ESA Recovery Plan for Snake River Idaho Spring/Summer Chinook Salmon and Steelhead Populations

November 2017

CHAPTERS 7-9

7. Cost and Time Estimates
8. Implementation
9. Research, Monitoring and Evaluation for Adaptive Management

WEST COAST REGION

NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | National Marine Fisheries Service

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7. Time and Cost Estimates

The ESA section 4(f)(1) requires that recovery plans, to the maximum extent possible, include "estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal" (16 U.S.C. 1531-1544, as amended). This section is intended to meet this ESA requirement.

7.1 Time Estimate

There are unique characteristics and challenges in estimating the time required for salmon and steelhead recovery given the complex relationship of these fish to their environment, and to human activities in the water and on land. The many uncertainties that preclude a precise estimate of recovery time include biological and ecosystem responses to recovery actions and the unknown impacts of future economic, demographic, and social developments.

Much work remains, both at a regional level and at the local levels, before Snake River spring and summer Chinook salmon and steelhead will be self-sustaining in the wild and no longer need ESA protection. Thus, many factors will influence the time required to recover the two species: It will depend on whether existing protective actions remain in place and on whether implementation of ongoing actions continues. It will depend on the timeliness of effective additional actions that close the gap between the species' present status and viability, and on the adequacy of RM&E activities to monitor changes in fish status, identify windows for improvement, and evaluate management action effectiveness. Further, it will depend on how the fish respond to both ongoing and additional actions, as well as to changes in ocean conditions, climate and the impacts of other ecological factors.

Given the many challenges to recovery, the timing will also depend on the implementation of a functioning and funded adaptive management framework. Finally, the time to recovery includes the need to have effective regulatory mechanisms, including binding agreements, in place so NMFS would have a high level of confidence that once the species are delisted they would continue to be conserved and the threats would remain ameliorated so that the species would not be likely to need to be listed again in the foreseeable future.

Given the complexity of tasks ahead, NMFS estimates that recovery of the Idaho Snake River spring/summer Chinook salmon and Snake River Basin steelhead major population groups, like recovery for most of the ESA-listed Pacific Northwest salmon and steelhead, could take 50 to 100 years. Together, the actions identified in this recovery plan and the larger ESU and DPS-level ESA recovery plan for the species will move the Snake River spring/summer Chinook salmon and Snake River Basin steelhead major population groups towards viable status. However, the actions will not get us to recovery. There will still be gaps, and our recovery efforts

will need to be expanded and adapted in the future to address the many critical uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions, as well as long-term and future funding.

NMFS believes that, while continued programmatic actions in the management of habitat, hatcheries, the hydropower system, and harvest will warrant additional expenditures beyond the first five years, it is impracticable to estimate all projected actions and costs over 50 to 100 years given the large number of economic, biological, and social variable involved. Instead, NMFS believes it is more appropriate to focus on the first 10 years of action implementation, with the understanding that before the implementation of each 5-year implementation period, actions and costs will be estimated for subsequent years.

Consequently, the approach relies heavily on the adaptive management process and framework identified in this Plan and the larger ESA recovery plan to guide us towards recovery. Rather than speculate on conditions that may or may not exist 25, 50, or 100 years in the future, NMFS outlines a structured process that conducts monitoring to improve the science and periodic plan reviews to evaluate the status of the MPGs and add, eliminate, or modify actions based on new information. The adaptive management process will continue to frame decision-making to gain needed information and refine our course strategically until such time as the protection under the ESA is no longer required.

7.2 Cost Estimates

This section provides the 5-year cost estimates for this Idaho management unit plan. These estimates primarily represent the costs of actions identified to restore tributary spawning, rearing, and migratory habitats within the Salmon and Clearwater River basins through Bonneville Power Administration programs. The estimates do not reflect the total cost of recovery of the Idaho spring/summer Chinook salmon and steelhead populations, or ESU and DPS-level recovery costs for Snake River spring/summer Chinook salmon and Snake River Basin steelhead. The total costs for both species are discussed in the larger ESA recovery plan for the species, as called for under ESA and NOAA Interim Recovery Planning Guidance, version 1.3, dated June 2010.

The recovery actions identified in this management unit plan for the Idaho Snake River spring/summer Chinook salmon populations (Chapter 5) and steelhead populations (Chapter 6) address the factors and threats that currently limit species' viability. Staff from NMFS' West Coast Region worked with staff from the Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, Idaho Office of Species Conservation, Clearwater Technical Group, Upper Salmon Basin Watershed Program, U.S. Forest Service, U.S. Bureau of Land Management, U.S. Corps of Engineers, Bonneville Power Administration and other federal agencies to identify these recovery actions. The recovery actions are identified for each

population. They were developed using the most up-to-date assessment of each species' needs, without consideration of cost or potential funding. For this initial phase of recovery plan implementation, NMFS is primarily using the tributary habitat actions identified in the 2008 Federal Columbia River Power System (FCRPS) biological opinion and 2010 and 2014 supplemental biological opinions (NMFS 2008, 2010, 2014). Additional future recovery actions will be identified with the partners listed above as the recovery plan is implemented over time.

Categorizing Recovery Actions and Corresponding Cost Estimates

The types of recovery actions can be separated into four different categories for purposes of cost estimates: (1) baseline actions, (2) actions for which cost estimates exist, (3) actions where costs are to be determined, and (4) actions were costs are not applicable. The types of actions identified in this Plan do not have cost estimates provided because they fall into three of the four categories:

- *Baseline Actions*: Actions categorized as part of ongoing, existing programs that will be carried out regardless of this Plan. The costs associated with these actions do not represent new costs that are a direct result of this Plan. While Table 7-1 shows costs for baseline tributary habitat actions identified in this Plan, the costs are provided to illustrate the financial scope and scale of the baseline actions and do not represent new costs.
- *To Be Determined*: Actions that need costs to be developed, need unit costs, and/or need project scale estimates to be sufficiently detailed to support a cost estimate. These costs will be developed during the implementation phase and a Recovery Cost Summary Table will be updated accordingly.
- *Not Applicable*: Actions that are generally policy actions requiring staff time and do not have separate, direct costs associated with them.

As described previously in Chapters 4, 5, and 6, multiple entities have implemented significant programs that have benefitted Idaho's Snake River spring/summer Chinook salmon and Snake River Basin steelhead populations since the ESU and DPS were listed in 1992 and 1997 respectively, and that have helped to achieve present viability levels. Many of these programs are ongoing, and their actions continue to improve salmon and steelhead viability. The costs for these programs are all considered baseline costs because they are associated with other programs that are being implemented to meet existing regulatory commitments or other obligations, not solely for the purpose of species recovery. Our assumption is that most of the baseline actions will continue into the future. If they do not, it is likely that additional recovery actions would need to be identified to replace them and maintain each species status. Those new costs would be added to the costs of implementing this recovery plan.

Baseline Costs for Tributary Habitat Recovery Actions from the FCRPS Biological Opinion

The costs associated with implementation of the FCRP biological opinion tributary habitat actions, the initial focus of this Idaho management unit plan, are considered baseline costs and

are not included as new costs for recovery. Instead, the FCRPS-related actions are generally funded through the Bonneville Power Administration's power and transmission activities. While these baseline costs are not used for purposes of calculating habitat recovery costs, they are provided here to illustrate the financial scope and scale of the baseline actions. Table 7-1 provides this information as a summary of cost expenditures for meeting recovery goals outlined in this Plan. NMFS prepared the cost estimates by working with Bonneville Power Administration staff familiar with current and proposed FCRPS-related habitat recovery actions. Based on availability of sufficient information, the total cost of each project was estimated using the scale described for each action, together with unit costs for each project type. For example, scale was measured either in stream miles of treatment or number of structures as described in Chapters 5 and 6. For some actions, no scale estimate is available at this time, in which case no baseline cost estimate is provided.

