IPTDS that are necessary for “near minimum” adult escapement monitoring. In general, the aim is for one IPTDS near the bottom of a population, or at least below one or more major spawning areas, and one additional IPTDS (or at least an upstream array) is required upstream of that site to estimate a detection probability at the lower site. However, relying on just one site upstream can be problematic if a site/array fails for a large portion of a run. The IPTDS recommendations in this case provide a low benchmark. As such, additional sites upstream of key locations could be considered in the future to ensure reliable adult escapement monitoring into tributaries and populations. Finally, if other RM&E objectives were to be considered e.g., fishery management, hatchery evaluations, life-cycle monitoring, juvenile survival monitoring, etc. additional IPTDS in support of those would help ensure reliability of data to support various RM&E objectives.

Next Steps

Our recommendations include four new proposed sites to address data gaps. Determining the feasibility of proposed sites would be a necessary next step which includes logistics (e.g., site remoteness) and site suitability (e.g., depth, substrate, hydrograph, power considerations, etc.). For example, we initially recommend two IPTDS located near the downstream boundaries of the SRUMA-s and SRPAH-s populations, respectively. If those locations are deemed unsuitable for any reason, alternate locations can be considered e.g., in the East Fork Salmon River. In any case, proposed locations can be “flexible” to accommodate suitability, logistics, etc. while also considering major spawning areas and/or population coverage to address data gaps. In populations where IPTDS operation is either infeasible or cost-prohibitive, alternate low-precision monitoring methods³ could be considered. Genetic-based effective population size monitoring and/or habitat availability-based interpolation/expansion methods could be considered, but if considered, should be validated in locations where IPTDS-based abundance estimates are available.

Some “tandem” arrays exist throughout the Snake River basin which may not be necessary for directional monitoring and/or to estimate detection probabilities for its lower array. Over the long-term, consolidating some tandem arrays to single-pass arrays could be considered to achieve cost-savings.

Finally, based on the recommendations in this report, an essential next step will be to develop an e.g., 3-to-5-year implementation plan to act on agreed upon recommendations. Within the implementation plan, decisions will need to ensure adequate funding and that proponents and staff are available or provided for the necessary O&M. The implementation plan will be developed in coordination with the funding agency, co-managers, and Biomark and consider feasibility, available time and staff, and infrastructure and O&M costs.

Conclusions

Snake River basin fish managers came together to develop a process to prioritize the current basin IPTDS sites to ensure completion of abundance and life history high-level metrics, following the recommendations of the ASMS (CBCAMW 2010). It is our recommendation that the currently funded IPTDS O&M project (2018-002-00) provide the funding and O&M necessary to obtain the adequate adult abundance and life history metrics for populations throughout the basin. We recommend the IPTDS O&M project potentially decommission, remove, or transfer 9 of its currently funded 32 sites, transfer 10 sites (funded under other projects), and add four additional sites (currently not funded), for a potential of 37 total IPTDS. These recommendations should achieve a cost-savings among all IPTDS-funded projects by placing the 37 required IPTDS under a single “umbrella”. Although this increases the O&M required under the project, likely with additional staff and funding needed, the aim is that proposed changes collectively result in an overall cost-savings across a portfolio of projects. An ongoing objective is that the Integrated IPTDS O&M

project provides the resources to ensure requisite, reliable, and safe adult status and trends monitoring for all fishery comanagers.

The Snake River IPTDS prioritization, among fishery managers, will occur annually or on an agree-upon schedule to ensure that the Integrated IPTDS O&M project continues to obtain adequate status and trends information for summer-run steelhead and spring/summer-run Chinook salmon population in the Snake River basin.

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APPENDIX A. IPTDS CONSIDERATIONS BY SPECIES, MPG, AND POPULATION

Snake River Basin Steelhead DPS

Salmon River MPG

Funding for O&M is currently provided for 17 IPTDS sites within the Salmon River MPG. We recommend the continued funding of O&M for 10 of those sites currently funded under the project (VC2, LLR, LRW, HYC, NFS, MAR, TAY, KRS, ESS, ZEN), potentially adding two existing sites (YFK and PCA) to ensure precise and long-term monitoring of the SRUMA-s and SRPAN-s populations, respectively, and adding up to four proposed sites to cover existing population monitoring gaps for a total of 16 sites funded under the IPTDS O&M project.

The SRLEM-s population is a strong candidate for high-precision monitoring due to extensive restoration actions and various RM&E activities in the watershed. Currently, the IPTDS O&M project funds seven sites within the SRLEM-s population; however, only three sites are necessary to obtain high-precision monitoring of abundance and distribution: LLR, LRW, and HYC. The remaining four sites (BHC, LLS, BTL, and CAC) could be considered for decommissioning, removal, or transfer to other projects.

The SFMAI-s population is currently monitored with high precision using KRS, ESS, and SFG combined. Although high-precision monitoring in the population is not required according to ASMS guidelines (CBCAMW 2010) because other populations within the MPG are monitored with high precision, it is desired because the population is one of two populations within the MPG with a high B-run component and is targeted for viability or high viability. Funding under the IPTDS O&M project should be continued for each of KRS and ESS.

The SRPAH-s population is currently monitored using a combination of the Pahsimeroi Hatchery weir and USE and USI (both O&M funded). The USE site provides more complete population coverage than USI and the weir; however, an estimate of abundance at USE is reliant on observations at USI and sites upstream (including Pahsimeroi Hatchery weir) to estimate a detection probability. Further, sites currently don't exist in appropriate locations upstream to effectively "parse" abundance estimates to the SRUMA-s and SREFS-s populations from abundance at USE to estimate abundance for the SRPAH-s population. Because other populations within the MPG are monitored with high-precision, USI could be considered for decommissioning, removal, or transfer from the project; however, SREFS-s is currently a data gap and should be considered (see below).

We recommend considering funding YFK and PCA under the IPTDS O&M project. PCA would ensure long-term monitoring of the SRPAN-s population. We recommend two new sites in the Upper Salmon River. Ideally, one site would be added near the lower boundary of the SREFS-s population on the Salmon River (below Morgan Creek or near Challis, ID) and one would be added near the lower boundary of the SRUMA-s population (near Clayton, ID); both could be single-pass arrays. These sites, combined, would allow parsing of abundance estimates among the SRPAH-s, SREFS-s, and SRUMA-s populations. If a site at the lower boundary of SRUMA-s is not feasible, a site in the lower East Fork Salmon River should be considered. Under either scenario, detections at YFK would aid in the parsing and precision of estimates. Finally, we recommend

new sites in the SRCHA-s and SRLSR-s populations to address existing data gaps and ensure at least low-precision monitoring for all populations in the MPG.