The estimated baseline recovery cost summary table of this document, Table 7-1, provides the estimated baseline costs for FCRPS biological opinion tributary actions identified in this recovery plan for fiscal year 2015, where information was sufficient to provide them. Where possible, it also identifies associated costs for research, monitoring, and evaluation; however, in many cases these costs have yet to be determined. For each BPA project, Table 7-1 identifies the proponents (entities, agencies or organizations with authority, responsibility, or expressed interest to implement a specific recovery action), project type, location, and estimated costs for fiscal year 2015. All yearly costs identified in this chapter are presented in present-year dollars (that is, without adjusting for inflation). Costs are estimates for the Fiscal Year (FY) in thousands of dollars ($K). The total costs are the sum of the yearly costs without applying a discount rate. The actions range widely from relatively less expensive projects to more expensive projects. Actions also vary considerably in length of time over which they will take place. In some cases, a length of time has yet to be determined.

In the recovery plan implementation phase, NMFS will work with regional experts and local implementers to identify additional tributary habitat actions to support recovery, and provide costs, scale or unit costs for actions that require more information. The recovery plan will be updated as new recovery actions and cost information becomes available.

Cost of Recovery for this Management Unit Plan

At this point in time, it is difficult to provide a definitive estimate for the total cost for recovery of the Idaho Snake River spring/summer Chinook salmon and steelhead populations. The tributary habitat actions identified in this Plan for initial implementation are primarily FCRPS biological opinion baseline actions categorized as part of ongoing, existing programs. These actions will improve population viability but will not be enough to reach recovery goals. The FCRPS actions, however, are not defined as recovery costs since they will be carried out regardless of this Plan.

NMFS recognizes that additional actions will be needed to recover the Idaho management unit, and that implementation of these actions will contribute to the costs of recovery. Nevertheless, there are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions, as well as long-term and future funding to implement needed actions through the species' life cycle.

Given the many remaining unknowns, it is impracticable to estimate all projected actions and costs to reach recovery. Instead, it is most appropriate to focus on the first five years of action implementation, with the understanding that before the end of each 5-year implementation period, specific actions and costs will be estimated for subsequent years. Rather than speculate on conditions that may or may not exist that far into the future, this Plan relies on ongoing monitoring and periodic plan review regimes to add, eliminate, or modify actions through adaptive management as information becomes available and until such time as the protection under the ESA is no longer required.

NMFS will use the cost of the average annual Pacific Coast Salmon Recovery Fund (PCSRF) allocation to the State of Idaho to calculate annual costs for recovery. The PCSRF was established by Congress to reverse the declines of Pacific salmon and steelhead, and is administered by NOAA Fisheries. Given that the most recent PCSRF average annual allocation to Idaho in 2015 was $4 million, the recovery costs for the first 10-year period are estimated to be $40 million. True habitat-related costs for recovery are more than this amount, yet NMFS believes that this estimate is reasonable and can sustain habitat-related recovery implementation. Preliminary research, monitoring, and evaluation costs have, in some cases, been estimated; however, these costs are not included at this time pending completion of research and monitoring plans and further development of each project.

These costs do not include costs directly associated with implementation of other programs being carried out to meet other mandates or requirements. As noted throughout this document, many salmon and steelhead actions are already ongoing, or will be implemented in the future as baseline actions, meaning that they will be carried out regardless of this plan. We have not included cost estimates for those actions, because they do not represent new costs that are a direct result of this Plan. As also noted in this Plan, additional actions will need to be identified and implemented to achieve recovery. Costs for those actions would be identified at that time.

Costs associated with implementing actions and RM&E for the following baseline programs are considered baseline costs:

- Federal Columbia River Power System operations, structural improvements, transportation, research, and other actions to maintain and enhance spawning, incubation, rearing, and migration conditions for Snake River spring summer Chinook and steelhead, as specified in the FCRPS Biological Opinion (NMFS 2014).

- Hatchery programs that support Snake River spring summer Chinook and steelhead recovery as described in this Plan and adopted Hatchery and Genetic Management Plans for these species.
- Idaho Power Company activities related to maintaining or improving rearing and migratory conditions for these two species.
- Activities conducted by multiple harvest-management jurisdictions to reduce harvest on Snake River spring/summer Chinook and steelhead in ocean and in-river fisheries, as described in the Harvest Module (included in the larger ESA recovery plan for the species as Appendix F) and in NMFS' ESA biological opinion on the fishing regimes (NMFS 2008). FCRPS and other actions improve Snake River spring/summer Chinook and Snake River Basin steelhead survival and productivity in the Columbia River estuary and plume, including those to increase habitat access, food availability, water quality and flow conditions. These actions are described in the Estuary Module (included in the larger ESA Upper Salmon River mainstem population for S/S Chinook recovery Upper Salmon River mainstem population for S/S Chinook plan for the species as Appendix E) and the FCRPS biological opinion (NMFS 2014).
- Related tributary habitat actions for recovery of Snake River Fall Chinook Salmon (NMFS 2017) or Snake River Sockeye Salmon (NMFS 2015).

Photo Credit: K. Fessenmyer

Table 7-1. Estimated Baseline Costs for Fiscal Year 2015 Recovery Actions for FCRPS Biological Opinion Tributary Actions.[1]

BPA Project #	Project Title	Proponent	Type	Basin	FY2015 Estimated Costs
1989-098-00	Salmon Studies in Idaho Rivers	Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, US Fish and Wildlife Service	Govt-State, Tribe, Tribe, Govt-Federal	Salmon	$725,943
1990-055-00	Idaho Steelhead Monitoring and Evaluation (M&E) Studies	Idaho Department of Fish and Game	Govt - State	Clearwater	$1,251,199
1991-028-00	Pit Tagging Wild Chinook	NMFS	Govt - Federal	Salmon	$490,880
1991-073-00	Idaho Natural Production Monitoring and Evaluation (M&E)	Idaho Department of Fish and Game	Govt - State	Salmon	$1,438,664
1994-015-00	Idaho Fish Screening Improvement	Idaho Department of Fish and Game	Govt - State	Salmon	$424,032
1994-050-00	Salmon River Habitat Enhancement	Shoshone-Bannock Tribes	Tribe	Salmon	$250,889
1996-043-00	Johnson Creek Artificial Propagation Enhancement	Nez Perce Tribe	Tribe	Salmon	$1,533,562
1996-077-02	Lolo Creek Watershed Restoration	Nez Perce Tribe	Tribe	Clearwater	$451,116
1996-086-00	Clearwater Focus Program	Idaho Office of Species Conservation	Govt - State	Clearwater	$102,961
1997-030-00	Chinook Salmon Adult Abundance Monitoring	Nez Perce Tribe	Tribe	Salmon	$528,278
1997-038-00	Listed Stock Chinook Salmon Gamete Preservation	Nez Perce Tribe	Tribe	Grand Ronde, Clearwater, Salmon, Snake Upper	$42,197
1999-017-00	Protect and Restore Lapwai Creek Watershed	Nez Perce Tribe	Tribe	Clearwater	$393,182
2000-035-00	Newsome Creek Watershed Restoration	Nez Perce Tribe	Tribe	Clearwater	$634,157
2002-059-00	Yankee Fork Salmon River Restoration	Shoshone-Bannock Tribes	Tribe	Salmon	$591,622
2002-060-00	Nez Perce Harvest Monitoring on Snake and Clearwater Rivers	Nez Perce Tribe	Tribe	Clearwater, Upper Snake	$346,269

[1] The costs included in Table 7-1 are considered baseline costs and do not represent new costs that are a direct result of this plan.

BPA Project #	Project Title	Proponent	Type	Basin	FY2015 Estimated Costs
2002-061-00	Potlatch River Watershed Restoration	Latah Soil and Water Conservation District	SWCD	Clearwater	$400,000
2002-068-00	Evaluate Stream Habitat - Nez Perce Tribe Watershed Monitoring and Evaluation (M&E) Plan	Nez Perce Tribe	Tribe	Clearwater	$214,690
2002-070-00	Lapwai Creek Anadromous Habitat	Nez Perce Soil and Water Conservation District	SWCD	Clearwater	$261,759
2002-072-00	Red River Watershed Restoration	Nez Perce Tribe	Tribe	Clearwater	$585,536
2007-064-00	Slate Creek Watershed Restoration	Nez Perce Tribe	Tribe	Salmon	$159,415
2007-092-00	Restore Selway River Watershed	Nez Perce Tribe	Tribe	Clearwater	$342,886
2007-127-00	East Fork of South Fork Salmon River Passage Restoration	Nez Perce Tribe	Tribe	Salmon	$765,316
2007-268-00	Idaho Watershed Habitat Restoration-Custer District	Custer Soil and Water Conservation District	SWCD	Salmon	$295,000
2007-394-00	Upper Salmon Basin Habitat Restoration	Idaho Office of Species Conservation	Govt - State	Salmon	$443,233
2007-395-00	Protect and Restore Lochsa Watershed	Nez Perce Tribe	Tribe	Clearwater	$1,364,775
2007-399-00	Upper Salmon Screen Tributary Passage	Idaho Department of Fish and Game	Govt - State	Salmon	$1,000,000
2007-403-00	Spring Chinook Captive Propagation - Idaho	Idaho Department of Fish and Game	Govt - State	Salmon	$181,272
2008-603-00	Pahsimeroi River Habitat	Idaho Office of Species Conservation	Govt - State, Govt - State	Salmon	$1,954,541
2008-604-00	Lower Clearwater and Potlatch Watersheds Habitat Improvements	Idaho Office of Species Conservation	Govt - State	Clearwater	$897,338
2008-608-00	Idaho MOA/Fish Accord Water Transactions	Idaho Department of Water Resources (IDWR), Idaho Office of Species Conservation	Govt - State	Salmon	$1,355,807
2008-903-00	ESA Habitat Restoration	Shoshone-Bannock Tribes	Tribe	Salmon	$671,885

BPA Project #	Project Title	Proponent	Type	Basin	FY2015 Estimated Costs
2008-904-00	Salmon River Basin Nutrient Enhancement	Shoshone-Bannock Tribes	Tribe	Salmon	$271,078
2009-023-00	Accord Administration - Idaho	Idaho Office of Species Conservation	Govt - State	Salmon	$102,709
2010-003-00	Lower South Fork Clearwater River Watershed Restoration	Nez Perce Tribe	Tribe	Clearwater	$790,265
2010-026-00	Chinook and Steelhead Genotyping for Genetic Stock Identification (GSI) at Lower Granite Dam	Idaho Department of Fish and Game	Govt - State	Grand Ronde, Imnaha, Salmon, Clearwater, Snake Lower	$669,448
2010-031-00	Snake River Chinook and Steelhead Parental Based Tagging	Idaho Department of Fish and Game	Govt - State	Grand Ronde, Imnaha, Salmon, Clearwater, Snake Lower	$1,436,187
2010-072-00	Lemhi River Restoration	Idaho Office of Species Conservation	Govt - State	Salmon	$969,961
2010-086-00	Protect and Restore The Crooked and American River Watersheds	Nez Perce Tribe	Tribe	Clearwater	$932,926
2011-021-00	Accord Administration - Shoshone-Bannock Tribes	Shoshone-Bannock Tribes	Tribe	Salmon, Snake Upper	$301,971
2012-006-00	Nez Perce Tribal Coordination	Nez Perce Tribe	Tribe	Clearwater	$82,926
				FY 15 Project Total	$25,655,875

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8. Implementation

This section proposes a framework for coordinated implementation of this Plan. Successful implementation of recovery actions, research and monitoring projects will build upon the over twenty years of leadership and recovery work carried out in the state of Idaho by numerous parties, including: IDFG, Idaho Governor's Office of Species Conservation, Nez Perce Tribe, Shoshone-Bannock Tribes, U.S. Forest Service, Bureau of Land Management, BPA, Upper Salmon Basin Watershed Program, Clearwater Technical Group, and other watershed councils, environmental organizations, landowners, and local, state and federal entities. These various organizations and individuals continue to partner with NMFS to identify and implement actions that are helping recover Snake River spring/summer Chinook salmon and Snake River Basin steelhead major population groups in Idaho. Successful implementation of this Plan will depend on the continued coordinated actions and funding from these diverse parties.

The Snake River spring/summer Chinook salmon and Snake River Basin steelhead major population groups in Idaho have not had a state-designated ESA recovery board (such as the SE Washington Snake River Recovery Board based in Dayton, Washington) that could take responsibility for writing a recovery plan. For that reason, NMFS led the development of this plan; however, the process for implementing this Plan will be a coordinated effort. NMFS recognizes that extensive coordination between all parties will be needed to implement actions effectively and achieve recovery.

NMFS will work with its Idaho partners to implement this management unit plan. Several existing groups in Idaho currently implement actions to improve salmon and steelhead habitat conditions. These groups provide strong representations by the private, state, federal and tribal entities that manage land and other resources within Idaho Snake River drainages. The entities include representatives from the IDFG, Idaho Governor's Office of Species Conservation, Nez Perce Tribe, Shoshone-Bannock Tribes, Upper Salmon Basin Watershed Program, Clearwater Technical Group, BPA/BOR expert panel, U.S. Forest Service, BLM, Idaho Department of Water Resources, the Natural Resource Conservation Service, Idaho Soil and Conservation Commission, irrigation districts, different county soil and water conservation districts, Nature Conservancy, Trout Unlimited, as well as many private landowners and other local groups involved in habitat restoration. These different entities have created effective processes for working together, providing technical reviews of proposed projects and working with interested parties to accomplish conservation on the ground. They are all partners with NMFS in some capacity in recovering listed salmon and steelhead.

NMFS will rely, to a great extent, on these different entities to voluntarily implement actions the Plan recommends or proposes. NMFS' interim recovery planning guidance (NMFS and USFWS 2010) acknowledges that recovery plans are not regulatory documents, and that it is not a

requirement of ESA section 4(f) for any entity to implement the recovery strategy or specific actions in a recovery plan unless otherwise legally mandated. In many cases, the Plan acknowledges and recommends coordinating the pre-existing, ongoing recovery efforts and pre-existing laws or regulations that are expected to benefit the species and its environment, such as ongoing hatchery, resource management and habitat restoration activities by its various partners (see Table 8-1).

Some of the ongoing actions that are in the Plan are required under other, separate resource management regulatory processes. Multiple forums share responsibilities for managing the species and their habitats throughout different phases of the life cycle. Some of these forums are regional, including those established for *U.S. v. Oregon*, the FCRPS biological opinion, the Lower Snake River Compensation Plan, the Pacific Salmon Treaty and the Columbia Basin Fish Accords. Other entities ─ such as the IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, U.S. Forest Service, and Idaho Governor's Office of Species Conservation ─ oversee efforts at the watershed level. These efforts include the implementation of forest practices, habitat restoration, operation of fish hatcheries, and regulation of local fisheries that may affect Idaho Snake River spring/summer Chinook salmon and Snake River Basin steelhead. The challenge is to provide coordination so these different forums collectively and individually focus efforts on the best management opportunities to protect and improve the species' status across the life cycle.

In accordance with the ESA section 7(a)(1), we will also work with our federal partners to find ways to increase federal interagency contributions to conservation, protection, and recovery of the species and habitat. We encourage federal agencies to use the recovery plans as they make decisions and allocate their resources.

This chapter proposes an overall framework for coordinated implementation of this Plan. It proposes processes for achieving coordinated evaluation, reporting, prioritizing and implementation of future recovery actions. It also describes processes for revisiting and updating the Plan and its proposed strategies and actions over time through the adaptive management process. Further, the proposed framework recognizes that coordination needs differ depending on the type and scale of action, with some actions requiring coordination at both the local and the ESU or DPS level. This coordination will ensure that overall recovery needs are being met, and that limited funds are used effectively. Thus, the implementation framework proposed in this Plan is one piece of the overall implementation strategy proposed in the larger ESA recovery plan for the species. It will be revised based on input and review during the public comment period.

NMFS recognizes that there may be alternative actions to those identified in this Plan that may also attain recovery goals. Actions to achieve a specific recovery strategy may vary due to logistics, project opportunities, willingness of landowners to participate, funding constraints, or an organization's authorities and administrative processes. This Plan does not constrain or inhibit entities or individuals from implementing actions as opportunities or funding become available.

Table 8-1. State and Federal Agencies, Public Organizations, and Tribes Involved in Projects to Restore Salmonid Habitat in Idaho.