Table 5. Populations within the Salmon River MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
SRUMA-s	Salmon River upper mainstem	Extant	Low	Other populations within the MPG are currently monitored with high precision, and so only low precision monitoring is necessary. Because no other major spawning areas are monitored using O&M funded IPTDS, VC2 should continue to be funded. Before operation of YFK, the minimum CV of IPTDS-based abundance estimates was 44.4%; since operation of YFK, CVs have been <15.0% in 6 of 11 years, and detections at YFK aid in estimates of detection probabilities for downstream arrays (e.g., USE).	Continue funding VC2. Consider funding YFK under the project and adding a site at lower end of the population (e.g., near Clayton) to aid in parsing SRUMA-s, SREFS-s, and SRPAH-s estimates.
SREFS-s	East Fork Salmon River	Extant	Data Gap	No monitoring currently occurs within the population i.e., the SREFS-s population is considered a data gap, and current IPTDS-based estimates for the population are unreliable and partially reliant on USI and SALREF/SALEFT. An IPTDS should be considered near the lower boundary of the population (below Morgan Creek or near Challis, ID). Alternatively, an IPTDS could be considered to monitor at least one major spawning area; possible locations include the lower East Fork Salmon River (East Fork major spawning area) or Morgan Creek (Challis major spawning area). The lower East Fork Salmon River would be preferable.	Add IPTDS near the lower boundary of the population; alternatively, add a site in the lower East Fork Salmon River.
SRPAH-s	Pahsimeroi River	Extant	High	The SRPAH-s population is currently monitored using the Pahsimeroi Hatchery weir. IPTDS-based estimates to SRPAH-s are partially reliant on USE and USI, which are O&M funded. USE provides more complete population coverage than the weir; however, the weir covers all 3 major spawning areas (part of one) and most of the high IP habitat in the population. USI is not needed to estimate a detection probability for USE. USE, along with recommendations for SRUMA-s and SREFS-s, would allow effective monitoring for all 3 Upper Salmon River populations. USI should be considered for decommissioning, removal, or transfer to another project.	Decommission, remove, or transfer the USI site from the project. Continue funding USE while also considering recommendations for SRUMA-s and SREFS-s.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
SRLEM-s	Lemhi River	Extant	High	SRLEM-s is a strong candidate to maintain for high-precision monitoring despite other populations within the MPG also being high-precision, given that the Lemhi River is an Intensively Monitored Watershed with various RM&E activities within the population. However, for status and trends monitoring, LLR, LRW, and HYC are of highest priority for population and major spawning area monitoring. Long-term, LLR could be consolidated to a single-pass array. Other O&M funded sites (e.g., BHC, LLS, BTL, CAC) don't need to be funded by the IPTDS O&M project.	Continue funding LLR, LRW, HYC. Remove BHC, LLS, BTL, and CAC from the project.
SRNFS-s	North Fork Salmon River	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in SRNFS-s is only monitored using IPTDS and other low-precision methods are less or not feasible. Funding was previously added to the project to operate NFS.	Continue funding NFS.
SRPAN-s	Panther Creek	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in SRPAN-s is only monitored using IPTDS and other low-precision methods are less or not feasible. The PCA site could be considered for funding under the IPTDS O&M project to ensure long-term monitoring.	Consider funding PCA under IPTDS O&M project.
SRCHA-s	Chamberlain Creek	Extant	Data Gap	The SRCHA-s population is currently considered a data gap and either low- or high-precision monitoring is necessary. An IPTDS near the mouth of Chamberlain Creek, the lone major spawning area, or at least below much of the available spawning habitat, could be considered, if feasible, and would provide high-precision monitoring. Alternatively, low-precision methods, including IPTDS ³ , could be considered for a minor spawning area (Sabe, Bargamin, Warren, Crooked, or Sheep creeks).	Consider an IPTDS in Chamberlain Creek, if feasible. Alternately, consider a site in a minor spawning area.
MFUMA-s	Middle Fork Salmon River upper mainstem	Extant	Low	One (Marsh Creek) of six major spawning areas within the population is monitored using O&M-funded IPTDS, which is the only adult escapement monitoring method in the population. The remaining five (Lower Bear, Upper Middle Fork Salmon, Rapid, Pistol, Marble) are unmonitored for adult escapement. Other populations within the MPG are currently monitored with high precision, and so only low precision monitoring is necessary. Funding was previously added to the project to operate MAR.	Continue funding MAR.
MFBIG-s	Big, Camas, and Loon Creek	Extant	Low	Three (Lower Big, Upper Big, Monumental) of five major spawning areas within the population are currently monitored (combined) by TAY, which is the only adult escapement monitoring method in the population. The remaining two (Upper Loon, Camas) are unmonitored for adult escapement. Other populations within the MPG are currently monitored with high precision, and so only low precision monitoring is necessary.	Continue funding TAY.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
SFMAI-s	South Fork Salmon River	Extant	High	Other populations within the MPG are monitored with high precision; and so only low-precision monitoring is required; however, SFMAI-s is one of only two populations within the MPG with a high (>40%) B-run component, and thus, high-precision monitoring is desired. ESS covers two major spawning areas and KRS covers one major and two minor spawning areas and KRS aids life-cycle monitoring for steelhead and spring/summer Chinook salmon.	Continue funding KRS and ESS.
SFSEC-s	Secesh River	Extant	High	Other populations within the MPG are monitored with high precision; and so only low-precision monitoring is required; however, SFSEC-s is one of only two populations within the MPG with a high (>40%) B-run component, and thus, high-precision monitoring is desired.	Continue funding ZEN.
SRLSR-s	Little Salmon and Rapid River	Extant	Data Gap	The SRLSR-s population is currently a data gap and either high- or low-precision monitoring is necessary. High-precision monitoring could be accomplished at the mouth of the Little Salmon River (only major spawning area); Low-precision monitoring could be accomplished with an IPTDS near the mouth of a minor (e.g., Rock, Whitebird, Skookumchuck, Slate) spawning area. Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required.	Consider adding an IPTDS near the mouth of the Little Salmon River, if feasible; alternatively, consider a site below a minor spawning area.

Clearwater River MPG

Funding for O&M is currently provided for seven IPTDS sites (LRL, LRU, SC1, SC2, CRA, LC1, LC2) within the Clearwater River MPG. We recommend the continued funding of O&M for six of those sites (LRL, LRU, SC1, SC2, LC1, LC2) and adding two existing sites (SW1, SW2) to ensure long-term monitoring of the CRSEL-s population. One additional site in each of the CRSFC-s and CRLMA-s populations should be included, resulting in 10 sites recommended within the MPG. Finally, funding was previously provided to the Project to provide O&M for CRA, resulting in a total of 11 sites recommended for funding under the Project.

To improve population status and trends monitoring for steelhead in the MPG, alternate site configurations could be considered within the CRSFC-s population. For example, either SC1 or SC2 site could be moved to near the bottom boundary of the population. Regardless, one additional site upstream within the population should be funded under the project to facilitate estimates of detection probabilities at the population boundary, but that site doesn't necessarily need to be CRA. The existing SC3 or SC4 sites would provide additional detections over CRA to increase precision of estimates; however, funding was previously provided to the Project for operation of CRA.