Entity	Roles and Responsibilities
Tribes	
Nez Perce Tribe	Manages fish programs and land and water uses to protect natural resources and provide long-term stability through an interdisciplinary approach. Implements salmon and steelhead habitat restoration projects. The Tribe's Fisheries Management Resource Plan describes the programs: http://www.nptfisheries.org/portals/0/impages/dfrm/home/fisheries-management-plan-final-sm.pdf
Shoshone-Bannock Tribes	Manages fish programs and land and water uses to protect, restore and enhance ecosystem processes that contribute to healthy, sustainable natural resources. Implements salmon and steelhead habitat restoration projects.
State Agencies	
Idaho Dept. of Agriculture	Regulates confined animal feeding operations and pesticides within state of Idaho.
Idaho Dept. of Environmental Quality	Protects human health and the quality of Idaho's air, land, and water. The department has primary responsibility for the Clean Water Act in Idaho and develops water quality standards and "total maximum daily loads" (TMDLs) to attain the standards.
Idaho Dept. of Fish and Game	Protects and manages fish and wildlife in Idaho.
Idaho Dept. of Lands	Regulates forestry and mining in the State of Idaho, manages state timber endowments lands, and is a key partner with the federal government in developing the proposed Idaho Forestry Program, a component of the Snake River Basin Adjudication (SRBA).
Idaho Dept. of Transportation	Develops and implements best management practices for road construction and maintenance in Idaho.
Idaho Dept. of Water Resources	Manages water rights and is a partner with federal agencies in settling the contentious Snake River Basin Adjudication (SRBA) and providing mechanisms for increasing instream flows for listed fish. The Idaho Water Resources Board has the authority to implement water transactions.
Idaho Governor's Office of Species Conservation	Coordinates programs related to the conservation of threatened and endangered species in Idaho and provides funding to local groups implementing recovery plans.
Clearwater Technical Group	A partnership between county soil and water conservation districts, Idaho Department of Fish and Game, Nez Perce Tribe, Natural Resources Conservation Service, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the Nature Conservancy. The committee reviews proposed watershed restoration projects and coordinates monitoring efforts within the Clearwater River Basin.
Upper Salmon Basin Watershed Program	A community-driven partnership in which landowners voluntarily work with local, state, and federal partners to improve stream habitat for salmon and resident fish in the Upper Salmon River Basin. The program is affiliated with the Idaho Governor's Office of Species Conservation. It helps landowners develop restoration projects, seeks funding, assists with the permitting process, oversees the work, and monitors outcomes.
Idaho Soil and Water Conservation Commission	Develops best management practices for irrigated agriculture and grazing and provides support and services to local conservation districts and landowners.
County Soil and Water Conservation Districts	Cover all of Idaho and have long been active in implementing conservation programs in the state. They have a long and successful history of pursuing funding and implementing on-the-ground practices with private partners, as well as implementing conservation practices on both state and federal lands through formal agreements with state and federal agencies.
Federal Agencies	
Bonneville Power Administration	Provides power to the Pacific Northwest and mitigates the impacts of the Federal Columbia River Power System on fish and wildlife.
Bureau of Land Management	Manages nearly 12 million acres of public lands in Idaho. Resources on the public lands include recreation, rangelands, timber, minerals, water, fish and wildlife, wilderness, air and soils, and scenic, scientific, and cultural values.
Bureau of Reclamation	Manages water in the western United States with dams, power plants, and canals. With the US Army Corps of Engineers, the Bureau of Reclamation owns and operates the Federal

Entity	Roles and Responsibilities
	Columbia River Power System, a series of hydropower projects on the Columbia and lower Snake Rivers in the migration corridor for Idaho's salmon and steelhead.
Environmental Protection Agency	Protects human health and the environment through regulations, enforcement, grants, research, and education. The Environmental Protection Agency (EPA) reviews state water quality standards developed by Idaho Department of Environmental Quality in accordance with the Clean Water Act. Under the Comprehensive Environmental Response, Compensation, and Liability Act (otherwise known as CERCLA or Superfund) the EPA enforces cleanup of uncontrolled or abandoned hazardous-waste sites, such as former mine sites.
Federal Highway Administration	Administers federal funding for maintenance and construction of roads and highways.
Natural Resources Conservation Service	Works with individual farmers and ranchers, landowners, and local conservation districts through conservation planning and assistance programs to maintain productive lands and healthy ecosystems. Assistance programs help landowners reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters.
U.S. Army Corps of Engineers	Provides public engineering services and regulates alteration of streams and wetlands. With the Bureau of Reclamation, the U.S. Army Corps of Engineers owns and operates the Federal Columbia River Power System, a series of hydropower projects on the Columbia and lower Snake Rivers in the migration corridor for Idaho's salmon and steelhead.
U.S. Fish and Wildlife Service	Conserves fish and wildlife and has ESA responsibilities for threatened bull trout, which occupy many of the same streams in Idaho as salmon and steelhead. They also operate salmon and steelhead hatcheries for supplementation programs in Idaho.
U.S. Forest Service	Manages 20 million acres of public forests and grasslands in Idaho for sustainable multiple uses. National Forests in Idaho with salmon and steelhead habitat include the Boise, Clearwater, Nez Perce, Payette, Salmon-Challis, and Sawtooth National Forests.
Interested public—organizations and individuals	
Lemhi Regional Land Trust	Protects working ranchland and river corridors in central Idaho through conservation easements.
Palouse-Clearwater Environmental Institute	Through its Watershed Program, implements riparian and wetland restoration, watershed planning, water quality protection, and biological monitoring in the Palouse-Clearwater region.
Salmon Valley Stewardship	Works on community-supported policies and programs to protect natural resources, encourage sustainable practices for natural resource-based businesses, and promote responsible growth in the Salmon River valley.
The Nature Conservancy	Protects salmon habitat and working farms and ranches through conservation easements, land acquisitions, and water conservation agreements in its Salmon River focus area.
Trout Unlimited	Implements habitat restorations projects, such as large woody debris placement and riparian revegetation, in salmonid streams throughout the state, with the participation of local members.

8.1 Implementation Framework

The proposed recovery plan implementation framework is presented below to begin the discussion about the best way to implement this Plan and engage interested parties on how best to coordinate future work. This proposal anticipates close working relationships with existing groups, builds on the important recovery work of the last twenty years and seeks continued collaborative initiatives to recover Snake River spring/summer Chinook salmon and Snake River Basin steelhead major population groups in Idaho. The roles of each of these proposed

implementation teams and the coordinator are described below for discussion with interested parties. Similar frameworks are being used to coordinate other recovery plan implementation efforts in Washington and Oregon. The following proposed framework will be revised based on input and review during the public comment period.

The components of this proposed implementation framework include the following (Figure 8-2):

- Idaho Snake River Implementation Team,
- Idaho Snake River Science Team, and
- NMFS' Snake River Coordination Group.

Idaho Snake River Implementation Team

The Idaho Snake River Implementation Team (Implementation Team) will provide overall leadership, coordination, direction, agenda setting and communication for implementation of the Idaho management unit recovery plan. It will work with the action implementers and all parties involved in recovery plan implementation. It will coordinate with entities at relevant federal, state and regional levels, and will represent Idaho Snake River spring/summer Chinook salmon and steelhead recovery plan implementation in the Snake River Coordination Group meeting. This team is made up of representatives from IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, U.S. Forest Service, Clearwater Technical Group, Upper Salmon Basin Watershed Program, soil and water conservation districts, Idaho Department of Water Resources, BPA, NMFS, and other entities and stakeholders as identified. It develops a 5-year implementation schedule, identifies action priorities, and reports annual progress on implementation and monitoring actions to the public.

The Implementation Team also coordinates implementation of the Adaptive Management and Research, Monitoring, and Evaluation Plan. It will coordinate with NMFS' Northwest Fisheries Science Center's Recovery Implementation Science Team (RIST), IDFG, Nez Perce Tribe, Shoshone-Bannock Tribes, and NMFS to design research, monitoring, and evaluation protocols and actions for research, data collection and reporting. It monitors and reports on status of populations in relation to recovery goals. It coordinates with technical teams from other Snake River management units to ensure consistency of cross-ESU/DPS project design, data collection and reporting through communication with the Snake River Coordination Group.