Additionally, a site within the CRLMA-s population should be considered to ensure low-precision monitoring in the population. Existing sites within the CRLMA-s population to consider include LAP (Lapwai Creek) or the previous JUL (Potlatch River) site; preference should be given to LAP given the current time-series of adult abundance estimates; however, feasibility of a new JUL site could be considered long-term given that the Potlatch River is an IMW.

Two arrays should continue to be funded within the CRLOL-s population. Though, LC2 is currently located at a site which is difficult for O&M. To reduce time and costs, it could be considered to either convert LC1 to a two-pass configuration (assuming arrays could be adequately spaced to ensure independent observations) or move LC2 upstream to a location easier for O&M, preferably downstream of major spawning areas.

Table 6. Populations within the Clearwater River MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
CRSEL-s	Selway River	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in CRSEL-s is only monitored using IPTDS and other low-precision methods are less or not feasible. Detections at SW2 facilitate estimating the detection probability (and abundance) at SW1. The population contains a high (>40%) B-run component (NOAA 2017).	Consider funding SW1 and SW2 under IPTDS O&M project.
CRLOC-s	Lochsa River	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in CRSEL-s is only monitored using IPTDS and other low-precision methods are less or not feasible. Detections at LRU facilitate estimating the detection probability (and abundance) at LRL. The population contains a high (>40%) B-run component and is targeted for viability or high viability (NOAA 2017).	Continue funding LRL and LRU.
CRSFC-s	South Fork Clearwater River	Extant	Low	Other populations within the MPG are currently monitored with high precision, and so only low precision monitoring is necessary. An estimate for one tributary, Crooked River, within the population is currently possible using the two-pass CRA site. SC1 and SC2, combined, allow for an abundance estimate for the entire South Fork Clearwater watershed; however, the CRSFC-s lower population boundary occurs well upstream of SC2 where Hwy 13 crosses the South Fork Clearwater River and abundance estimates at SC1 don't account for e.g., pre-spawn or harvest mortality or spawning that occurs below the CRSFC-s population boundary. If improved monitoring was desired for the steelhead (and Chinook salmon) population, a site should be considered near the crossing of Hwy 13 and below any major spawning areas (Newsome [includes Crooked River], American, Upper South Fork). If a site was moved to this new location, SC1 or SC2 could potentially be removed; the new site would either need to be a	No action needed to maintain low-precision monitoring. Alternate site configurations, including for SC1 and SC2, could be considered to improve cost-savings and monitoring for the CRSFC-s and CRLMA-s populations.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
				two-pass configuration or sites upstream (e.g., SC3, SC4, CRA) would need to be maintained to ensure that detection probabilities could be estimated. The population contains a high (>40%) B-run component (NOAA 2017).	
CRLOL-s	Lolo Creek	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in CRLOL-s is only monitored using IPTDS and other low-precision methods are less or not feasible. Detections at LC2 facilitate estimating the detection probability (and abundance) at LC1; however, LC2 is a difficult site for O&M, so it could be considered to convert LC1 to a two-pass configuration or to move LC2 upstream in the watershed to an easier access location, but preferably downstream of major spawning areas. The population contains a high (>40%) B-run component and is targeted for viability or high viability (NOAA 2017).	Continue funding LC1 and LC2; consider changes to array configurations to reduce long-term costs, if desired.
CRNFC-s	North Fork Clearwater River	Extirpated	-	-	-
CRLMA-s	Clearwater River lower mainstem	Extant	Low	Other populations within the MPG are monitored with high precision; however, adult escapement in CRLMA-s is only monitored using IPTDS and other low-precision estimates are less or not feasible. Two sites within the population are currently funded under the IPTDS O&M project (SC1 and SC2), but as noted above, those sites provide estimate of abundance for the South Fork Clearwater River, and not necessarily the CRSFC-s population (or the Lower SF Clearwater Tribes major spawning area). Alternatively, a site should be considered near the bottom of a major spawning area (Potlatch [JUL], Lapwai [LAP], Lawyer [LAW], Big Canyon, Lower SF Clearwater Tribes [SC1 or SC2]) within the CRLMA-s population funded under the IPTDS O&M project. Moving SC1 or SC2 to a new location at the bottom of CRSFC-s or moving/funding SC3 (which occurs below all major spawning areas within CRSFC-s), would allow parsing estimates for the CRSFC-s population and Lower SF Clearwater Tribes major spawning area.	Consider altering site configurations within the population including for SC1 and SC2, to improve cost-savings and monitoring precision for both CRSFC-s and CRLMA-s populations. Consider funding LAP under the IPTDS O&M project, recognizing historical difficulties in operating JUL.

Imnaha River MPG

Funding for O&M is currently provided for five IPTDS sites within the Imnaha River MPG (COC, IR1, IR2, IR3, BSC). We recommend the continued funding of O&M for two sites currently funded by the IPTDS O&M project: IR1 and IR3. Detections at IR3 would ensure adequate detections to reliably estimate detection probability and abundance at IR1 and provide high-precision status and trends monitoring. IR1 should be considered for upgrades to a IS1001 Master Controller to increase reliability and read range. High-precision monitoring is required for the IRMAI-s population since it is the only population in the MPG.

Table 7. Populations within the Imnaha River MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
IRMAI-s	Imnaha River	Extant	High	IRMAI-s is the only population in the MPG and targeted for high viability (NOAA 2017) and so should be monitored with high precision. High-resolution monitoring could be accomplished using IR1 as the site is below all major spawning areas. One additional array upstream of IR1 should also be operated under the IPTDS O&M project to provide a reliable estimate of a detection probability at IR1. Currently, five sites within the population are funded under the project; however, only two are needed to estimate abundance at IR1 for status and trends monitoring. IR1 should be considered for upgrades to a IS1001 MC. COC would provide complete coverage for the population, but is not necessary, as Cow Creek is a minor spawning area.	Continue funding IR1 plus one additional site upstream, likely IR3.

Grande Ronde River MPG

Funding of O&M is currently provided for three sites in the Grande Ronde MPG: UGR, WR1, and JOC. We recommend the continued funding of each of these sites plus three additional sites (MR1, WR2, and WEN) for a total of six IPTDS within the MPG funded under the project.

High-precision monitoring for the GRWAL-s population is not required, because GRJOS-s is currently monitored with high-precision. However, site configurations, as proposed, would provide an unbiased estimate of detection probability at WR1, which is necessary, and would aid in monitoring of the GRMIN and GRLOS spring/summer Chinook salmon populations.

Table 8. Populations within the Grande Ronde River MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
GRUMA-s	Grande Ronde River upper mainstem	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. UGR, currently funded by the IPTDS O&M project, provides low-precision monitoring as it doesn't capture abundance for the Lookingglass major spawning area.	Continue funding UGR.
GRWAL-s	Wallowa River	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. WR1, funded under the IPTDS O&M project, is a single-pass array used to estimate abundance for the GRWAL-s, but relies on two upstream sites not funded under the project (MR1 and WR2) to estimate detection probability at WR1. Detections from either MR1 or WR2 alone have been found to provide a biased estimate of detection probability at WR1, due to issues associated with fish from either the Minam or Wallowa rivers "sorting" before they arrive at WR1. As such, both MR1 and WR2 should also be funded under the project. MR1, currently a tandem array, allows an estimate of abundance to the Minam River, which further allows parsing of abundance between the Minam and Wallowa rivers. This configuration would also aid monitoring of the GRMIN and GRLOS spring/summer Chinook salmon populations. However, the proposed location for the WR2 site only need to be a single-pass array.	Continue funding WR1; begin funding MR1 (two-pass array) and WR2 (single-pass array).
GRJOS-s	Joseph Creek	Extant	High	Other populations within the MPG are monitored with high precision; however, adult escapement in GRJOS-s is only monitored using IPTDS and other low-precision methods are less or not feasible. Moreover, JOC is a two-pass array site and is in an ideal location for population status and trends monitoring and so should be maintained to ensure high-precision monitoring of a population within the Grande Ronde River MPG.	Continue funding JOC.
GRLMT-s	Grande Ronde River	Extant	Low	Other populations within the MPG are monitored with high precision; however, adult escapement in GRLMT-s is only monitored using IPTDS and other low-	Consider funding WEN.

	lower mainstem tributaries			precision methods are less or not feasible. WEN, the only site within the population monitoring adult status and trends, is currently not funded under the IPTDS O&M project, and so should be considered for funding under the project.	
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Hells Canyon MPG

The lone population in the MPG (SNHCT-s) is listed as extirpated, and so no considerations for the MPG were made.

Table 9. Populations within the Hells Canyon MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
SNHCT-s	Hells Canyon	Extirpated	-	-	-

Lower Snake MPG

No IPTDS within the MPG are currently funded under the IPTDS O&M project. Currently, the SNASO-s population is monitored with high-precision using an IPTDS-based estimate at ACM plus the operation of a weir in lower Alpowa Creek. Additionally, there are tentative plans to install an array in lower Alpowa Creek. We recommend funding an IPTDS in lower Asotin Creek (e.g., ACM) to ensure long-term, high-precision monitoring; funding of the proposed site in lower Alpowa Creek could also be considered if the weir were ever discontinued. No action is needed in SNTUC-s if existing population monitoring continues.

Table 10. Populations within the Lower Snake MPG, Snake River Basin Steelhead DPS including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Status	Current Monitoring Type	Considerations	Recommendation
SNASO-s	Asotin Creek	Extant	Low	SNASO-s is currently monitored with high precision using IPTDS-based estimates at ACM plus the operation of a weir in lower Alpowa Creek. Consider funding ACM to ensure long-term, high-precision monitoring. Funding of a site in lower Alpowa Creek could be considered if the weir were discontinued.	Consider funding ACM.
SNTUC-s	Tucannon River	Extant	Low	SNASO-s is monitored with high-precision and so only low-precision monitoring is necessary. No action is needed if existing monitoring continues.	No action needed if existing monitoring continues.

Snake River Spring/Summer-run Chinook Salmon ESU

Upper Salmon River MPG

Funding for O&M is currently provided for 11 IPTDS sites within the Upper Salmon River MPG (VC2, USI, USE, LLR, LRW, HYC, BHC, LLS, BTL, CAC, NFS). We recommend the continued funding for six of these sites: VC2, USE, LLR, LRW, HYC, and NFS. Five sites could be removed, decommissioned, or funded by other projects as their data are not integral for population adult status and trends monitoring: USI, BHC, LLS, BTL, and CAC. Two additional sites are proposed under the IPTDS O&M project to provide monitoring for the SRUMA-s, SREFS-s, and SRPAH-s steelhead populations, which would also improve monitoring for the SRLMA and SREFS Chinook salmon populations and the Upper Salmon MPG. YFK and PCA are recommended to be considered for funding under the project to improve steelhead monitoring; these sites would additionally improve monitoring for the SRYFS and SRPAN Chinook salmon populations, respectively. In total, 10 sites in the Upper Salmon MPG are recommended for funding under the project.

Table 11. *Populations within the Upper Salmon MPG, Snake River Spring/Summer-run Chinook Salmon ESU including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.*

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
SRUMA	Salmon River upper mainstem above Redfish Lake	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRUMA population is monitored using the Sawtooth Hatchery weir, spawning ground surveys, and redd counts ⁵ (boat, ground, UAS); no additional monitoring necessary. Current IPTDS-based abundance estimates in SRUMA use detections at RFL and STL.	No action needed.
SRVAL	Valley Creek	Spring / Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRVAL population is monitored using redd counts (ground). VC2 is the only site within the SRVAL-s steelhead population and is recommended for continued funding.	Continue funding VC2.
SRLMA	Salmon River lower mainstem below Redfish Lake	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRLMA population is monitored using redd counts (UAS). In addition, USE and USI, which are O&M funded, currently provide monitoring for the population. Estimates of abundance at USE are partially reliant on observations at USI and upstream to estimate a detection probability at USE. Further, some sites don't exist	Consider removing USI from IPTDS O&M project.

⁵ Redd count index transect methods throughout for surveys completed in Idaho in SY2021 were identified in Poole et al. (2022).

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
					upstream to appropriately parse abundance estimates to e.g., SREFS from SRLMA. Because other populations are monitored with high precision, USI could be considered for removal from the project, especially if other upstream sites provide adequate detections to estimate a detection probability at USE (see steelhead recommendations).	
SRYFS	Yankee Fork Salmon River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRYFS population is currently monitored using a weir, the YFK site, and redd counts (ground, UAS); no additional methods needed.	No action needed. Consider funding YFK under IPTDS O&M project.
SREFS	East Fork Salmon River	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SREFS population is currently monitored using redd counts (ground, UAS). Two sites are being proposed to provide steelhead monitoring and would improve monitoring for the SREFS population and Upper Salmon River spring/summer Chinook salmon MPG.	See recommendations for SRUMA-s, SREFS-s, and SRPAH-s steelhead populations.
SRPAH	Pahsimeroi River	Summer	Extant	High	The SRPAH population is the only summer-run population in the MPG and so high-precision monitoring is required. The Pahsimeroi Hatchery weir currently provides high-precision monitoring for the population, and the population is also monitored with redd counts (ground, UAS). No IPTDS necessary, so long as the Pahsimeroi Hatchery weir continues to operate.	No action needed.
SRLEM	Lemhi River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRLEM population is monitored using redd counts (ground, UAS), which provides low-precision monitoring. However, the SRLEM population is a strong candidate for high-precision monitoring despite other populations in the MPG also being monitored with high precision, given that it is an Intensively Monitored Watershed with various RM&E activities. For steelhead, it is recommended that LLR, LRW, and HYC are of highest priority for status and trends monitoring and would provide additional monitoring for SRLEM. Long-term, LLR could be considered for a single-pass array. Other O&M funded sites (e.g., BHC, LLS, BTL, CAC) should be considered for decommissioning, removal, or transfer from the IPTDS O&M project.	Continue funding LLR, LRW, HYC; consider decommissioning, removal, or transfer from the project for BHC, LLS, BTL, and CAC.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
SRNFS	North Fork Salmon River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRNFS is currently monitored using redd counts (ground). The NFS site is recommended for continued monitoring of the SRNFS-s steelhead population and provides improved monitoring for the SRNFS Chinook salmon population.	No action needed; continue funding NFS.
SRPAN	Panther Creek	Unknown	Extirpated	-	-	-

Middle Fork Salmon River MPG

Funding for O&M is currently provided for two IPTDS sites within the Middle Fork Salmon River MPG (MAR, TAY), and we recommend continued funding of those sites.