Idaho Snake River Science Team

The Idaho Snake River Science Team (Science Team) will provide science input and advice on full life cycle MPG actions, strategies, research designs, and RM&E priorities, including scoping science needs at the ESU-level. The Science Team will ensure that rigorous and "best available science" informs implementation and is applied in RM&E for all "H's" within the MPGs, and assist in translating information into status of species viability. The Science Team's input will be critical to five-year reviews of the ESU and DPS.

NMFS' Snake River Coordination Group

The Snake River Coordination Group (Coordination Group), convened by NMFS, brings together representatives from the southeast Washington, northeast Oregon and Idaho Snake River recovery plan management units and other relevant parties to coordinate policy and technical issues across the four listed Snake River salmon and steelhead ESUs and DPS in the Snake River recovery domain. These include related recovery efforts in the Columbia River estuary and mainstem, actions being implemented through the FCRPS biological opinion to improve survival of salmonids through the migratory corridor of the Columbia and Snake Rivers, and other related efforts by the Northwest Power and Conservation Council, Tribes, Bonneville Power Administration, Bureau of Reclamation, Army Corps of Engineers, and federal land and water management agencies. The Coordination Group provides organizational structure for communication and coordination on a tri-state and multi-tribal level across the Snake River recovery domain. This group will provide cross-management unit communication, advise NMFS on recovery plan issues, and promote recovery plan implementation.

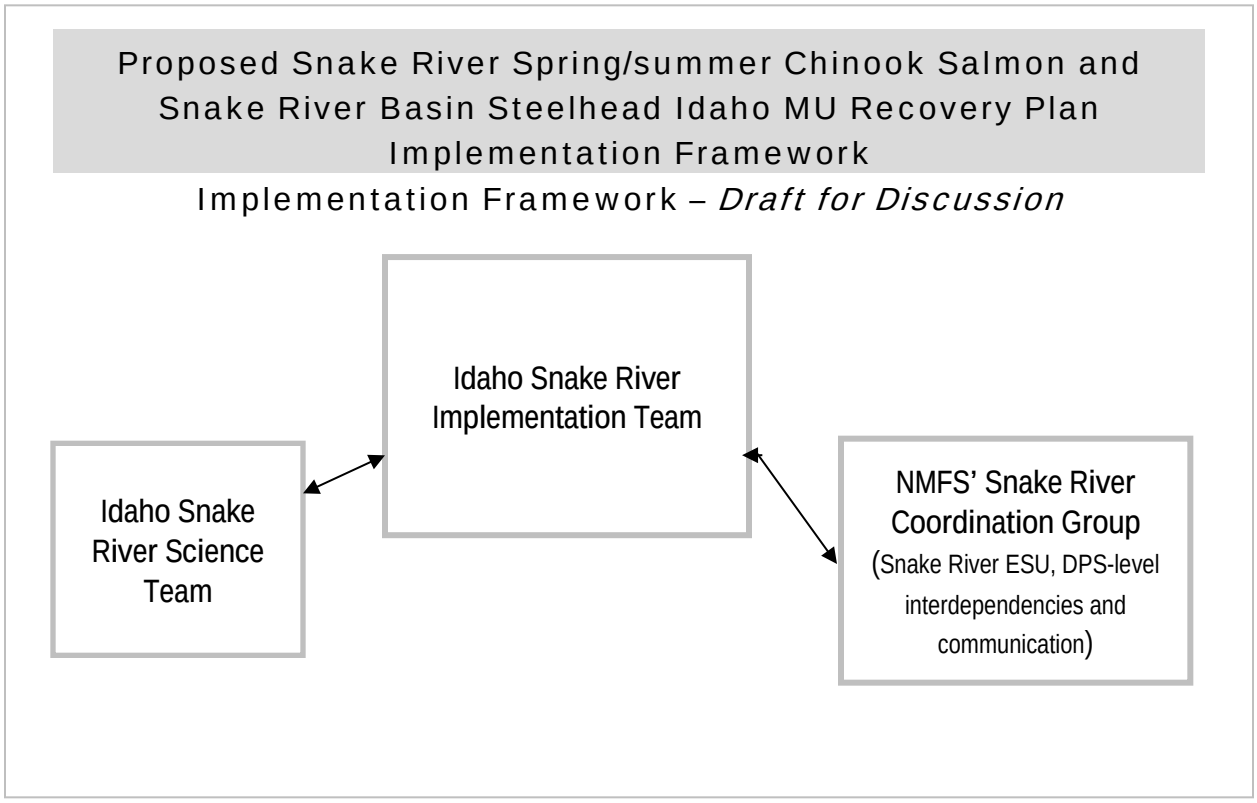

Figure 8-2. Proposed Snake River Spring/Summer Chinook salmon and Snake River Basin Steelhead Recovery Plan Implementation Framework in Idaho.

8.2 Implementation Progress and Status Assessments

Evaluating a species for potential delisting requires an explicit analysis of population or demographic parameters (biological viability criteria) and also of threats under the five ESA listing factors in ESA section 4(a)(1) (listing factors (threats) criteria). Together these make up the "objective, measurable criteria" required under section 4(f)(1)(B). The ESU and DPS-level recovery plan summarizes the biological viability criteria and threats criteria that will be used to evaluate the Snake River spring/summer Chinook salmon ESU and Snake River Basin steelhead DPS for potential change in listing status or delisting. Section 3.4 of the ESA recovery plan for the species describes these biological viability and threats criteria.

ESA 5-Year Reviews and ESU/DPS Status Assessments

Under the ESA, NMFS is required to review the status of listed species at least every five years. The 5-year review is used to determine whether an ESA-Upper Salmon River mainstem population for S/S Chinook listed species should: (1) be removed from the list, (2) be changed in status from an endangered species to a threatened species, or (3) be changed in status from a threatened species to an endangered species.

Accordingly, at 5-year intervals, NMFS will conduct reviews of the listed Snake River salmon ESUs and steelhead DPS. These reviews will consider information that has become available since the most recent status review, and that informs assessment of the biological status of the ESU/DPS and/or of the limiting factors and threats that affect the species. The reviews will make recommendations regarding whether a change in listing status is appropriate. Any status reviews will be based on the NMFS Listing Status Decision Framework (see Figure 9-2) and will be informed by the information obtained through implementation of monitoring, research, and evaluation programs in each management unit plan and the recovery modules.

Similarly, new information considered during 5-year status reviews may also compel more in-depth assessments of implementation and effectiveness monitoring and associated research to inform adaptive management decision at the management unit level.

Modifying or Updating the Recovery Plan

Guidance for conducting 5-year status reviews was developed jointly by NMFS and the U.S. Fish and Wildlife Service. This guidance is provided on the NMFS website: http://www.nmfs.noaa.gov/pr/pdfs/laws/guidance_5_year_review.pdf. According to recovery planning guidance, immediately following the 5-year species status review, an approved recovery plan should be reviewed in conjunction with implementation monitoring, to determine whether or not the plan needs to be brought up to date.

Recovery planning guidance provides for three types of plan modifications: (1) an update, (2) a revision, or (3) an addendum (NMFS and USFWS 2010). An update involves relatively minor changes. An update may identify specific actions that have been initiated since the plan was

completed, as well as changes in species status or background information that do not alter the overall direction of the recovery effort. An update does not suffice if substantive changes are being made in the recovery criteria or if any changes in the recovery strategy, criteria, or actions indicate a shift in the overall direction of recovery; in this case, a revision would be required. Updates can be made by NMFS' Interior Columbia Basin Area Office in the West Coast Region, which will seek input from co-managers and implementing partners prior to making any update. An update would not require a public review and comment period.

NMFS expects that updates will result from implementation of the adaptive management program for this Plan. Adaptive management depends on the flow of information from field staff to recovery managers and planners; hence, it requires frequent updates from monitoring and research on the effectiveness of recovery actions and the status and trends of the listed species. It may be most efficient to keep the recovery plan current by updating it frequently enough to forego the need for major revisions.

A revision is a substantial rewrite and is usually required if major changes are required in the recovery strategy, objectives, criteria, or actions. A revision may also be required if new threats to the species are identified, when research identifies new life history traits or threats that have significant recovery ramifications, or when the current plan is not achieving its objectives. Revisions represent a major change to the recovery plan and must include a public review and comment period.

An addendum can be added to a recovery plan after the plan has been approved and can accommodate minor information updates or relatively simple additions such as implementation strategies, or participation plans, by approval of the field office or NMFS West Coast Regional Administrator. More significant addenda ─ for example, adding a species to a recovery plan ─ should undergo public review and comment before being attached to a recovery plan. Addenda are approved on a case-by-case basis because of the wide range of significance of different types of addenda. NMFS will seek input from stakeholders on minor addenda to this Idaho management unit plan or the larger ESU/DPS-level recovery plan.

9. Research, Monitoring, and Evaluation for Adaptive Management

This chapter describes the proposed approaches for research, monitoring, and evaluation (RM&E) and adaptive management framework to support recovery of the Idaho Snake River spring/summer Chinook salmon and steelhead MPGs. It defines how adaptive management can frame efforts to track, evaluate, and adapt progress towards recovery. Section 9.1 proposes a plan for research, monitoring, and evaluation. Section 9.2 provides a framework for carrying out adaptive management.

Implementation of the proposed direction calls for collective efforts by many entities and stakeholders. Many different organizations, including state, tribal, federal, local, and private entities, currently conduct programs and actions designed to improve survival across all "H's" for Idaho Snake River spring/summer Chinook salmon and steelhead as they travel from natal streams to the ocean and back. These entities also conduct various kinds of monitoring. Coordination of these diverse local and regional monitoring actions will be essential for future NMFS status reviews of the Snake River spring/summer Chinook salmon ESU and Snake River Basin steelhead DPS, and for understanding the effects of recovery actions to improve ESU/DPS viability and promote recovery.

Tracking, Evaluating, and Refining our Steps through Adaptive Management

RM&E plays a critical role in the recovery plan adaptive management framework. The long-term success of recovery efforts will depend on the effectiveness of incremental steps taken to move the Idaho Snake River spring/summer Chinook salmon and steelhead MPGs to viable levels. Adjustments will be needed if actions do not achieve desired goals, and to take advantage of new information and changing opportunities. RM&E and life-cycle modeling provide the information, and adaptive management provides the mechanism to facilitate these adjustments.

Adaptive management is a structured process designed to improve understanding and management by helping managers and scientists learn from the implementation and consequences of natural resource policy decisions (Holling 1978; Walters 1986; Lee 1993). Monitoring associated with recovery plans needs to provide information to assess the status and trends of listed species and their habitats and the effectiveness of recovery actions. Research must address critical uncertainties for the species. Planners and managers then need to use the information collected to guide and refine recovery strategies and actions. The research also informs life-cycle modeling to evaluate and weigh the combined and relative effects of hydropower, habitat, harvest, hatchery and predation strategies under different climate and ocean conditions. This process is crucial for salmon and steelhead recovery because of the complexity of the species' life cycle, the range of factors affecting survival, and the limits to our understanding of how specific actions affect species' characteristics and survival.

Adaptive management works by coupling decision-making with data collection and evaluation. Most importantly, it offers an explicit process through which alternative approaches and actions can be proposed, prioritized, implemented, and evaluated. Successful adaptive management requires that monitoring and evaluation plans be incorporated into overall implementation plans for recovery actions. These plans should link monitoring and evaluation results explicitly to feedback on the design and implementation of actions. Figure 9-1 illustrates the adaptive management process. Section 9.2 describes the proposed adaptive management framework and approach.

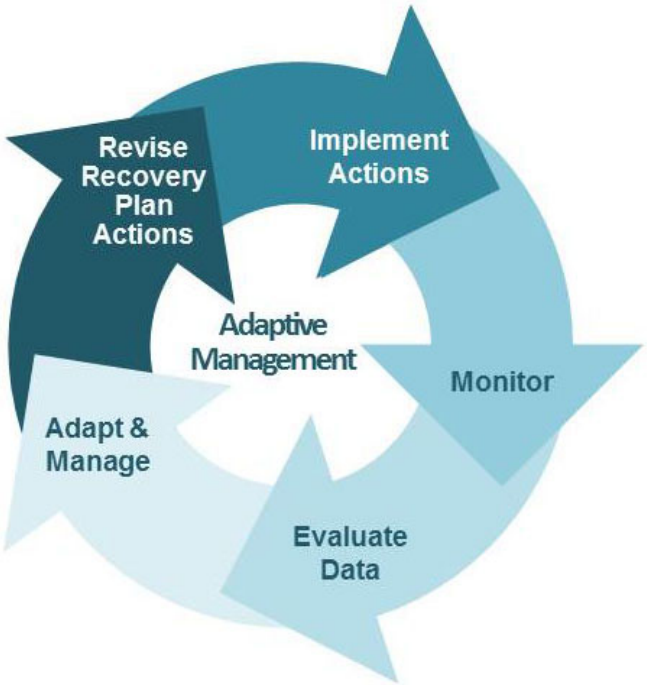

Figure 9-1. The Adaptive Management Cycle.

The RM&E plan described below identifies the level of monitoring and evaluation needed to determine the effectiveness of recommended actions, and whether they are leading to improvements in population viability. The plan also identifies critical data gaps in species and habitat knowledge. The data obtained through RM&E plan implementation will be used to assess, and if necessary, correct current restoration strategies.

The Science Team will oversee implementation of an adaptive management plan in coordination with participating agencies, tribes and other entities (see Chapter 8). The group will:

- Confirm goals and objectives for salmon and steelhead recovery;
- Compare monitoring results with performance measures within the RM&E plan;
- Review progress toward goals and objectives; and

- Identify and recommend needed changes in strategies and/or actions to better meet goals/objectives, and revise strategies and/or actions accordingly.

The effectiveness of the adaptive management strategy for Idaho spring/summer Chinook salmon and steelhead recovery will depend greatly on the ability to involve the large number of organizations that manage the resources and implement restoration actions. These organizations include, but are not limited to, Idaho Department of Fish and Game, Idaho Governor's Office of Species Conservation, Shoshone-Bannock Tribes, Nez Perce Tribe, state agencies, counties, irrigation districts, agriculture and private forest land managers, NMFS, U.S. Forest Service, BLM, Northwest Fisheries Science Center, the Nature Conservancy, Trout Unlimited, Upper Salmon Basin Watershed Program and Clearwater Technical Group, as well as other local and federal agencies, utilities, citizen groups, and landowners. Section 9.2 provides a brief summary of the different entities, management decision processes and associated adaptive management plans that affect management actions for tributary habitat, hatcheries, harvest, and the hydropower system.

Adding to the complexity is the fact that there is no one single decision-making body that holds authority for management actions across all sectors (habitat, hatcheries, harvest, and hydropower). It is unreasonable to expect centralization of all authorities and decision processes into a single decision framework. Therefore, the intent of this adaptive management plan is to develop a collaboration and coordination process that uses the current implementation structures and allows for sharing of information and decisions that influence recovery of Snake River spring/summer Chinook salmon and Snake River Basin steelhead.

9.1 Research, Monitoring, and Evaluation Plan

This RM&E plan covers the Idaho portion of the Snake River spring/summer Chinook salmon ESU and Snake River Basin steelhead DPS. It describes the RM&E recommended for assessing the status and trends in population viability, progress in addressing statutory listing factors, and success of actions implemented to recover Idaho spring/summer Chinook salmon and steelhead MPGs. In addition, this plan identifies current efforts and additional RM&E needs. Although logistical and monetary limitations exist, this plan will focus on the common goal of assessing success in population, MPG, and ESU/DPS recovery.

This RM&E plan is based in part on principles and concepts laid out in the NMFS documents *Guidance for Monitoring Recovery of Pacific Northwest Salmon and Steelhead Listed Under the Federal Endangered Species Act* (Crawford and Rumsey 2011) and *Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance* (NMFS 2007). These guidance documents provide a listing status decision framework, which is a series of decision questions that address the status and change in status of a salmonid ESU/DPS, and the risks posed by threats to the ESU or DPS (Figure 9-2).

In line with these documents, the RM&E plan recognizes the need to prioritize monitoring objectives for each MPG. It also recognizes the need for specificity in the degree of certainty or precision required to address each of the monitoring objectives. The need for certainty and data precision requirements is addressed in Crawford and Rumsey (2011).