Table 12. Populations within the Middle Fork Salmon River MPG, Snake River Spring/Summer-run Chinook Salmon ESU including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
MFBEA	Bear Valley Creek	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. MFBEA is currently monitored using the Bear Valley weir and redd counts (ground). No action needed. If the Bear Valley weir were to be removed, an IPTDS funded under the O&M project could be considered.	No action needed.
MFMAR	Marsh Creek	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. MFMAR is currently monitored using MAR and redd counts (ground). The MAR site is recommended for continued monitoring of the MFUMA-s steelhead population and provides improved monitoring for the MFMAR Chinook salmon population.	No action needed; continue funding MAR.
MFSUL	Sulphur Creek	Spring	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. MFSUL is current monitored using redd counts (ground); no additional monitoring needed.	No action needed.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
MFUMA	Middle Fork Salmon River above Indian Creek	Spring	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. Through SY2023, MFUMA was monitored using helicopter-based index redd count surveys; starting in SY2024 it is anticipated that multiple-pass raft-based redd counts will continue aided by ground-based counts in a portion of Rapid River.	No action needed.
MFLMA	Middle Fork Salmon River below Indian Creek	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. Through SY2023, MFUMA was monitored using helicopter-based index redd count surveys; starting in SY2024 it is anticipated that multiple-pass raft-based redd counts will continue.	No action needed.
MFLOO	Loon Creek	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. Through SY2023, MFLOO was monitored using helicopter-based index redd count surveys; starting in SY2024 it is anticipated that ground-based redd counts will continue for a small portion of the population.	No action needed.
MFCAM	Camas Creek	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. Through SY2023, MFLOO was monitored using helicopter-based index redd count surveys; starting in SY2024 it is anticipated that ground-based redd counts will continue for a small portion of the population.	No action needed.
MFBIG	Big Creek	Spring / Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. However, the MFBIG population provides a unique opportunity for high-resolution monitoring of a (largely) wilderness population paired with a rotary screw trap and is only one of two populations in the MPG with IPTDS-based high-resolution monitoring. The TAY IPTDS provides monitoring for three major spawning areas (Lower Big, Monumental, Upper Big).	Continue funding TAY.
SRCHA	Chamberlain Creek	Spring	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. SRCHA is currently monitored using index redd count surveys; no additional methods needed.	No action needed.

South Fork Salmon River MPG

We recommend the continued funding of O&M for three of the four sites that are currently managed by the IPTDS O&M project: KRS, ESS, and ZEN. The SFSMA population could be monitored using only KRS and so SFG could be considered for decommissioning, removal, or transfer to another project. In addition, a new site is recommended to address a data gap for the SRLSR-s steelhead population which would aid adult monitoring for the SRLSR Chinook salmon population, resulting in a total of four sites in the MPG funded by the Project.

Table 13. Populations within the South Fork Salmon River MPG, Snake River Spring/Summer-run Chinook Salmon ESU including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
SFSMA	South Fork Salmon River mainstem	Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low precision monitoring is required. SFSMA is currently monitored using SFG and KRS (using ZEN and ESS to parse those populations), the South Fork Salmon River weir, and redd count surveys (ground). The population could be monitored using only KRS; SFG could be considered for removal, decommissioning, or transfer to another project.	Continue funding KRS.
SFEFS	East Fork South Fork Salmon River	Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SFEFS population is currently monitored using ESS, the Johnson Creek weir, and redd count surveys (ground). The population could be monitored with low precision without ESS, but if so, either the SFSMA or SFSEC populations need to be monitored with high precision i.e., using KRS or ZEN. Continued funding of ESS is recommended for monitoring the SFMAI-s steelhead population.	Continue funding ESS.
SFSEC	Secesh River	Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SFSEC population is currently monitored using ZEN and redd count surveys (ground). The SFSEC population could be monitored with low precision without ZEN; however, ZEN is needed for monitoring the SFSEC-s steelhead population.	Continue funding ZEN.
SRLSR	Little Salmon River	Spring / Summer	Extant	Low	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The SRLSR population is currently monitored using redd count surveys (ground); no additional methods needed.	No action needed.

Grande Ronde / Imnaha River MPG

Recommendations for the MPG are largely driven by recommendations for the Imnaha River and Grande Ronde River MPGs for the Snake River Basin steelhead DPS. Funding for O&M is currently provided for seven IPTDS sites within the Grande Ronde / Imnaha River MPG: IR1, IR2, IR3, COC, BSC, UGR, and WR1. We recommend the continued funding for four of these sites: IR1, IR3, UGR, and WR1. Three existing sites are recommended to be funded under the project to provide necessary steelhead monitoring (MR1, WR2, WEN) which would also aid monitoring of the GRMIN, GRLOS, and GRWEN spring/summer Chinook salmon populations.

Table 14. Populations within the Grande Ronde / Imnaha River MPG, Snake River Spring/Summer-run Chinook Salmon ESU including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
IRBSH	Big Sheep Creek	Spring	Functionally Extirpated	-	-	Consider removing BSC from IPTDS O&M project.
IRMAI	Imnaha River mainstem	Spring / Summer	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. High-precision monitoring is required for the IRMAI-s steelhead population and so those considerations/recommendations should be followed.	Continue funding IR1 and IR3.
GRUMA	Grande Ronde River upper mainstem	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The GRUMA population is currently monitored using a weir and redd counts; additionally, UGR provides an abundance estimate for the combined GRUMA and GRCAT populations.	No action needed; continue funding UGR.
GRCAT	Catherine Creek	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The GRUMA population is currently monitored using a weir and redd counts; additionally, UGR provides an abundance estimate for the combined GRUMA and GRCAT populations.	No action needed; continue funding UGR.
GRLOO	Lookingglass Creek	Unknown	Functionally Extirpated	-	-	-
GRMIN	Minam River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. MR1, currently not funded under the IPTDS O&M project, is recommended for funding to improve monitoring of the GRWAL-s steelhead population. Funding MR1 would additionally ensure	Consider funding MR1 under the IPTDS O&M project.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
					high-resolution monitoring for at least one population in the Chinook salmon MPG.	
GRLOS	Lostine River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. The GRLOS population is currently monitored using a weir, redd counts surveys, and WR1 and WR2 (using MR1 to “parse” abundance for the GRMIN population). WR1 and WR2 are recommended for monitoring of the GRWAL-s steelhead population, and so those considerations/recommendations should be followed.	Continue funding WR1. Consider transferring WR2 (as single-pass array) to project.
GRWEN	Wenaha River	Spring	Extant	High	Other populations within the MPG are monitored with high precision, and so only low-precision monitoring is required. WEN is recommended for monitoring of the GRLMT-s steelhead population, and so those considerations/recommendations should be followed.	Consider funding WEN under the IPTDS O&M project.