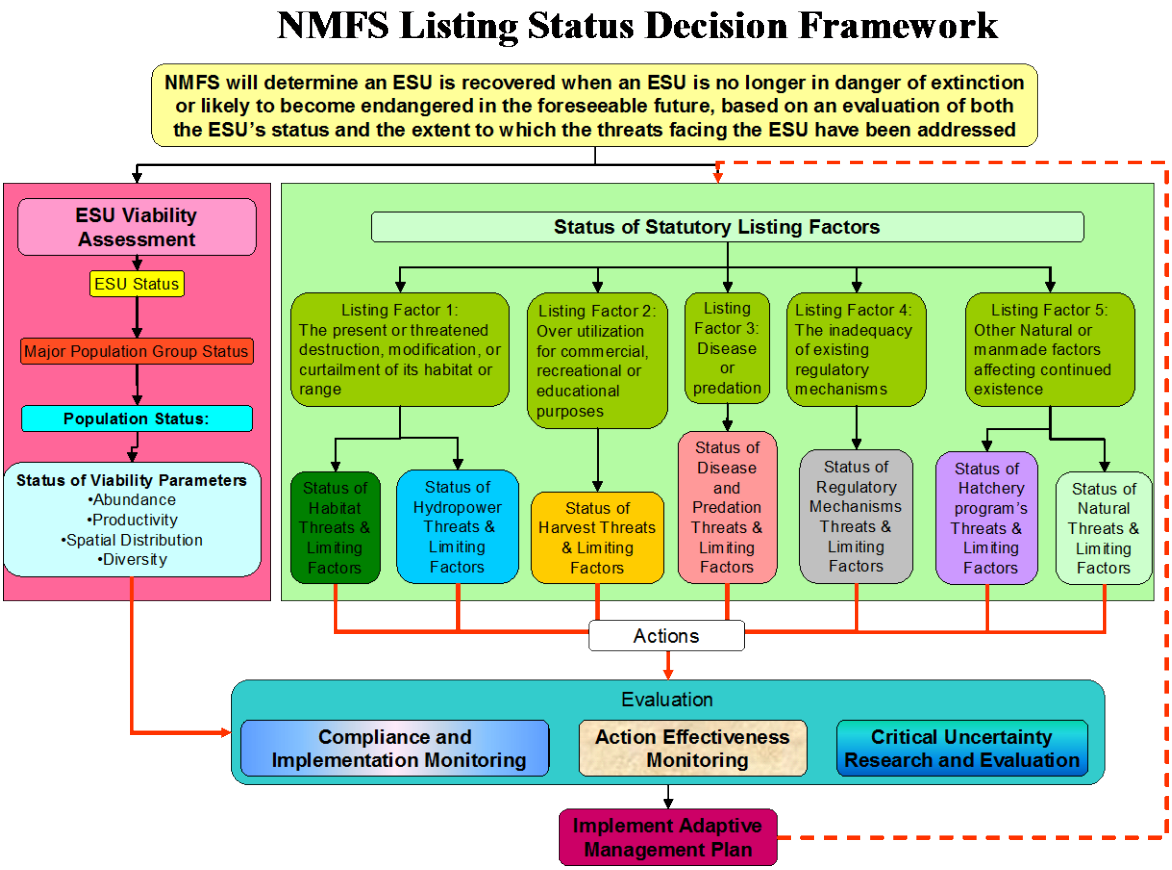

Figure 9-2. Flow diagram outlining the decision framework used by NMFS to assess the status of biological viability criteria and limiting factors criteria.

9.1.1 Types of Monitoring

Several types of monitoring support adaptive management and allow managers to make sound decisions:

- *Status and Trend Monitoring.* Status monitoring describes the current state or condition of the population and its limiting factors at any given time. Trend monitoring tracks these conditions to provide a measure of the increasing, decreasing, or steady state of a status measure through time. Status and trend monitoring includes the collection of standardized information used to describe broad-scale trends over time. This information is the basis for evaluating the cumulative effects of actions on fish and their habitats.
- *Action Effectiveness Monitoring.* This type of monitoring evaluates the cause-and-effect of management actions. It is designed to determine whether a given action or suite of actions achieved the desired effect or goal. This type of monitoring is research oriented

and therefore requires elements of experimental design (e.g., controls or reference conditions) that are not critical to other types of monitoring. Consequently, action effectiveness monitoring is usually designed on a case-by-case basis. Action effectiveness monitoring provides funding entities with information on benefit/cost ratios and resource managers with information on what actions or types of actions improved environmental and biological conditions.

- *Implementation and Compliance Monitoring.* Implementation and compliance monitoring determines if actions were carried out as planned and meet established benchmarks. This type of monitoring is generally carried out as an administrative review or site visit and does not require any parameter measurements. Information recorded under this type of monitoring includes the types of actions implemented, how many were implemented, where they were implemented, and how much area or stream length was affected by the action. Success is determined by comparing field notes with what was specified in the plans or proposals (detailed descriptions of engineering and design criteria). Implementation monitoring sets the stage for action effectiveness monitoring by demonstrating that the restoration actions were implemented correctly and followed the proposed design.
- *Key Information Needs Research.* Research of key information needs includes scientific investigations of critical assumptions and unknowns that constrain effective recovery plan implementation. Uncertainties include unavailable pieces of information required for informed decision-making, as well as studies to establish or verify cause-and-effect and identification and analysis of limiting factors. Evaluation of uncertainties can also include life-cycle modeling to assess relative effects across life stages, or under projected climate change scenarios.

9.1.2 Monitoring Framework

The desired outcome of the recovery plan is the long-term persistence of viable populations of naturally produced spring/summer Chinook salmon and steelhead distributed across their native range. To determine if the desired outcome has been achieved, answers to two general questions are needed.

- Is the status of the population and MPG trending towards improving?
- Are the effects of the factors limiting the status of the population and MPG increasing, decreasing, or remaining stable?[2]

[2] NMFS determines if a population/ESU/DPS is no longer in danger of extinction by evaluating both the status of the population/ESU/DPS and the extent to which the threats facing the population/ESU/DPS have been addressed. This RM&E plan does not attempt to monitor "threats." Rather, this plan measures the "limiting factors" that directly or indirectly affect the status of the population. Although threats cause a factor to be limiting, it is actually the factor that limits the population. For example, forest roads and landslides (threats) may increase recruitment of fine sediments (limiting factor) to a stream channel, thereby limiting survival of juvenile steelhead. Simply monitoring threats will not tell us if the limiting factor is decreasing. Therefore, it is important to monitor changes in the limiting factor.

Although these two general questions provide the basis for developing the RM&E plan, it is important to note that several specific questions attend each of the two general questions. Below are listed the specific questions.

Question 1: What is the status of the population?

The status of a population is determined by measuring (or estimating) the four Viable Salmonid Population (VSP) parameters. Those parameters are adult abundance, population productivity or growth rate, population spatial structure, and diversity. The status of these parameters is compared to the population-specific recovery criteria to arrive at an overall conclusion on the status of the population/MPG/ESU or DPS. The specific questions associated with VSP are:

1.1 Has the abundance of naturally produced adult fish reached the recovery criteria for each population?

This question deals with the number of naturally produced fish that spawn within each population. Recovery criteria in the recovery plan are based on the 10-year geometric mean (GM) of naturally produced spawners.

1.2 Has the intrinsic productivity of the naturally produced population reached the recovery criteria for each population?

This question addresses intrinsic population productivity, which is the number of recruits produced per spawner in the natural population, adjusted for the confounding effects of spawner density. Intrinsic productivity provides an index of population resilience and capacity to rebuild. Spawners include both hatchery and natural adults. Recruits represent the number of natural produced offspring created by each year's total spawner escapement. Because productivity varies directly with spawner abundance relative to habitat capacity, annual measurements of R/S (recruits per spawner) are not informative unless they are standardized to a common spawner density. Intrinsic productivity represents a measurement of productivity that is standardized to the same near zero spawner abundance level. Intrinsic productivity can be estimated from fitting recruitment models to a time series of spawner and recruit data or other approaches. For the recovery plan, intrinsic productivity estimates are based on population data for the most recent 20 years of population recruitment.

1.3 Has the spatial structure of the populations reached the recovery criteria for each population?

This question deals with factors that affect the distribution and spatial complexity of the population. Spatial structure of a population is maintained by not destroying habitat (or their functions) at rates faster than they are created or restored, by maintaining suitable habitats (major and minor spawning areas) even if they contain no listed species, and by addressing man-made barriers to fish migration and movement.