Lower Snake River MPG

The SNASO population is considered functionally extirpated, and thus, high-precision monitoring of the remaining SNTUC population is desired. Currently, no O&M project IPTDS exist in the MPG. Funding of an IPTDS site(s) could be considered for funding under the IPTDS O&M project if they could be used to support high-resolution monitoring.

Table 15. Populations within the Lower Snake River MPG, Snake River Spring/Summer-run Chinook Salmon ESU including their status, current level of status and trends monitoring, and considerations and recommendations for each population for funding of IPTDS O&M for adult abundance monitoring.

Pop ID	Pop Name	Run	Status	Current Monitoring Type	Considerations	Recommendation
SNASO	Asotin Creek	Spring	Functionally Extirpated	-	-	-
SNTUC	Tucannon River	Spring	Extant	High	<p>The only other population in the MPG, SNASO, is considered functionally extirpated and so high-precision monitoring is desired. IPTDS-based abundance monitoring of the SNTUC-s population is (at least partially) reliant on “fallbacks” PIT-tagged at Lower Granite Dam, and so only provides low-precision monitoring. Alternate high-precision methods should be considered if not already in place; however, if IPTDS could be used to support high-precision monitoring, their funding could be considered under the IPTDS O&M project.</p>	Consider funding IPTDS in the SNTUC population if they could support high-resolution monitoring.

APPENDIX B. RECOVERY SCENARIOS FOR SNAKE RIVER POPULATIONS

Table 16. Recovery scenarios for Snake River Basin Steelhead MPGs. Adapted from NOAA (2017). Notes added by the IPTDS workgroup are designated in italics.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
Salmon River					
SRUMA-s	Salmon River upper mainstem	Intermediate	A-Run	Maintained	Population has some hatchery influence, with some from out-of-MPG. There has been little monitoring of the population; <i>however, there has been a time-series of counts and age data at the Sawtooth weir but unclear how efficient the weir is for steelhead.</i>
SREFS-s	East Fork Salmon River	Intermediate	A-Run	Maintained	Population has hatchery influence, with some from out-of-MPG. There has been little monitoring of the population; <i>however, there has been a time-series of counts and age data from a weir in the East Fork Salmon River but unclear how efficient the weir is for steelhead. Active hatchery supplementation program.</i>
SRPAH-s	Pahsimeroi River	Intermediate	A-Run	Maintained	Population has some hatchery influence from out-of-MPG. There has been little monitoring of the population; <i>however, there has been a time-series of counts and age data from the Pahsimeroi hatchery weir. Active hatchery supplementation.</i>
SRLEM-s	Lemhi River	Intermediate	A-Run	Viable	Targeted for viability. Population has some hatchery influence from out-of-MPG. There has been little monitoring of the population.
SRNFS-s	North Fork Salmon River	Intermediate	A-Run	Maintained	Some hatchery influence from out-of-MPG stock.
SRPAN-s	Panther Creek	Basic	A-Run	Viable	Targeted for viability. Some hatchery influence, likely from out-of-MPG. Watershed is <i>publicly</i> owned, could become very productive. Fewer water withdrawals than other populations.
SRCHA-s	Chamberlain Creek	Basic	A-Run	Viable	Targeted for viability. A-run life-history strategy with very little hatchery influence. Natural river system characteristics. Population provides connectivity between populations in the South Fork, Middle Fork, and Upper Salmon River drainages.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
MFUMA-s	Middle Fork Salmon River upper mainstem	Intermediate	Moderate B-Run	Viable	Targeted for viability. Moderate B-run component (15-40%) of population. Very little hatchery influence. Geographic separation from other targeted populations. Natural river system within wilderness boundaries.
MFBIG-s	Big, Camas, and Loon Creek	Intermediate	Moderate B-Run	Highly Viable	Targeted for viability. Moderate B-run component (15-40%) of population with little hatchery influence. Natural river system within wilderness boundaries.
SFMAI-s	South Fork Salmon River	Intermediate	High B-Run	Viable	Targeted for viability. One of two populations in MPG with a strong B-run component (>40% of population). No hatchery influence or effects. Natural river system characteristics. Located at downstream end of MPG. Would provide geographic distribution of viable populations.
SFSEC-s	Secesh River	Basic	High B-Run	Maintained	One of two populations in MPG with a strong B-run (>40% of population). Genetically distinct. No hatchery influence or effects. Natural river system characteristics.
SRLSR-s	Little Salmon and Rapid River	Intermediate	A-Run	Maintained	Population has some hatchery influence, which tends to be out-of-MPG (Dworshak B, Hells Canyon A). There has been little monitoring of the population except Rapid River.
Clearwater River					
CRSEL-s	Selway River	Intermediate	High B-Run	Viable	Targeted for viability. B-run fish make up >40% of population. Very little hatchery influence. Much of habitat in wilderness protection.
CRLOC-s	Lochsa River	Intermediate	High B-Run	Highly Viable	Targeted for High Viability. B-run fish constitute >40% of population. Very little hatchery influence. Much of habitat in wilderness protection. Area accessible for data collection using current monitoring programs.
CRSFC-s	South Fork Clearwater River	Intermediate	High B-Run	Maintained	High degree of hatchery influence. B-run steelhead make up >40% of population.
CRLOL-s	Lolo Creek	Basic	High B-Run	Maintained	B-run steelhead constitute >40% of Lolo Creek population. <i>High degree of hatchery influence.</i>
CRNFC-s	North Fork Clearwater River	Large		Not part of recovery scenario	Population is extirpated.
CRLMA-s	Clearwater River lower mainstem	Large	Low B-Run	Viable	Targeted for viability. The only extant Large population. Contains A-run and B-run fish with B-run making up <15% of population.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
Imnaha River					
IRMAI-s	Imnaha River	Intermediate	A-Run	Highly Viable	Targeted for high viability. Only population in MPG.
Grande Ronde River					
GRUMA-s	Grande Ronde River upper mainstem	Large	A-Run	Viable or Highly Viable	Recently tentatively rated as viable. This is the only Large population in the MPG. Currently receives no hatchery releases.
GRWAL-s	Wallowa River	Intermediate	A-Run	Viable or Highly Viable	Wallowa includes multiple core areas and some unique habitat characteristics (e.g. Eagle Cap Wilderness) but supports a hatchery (with little straying).
GRJOS-s	Joseph Creek	Basic	A-Run	Highly Viable	Recently rated as highly viable. Joseph Creek population has the least hatchery influence. The population contributes to spatial structure in the lower MPG.
GRLMT-s	Grande Ronde River lower mainstem tributaries	Intermediate	A-Run	Viable or Highly Viable	Lower Grande Ronde population receives hatchery releases. The population would contribute to spatial structure in the lower MPG.
Hells Canyon					
SNHCT-s	Hells Canyon	NA	NA	Not part of recovery scenario	Do not appear large enough (separate or combined) to support independent population.
Lower Snake					
SNASO-s	Asotin Creek	Basic	A-Run	Viable or Highly Viable	Currently rated as Maintained.
SNTUC-s	Tucannon River	Intermediate	A-Run	Viable or Highly Viable	Currently rated as Maintained.

Table 17. Recovery scenarios for Snake River Spring/Summer Chinook MPGs. Adapted from NOAA (2017). Notes added by the IPTDS workgroup are designated in italics.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
Upper Salmon River					
SRUMA	Salmon River upper mainstem above Redfish Lake	Large	Spring	Viable or Highly Viable	Targeted for high viability. Population is at the geographic end of the ESU and MPG and provides proportional representation of class size. <i>Ongoing supplementation.</i>
SRVAL	Valley Creek	Basic	Spring	Viable	Targeted for viability. Historically had larger production than most Basic populations.
SRLMA	Salmon River lower mainstem below Redfish Lake	Very Large	Spring / Summer	Maintained	<i>Adult monitoring includes single-pass redd counts only.</i>
SRYFS	Yankee Fork Salmon River	Basic	Spring	Maintained	Currently occupied by non-native stock.
SREFS	East Fork Salmon River	Large	Spring / Summer	Viable	Targeted for viability.
SRPAH	Pahsimeroi River	Large	Summer	Viable	Targeted for viability. Only extant population in this MPG with summer life history. <i>Ongoing supplementation.</i>
SRLEM	Lemhi River	Very Large	Spring	Viable	Targeted for viability to provide proportional representation of class size. Lemhi historically may have had summer Chinook salmon production. Lemhi provides important connectivity to other MPGs, as a large, downstream population.
SRNFS	North Fork Salmon River	Basic	Spring	Maintained	The most downstream population. However, relatively few data are available, and there have been substantial anthropogenic effects on population and habitat.
SRPAN	Panther Creek	Intermediate	Spring	Not included in initial recovery strategies ⁶	Functionally extirpated, but the only Intermediate population. A large population could be substituted for this population to meet viability criteria.

⁶ Because the ICTRT (2003) defined the Panther Creek population as functionally extirpated, the population is not included in the initial recovery strategies for achieving a viable MPG or a viable ESU. Thus, the recovery plan does not designate a proposed status for this population. The primary recovery function of the

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
Middle Fork Salmon River					
MFBEA	Bear Valley Creek	Intermediate	Spring	Viable	Targeted for viability because of historical production potential and opportunity.
MFMAR	Marsh Creek	Basic	Spring	Viable	Targeted for viability due to geographic distribution in MPG and historic production potential.
MFSUL	Sulphur Creek	Basic	Spring	Maintained	
MFUMA	Middle Fork Salmon River above Indian Creek	Intermediate	Spring	Maintained	Upper Middle Fork mainstem is composed of a number of small tributaries (rather than a core, contiguous spawning area).
MFLMA	Middle Fork Salmon River below Indian Creek	Basic	Spring / Summer	Maintained	-
MFLOO	Loon Creek	Basic	Spring / Summer	Viable	Targeted for viability because of geographic distribution in MPG and historic production potential.
MFCAM	Camas Creek	Basic	Spring	Maintained	-
MFBIG	Big Creek	Large	Spring / Summer	Highly Viable	Targeted for high viability. The only Large population in this MPG. Supports spring and summer run fish.
SRCHA	Chamberlain Creek	Intermediate	Spring	Viable	Targeted for viability. Significant geographic position provides connectivity between MPGs. Population has unique, apparently persistent genetic characteristics.
South Fork Salmon River					
SFSMA	South Fork Salmon River mainstem	Large	Summer	Viable	Targeted for viability to achieve large-size requirement. <i>Ongoing supplementation.</i>

population will be to contribute to the abundance, productivity, and spatial structure of the Upper Salmon River MPG and the ESU. However, as more information is gathered about the spring/summer Chinook salmon spawning in Panther Creek, it is possible that NMFS will select Panther Creek as one of the Upper Salmon River populations to reach low risk status as part of the MPG recovery strategy. This determination would then be integrated into the recovery plan.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
SFEFS	East Fork South Fork Salmon River	Large	Summer	Maintained	Ongoing supplementation exists in this population (Johnson Creek).
SFSEC	Secesh River	Intermediate	Summer	Highly Viable	Targeted for high viability. No supplementation and satisfies Intermediate-size requirement for MPG.
SRLSR	Little Salmon River	Intermediate	Spring / Summer	Maintained	Only population with spring/summer life history. Size category is driven by small, adjunct tributaries where the spring life history is represented in the population, although minor. Location outside main drainage. Population is greatly influenced by Rapid River Hatchery production and releases.
Grande Ronde / Imnaha River					
IRBSH	Big Sheep Creek	Basic	Spring	Consider for reintroduction as recovery efforts progress	Functionally extirpated. ICTRT recommends that initial recovery efforts focus on extant populations, i.e., the adjacent Imnaha River population, with scoping efforts for re-introduction conducted concurrently. Currently hatchery releases into Big Sheep Creek are from the adjacent Imnaha River population.
IRMAI	Imnaha River mainstem	Intermediate	Spring / Summer	Viable or Highly Viable	Only population with spring/summer life history.
GRUMA	Grande Ronde River upper mainstem	Large	Spring	Viable or Maintained	Population has the poorest abundance/productivity status of all populations in MPG, would likely require the most improvement to achieve viability.
GRCAT	Catherine Creek	Large	Spring	Viable or Highly Viable	Large population, would likely require less improvement than the Upper Grande Ronde population to achieve viability. ICTRT recommends initial focus on Catherine Creek core area (equivalent to Intermediate population).
GRLOO	Lookingglass Creek	Basic	Spring	Consider options as ongoing reintroduction efforts progress	Functionally extirpated. ICTRT recommends that initial recovery efforts focus on extant populations. Efforts to re-establish natural production are currently underway.
GRMIN	Minam River	Intermediate	Spring	Viable or Highly Viable	Minam R. has little spatial structure or diversity impairment. Wenaha R. and Minam R. populations are currently the most unaffected by hatchery fish.

MPG & Pop ID	Population Name	Size Category	Adult Life History Type	Role In Scenario	Considerations
GRLOS	Lostine River	Large	Spring	Viable or Highly Viable	One of the populations that would likely achieve viability with least improvement.
GRWEN	Wenaha River	Intermediate	Spring	Viable or Highly Viable	Wenaha R. is most downstream, providing connectivity with other MPGs. Population has little spatial structure or diversity impairment. Wenaha R. and Minam R. populations are currently the most unaffected by hatchery fish; <i>however, recent data suggests that stray rates with the last 10 years may be as high as ~50%.</i>
Lower Snake					
SNASO	Asotin Creek	Basic	Spring	Consider for reintroduction as recovery efforts progress	Functionally extirpated. ICTRT recommends that initial recovery efforts focus on extant populations, with scoping efforts for reintroduction conducted concurrently.
SNTUC	Tucannon River	Intermediate	Spring	Highly Viable	The only extant population in the MPG.

APPENDIX C. COEFFICIENTS OF VARIATION FOR IPTDS-BASED ABUNDANCE ESTIMATES

Table 18. Previous coefficients of variation (%) for IPTDS-based abundance estimates within Snake River steelhead populations for spawn years 2010 – 2023 based on natural-origin adult PIT-tagging at Lower Granite Dam. Note: For many values with an NA, alternate CV estimates are available from PIT-tag observations at mark-recapture-recovery (MRR) sites within those populations.

Pop ID	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	'21	'22	'23	Mean
Salmon River															
SRUMA-s	64.8	48.4	62.6	12.2	18.8	12.2	15.8	21	21.6	24.4	11.8	10.2	12.5	27.7	26
SREFS-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRPAH-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRLEM-s	9.7	11	8.2	7.2	31.8	9.3	7.4	9.1	10.3	14.4	9.4	12	18.3	17.4	12.6
SRNFS-s	NA	NA	NA	NA	NA	NA	NA	NA	41.8	12.4	11.6	NA	21.3	15.3	20.5
SRPAN-s	NA	NA	NA	NA	NA	NA	NA	NA	11.9	10.8	8.6	7.5	9.9	8.2	9.5
SRCHA-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFUMA-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32.8	14.4	21.6	18.8	21.9
MFBIG-s	NA	8.8	15.1	7.8	13.9	24.5	12.7	34.7	9.1	12.5	14.9	11.5	9.2	8.1	14.1
SFMAI-s	5.7	4.5	5.4	5.3	9	4.8	8.1	6.1	9.3	8.9	12.3	6.5	7.5	6.7	7.2
SFSEC-s	12.1	7.9	11.8	19.6	14.1	10.6	12.2	12.5	16.8	22.9	26.2	19.9	19.6	15	15.8
SRLSR-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.7	13	NA	12.9
Clearwater River															
CRSEL-s	NA	NA	NA	NA	NA	NA	NA	51.5	7	8	9.4	4.4	5.9	4.5	13
CRLOC-s	NA	NA	NA	NA	NA	NA	NA	15.3	6.4	6.7	9.8	4.9	5.7	4.7	7.6
CRSFC-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	15.9	24.9	20.4
CRLOL-s	NA	NA	6.4	8.1	10.5	7.3	7.8	10.6	9.3	45	14	7.5	12.5	9.5	12.4
CRNFC-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CRLMA-s	6.6	13.3	14.2	6.3	7.2	6	5.5	7.2	6.3	9.1	7.3	8.1	20.7	8.4	9
Imnaha River															
IRMAI-s	NA	3.3	3.1	4.3	5.3	4.2	4.1	4	4.3	6	4.4	4.3	4.3	4	4.3
Grande Ronde River															
GRUMA-s	NA	NA	NA	4.8	6.6	5	4.3	5.4	5.8	6.8	5.1	4.6	7.8	5.3	5.6
GRWAL-s	NA	NA	NA	NA	9.1	6	5.1	5.9	6.4	6.9	4.6	4.2	6.5	5.7	6
GRJOS-s	NA	4.6	3.7	4.4	5.7	4.1	3.9	4.7	4.1	5.8	5.2	4.5	7.3	6.7	5
GRLMT-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5	6.6	6.5	10	12	8.3
Hells Canyon															
SNHCT-s	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lower Snake															
SNASO-s	63.9	46.1	5.2	5.7	10.3	9.5	7.2	11.5	8	24.2	9.3	7.9	7.8	7.2	16
SNTUC-s	5.9	7.5	5.4	7.7	9	7.7	6.3	7.9	5.4	9.1	8	6.8	7.1	6.3	7.1

Table 19. Previous coefficients of variation for IPTDS-based abundance estimates within Snake River spring/summer Chinook salmon populations for spawn years 2010 – 2023 based on natural-origin adult PIT-tagging at Lower Granite Dam. Note: For many values with an NA, alternate CV estimates are available from PIT-tag observations at mark-recapture-recovery (MRR) sites within those populations.

Pop ID	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'21	'22	'23	Mean
Upper Salmon River														
SRUMA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRVAL	84.6	58.8	45.9	7.9	6.5	9.9	8.2	14.5	10.6	10.8	11.7	9.9	13	22.5
SRLMA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRYFS	NA	NA	47.2	8.4	10.1	16.5	10.8	17.4	13.6	20	18	22.8	18.3	18.5
SREFS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRPAH	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SRLEM	18.4	9.2	15.8	6.6	6.2	6.7	8.9	11.8	10.1	7.4	8.5	5.1	7.2	9.4
SRNFS	NA	NA	NA	NA	NA	NA	22.6	35.6	24.6	22.5	NA	11.6	13.5	21.7
SRPAN	NA	NA	NA	NA	NA	NA	NA	NA	9.4	10	11.9	6.8	8.2	9.3
Middle Fork Salmon														
MFBEA	NA	NA	NA	NA	NA	5	5.9	20.6	7.3	9.3	7.1	6.3	34.5	12
MFMAR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.8	5.2	9.3	7.4
MFSUL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFUMA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFLMA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFLOO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFCAM	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MFBIG	NA	NA	6.6	5.4	6.4	7	5.2	10.2	7.1	8.7	5.3	5	5.8	6.6
SRCHA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
South Fork Salmon														
SFSMA	5	3.4	4.4	5.5	4.8	10.2	5.3	8.2	7.4	8.3	4.7	3.5	4.9	5.8
SFEFS	8.5	6.3	6.4	5.4	5.3	9.6	4.6	7.7	6.6	7.5	5.5	4.1	5.5	6.4
SFSEC	8.1	5.6	5.6	5.3	5	10.1	4.8	7.1	6.9	7	5.3	4.2	5.2	6.2
SRLSR	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grande Ronde / Imnaha														
IRBSH	NA	8.6	14.3	16.2	13.5	26.5	14.8	17.8	26.8	38.8	14.6	23.1	22.1	19.8
IRMAI	NA	4	5.5	8.7	5.8	9.6	4.5	6.4	7.7	7.8	6	6	7.7	6.6
GRUMA	NA	NA	NA	NA	NA	NA	NA	NA	36.1	28.6	34.4	26.7	18.4	28.8
GRCAT	NA	NA	NA	NA	NA	11.6	11.9	14	13.2	10.5	11	9.8	12.6	11.8
GRLOO	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.9	16.9
GRMIN	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	6.3	7.4	6.6
GRLOS	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.3	5.3	4.5	NA	5.7
GRWEN	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.2	10.8	12.6	60.1	23.4
Lower Snake														
SNASO	213.3	354.2	506.7	29.3	271	47.3	1160.7	46.9	NA	NA	NA	46.6	29.9	270.6
SNTUC	28.8	26.2	16.9	20.9	13.6	15.2	13.8	17.9	19	20.4	21	37.6	31.4	21.8