1.4 Has the phenotypic and genotypic diversity of the population reached the recovery criteria for each population?

This question refers to a population's degree of adaptation to the existing diversity of environments it occupies, and its capacity to evolve and adapt to future environmental change (e.g. climate change). The expression of this capacity may be reflected in measurable traits such as run timing, age structure, behavior, disease resistance, allozymes, microsatellite DNA, and mitochondrial DNA. However, important elements of diversity undoubtedly exist that are not detectable by these or any other currently available tools. Therefore, maintaining natural population processes that are likely to foster this 'hidden' (as well as observable) diversity – such as large population size, normative levels of immigration from other populations, and distribution patterns to ensure an interaction with the full range of diverse habitats – is also important. Further, it is necessary to minimize the effects of counterproductive forces that select against a specific life history type or trait (e.g. trait-selective fisheries or operation of the mainstem river hydropower system) and to minimize excessive interbreeding with hatchery fish.

Collecting data that can be used to answer these specific questions will help NMFS determine if the ESU and DPS are moving toward, and ultimately achieve, recovery criteria.

Question 2: Are the effects of the primary factors that limit the status of the population increasing, decreasing, or remaining stable?

Before the ESU/DPS can be reclassified or de-listed, NMFS must evaluate if the existing regulatory mechanisms are sufficient to address the threats and ensure that the populations remain viable. This will be accomplished by monitoring the status and trend of factors limiting the viability of the populations, as reflected in the following questions.

2.1 Are the limiting factors associated with habitat being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 1 (the presence or threatened destruction, modification, or curtailment of its habitat or range; Figure 9-2). The recovery plan identifies specific habitat limiting factors for each population. Primary limiting factors include connectivity (fish passage and unscreened diversions), water quality, water quantity, channel morphology and complexity, and habitat fragmentation. Where these limiting factors occur, they need to be monitored for status and trend. In addition, non-limiting habitat factors need to be monitored to ensure that they do not become limiting in the future.

2.2 Are the limiting factors associated with hydropower being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 1 (the presence or threatened destruction, modification, or curtailment of its habitat or range; Figure 9-2). Specific limiting factors associated with hydropower include fish passage survival, fish passage timing, water quantity, water quality, and habitat alterations. The limiting factors identified in the recovery plan need to be monitored for status and trend.

2.3 Are the limiting factors associated with harvest being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 2 (over utilization for commercial, recreational or education purposes; Figure 9-2). The specific limiting factors associated with harvest include the incidental and illegal take (poaching) of Snake River listed species. The take of listed species needs to be monitored over time.

2.4 Are the limiting factors associated with hatcheries being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 5 (other natural or manmade factors affecting continued existence; Figure 9-2). Limiting factors associated with hatcheries in the Snake River basin include ecological interactions between hatchery and natural-origin fish, including predation and competition for limited resources, potential genetic effects resulting from interbreeding between hatchery and natural-origin fish, and straying. The status of these factors needs to be monitored over time.

2.5 Are the limiting factors associated with disease and predation being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 3 (disease or predation; Figure 9-2). Disease and predation by birds, fish, and mammals are limiting factors addressed in this question. Predation by introduced fish species (e.g., bass and walleye), northern pikeminnow (native species), birds, and mammals affect the viability of listed species in the Snake River basin. These factors need to be monitored for status and trend.

2.6 Are the inadequacies of existing regulatory mechanisms being ameliorated such that they do not limit the desired status of the population?

This question addresses Statutory Listing Factor 4 (the inadequacy of existing regulatory mechanisms; Figure 9-2). Federal, state, tribal, and local regulatory mechanisms are included in this question. Monitoring the status of enforcement of existing regulations is needed over time.

2.7 What natural factors limit the desired status of the population?

This question addresses Statutory Listing Factor 5 (other natural or manmade factors affecting continued existence; Figure 9-2). Drought and poor ocean conditions are natural factors that limit populations in the Snake River basin. The status of these factors needs to be monitored over time.

Answers to these questions will guide decisions regarding the reclassification or delisting of the ESU and DPS.

9.1.2.1 Monitoring Objectives and Approach

The questions identified above provide the framework for the RM&E plan for Idaho Snake River spring/summer Chinook salmon and steelhead. Using these overarching questions, recovery planners defined ten monitoring objectives to guide monitoring activities for the populations and MPGs, and provide information to determine if desired outcomes have been achieved:

1. Determine the current natural population status in terms or abundance and intrinsic productivity for each population within the MPG.
2. Determine the status of the spatial structure of each population based on current and historically used habitat.
3. Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the MPG.
4. Determine the status and trend in conditions of current and historically used habitat within each population in the MPG.
5. Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the MPG.
6. Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the MPG.
7. Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the MPG.
8. Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the MPG.
9. Determine the effect of predation on the abundance and productivity of the natural populations within the MPG.
10. Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the MPG.

These ten monitoring objectives will direct RM&E efforts for Idaho Snake River spring/summer Chinook salmon and steelhead. The type of monitoring efforts needed, monitoring questions, performance metrics, general approach (monitoring methods), and analysis are summarized below for each monitoring objective. The approaches and analyses described for each objective are not exhaustive, but are intended to represent those actions considered to have potential while recognizing logistical and monetary constraints. The intent of these monitoring objectives is to help standardize approaches and analyses for monitoring and evaluation purposes.

Objective 1: Determine the current natural population status in terms or abundance and intrinsic productivity for each population within the MPG.

The status of a population is determined by estimating the VSP parameters described in Section 9.1.2. The status of adult abundance, population productivity, and growth rate is compared to the population-specific recovery criteria resulting in an overall determination of the status of the population, MPG, and ESU. Tracking these parameters over time within each population also allows estimation of long-term trends. Monitoring long-term trends will be critical to assessing the performance of restoration projects.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- Is the 10-year GM for natural-origin spawners in each population greater than or equal to the recovery criteria for natural spawners?
- What are the current natural-origin spawner abundance and five-year trend in abundance?
- What are the current and trend in the natural-origin spawner 20-year population growth rate?
- What is the current intrinsic productivity for the natural population compared to the delisting criteria?

Performance metrics: Number of spawners (natural vs. hatchery), number of natural adult recruits, population intrinsic productivity.

General Approach:

- Operate weirs to track abundance (including mark-recapture methods). Estimate weir efficiency and/or pre-spawning mortality.
- Conduct redd surveys in index and non-index areas.
- Conduct stock assessment at weir and carcass surveys to provide information on size (fork length), gender, origin, age (from scales), and marks and tags.
- Collect counts and scale samples of natural- and hatchery-origin adults at Lower Granite Dam to estimate smolt–to-adult returns and determine age structure.

Specific monitoring approaches are described at sections 9.1.3 and 9.1.4 for each spring/summer Chinook salmon and steelhead MPG.

Analysis: The number of naturally produced spawners is estimated using proportions of hatchery and naturally produced fish, total number of redds, expansion factor of surveyed stream length/available stream length, and fish/redd ratio. If weirs are used, abundance is based on counts at the weir, proportions of hatchery and naturally produced fish, and pre-spawn survival rates. The 10-year GM for abundance of naturally produced fish is calculated. Intrinsic productivity is based on an evaluation of the most recent 20-year period of spawner abundance (both natural and hatchery-origin spawners) and an estimate of natural recruits based a run re-construction that includes age structure and downstream fishery impacts information. The abundance and productivity estimates are analyzed in a time series and compared to recovery criteria.

Objective 2: Determine the status of the spatial structure of each population based on current and historically used habitat.

The escapement of natural-origin spawners to each watershed can differ because of habitat conditions, juvenile survival, parental cohort size, pre-spawn mortality, hatchery programs, and stochasticity. The production of juveniles can vary among watersheds because of density

dependent and density independent factors. Understanding the spatial and temporal variance in both spawner and juvenile distribution is therefore necessary to address uncertainties.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What is the spatial and temporal distribution of natural-origin spawners within each population?
- What is the distribution and density of natural-origin spawners within the major (MaSA) and minor (MiSA) spawning areas defined by the ICTRT (2007)?
- What is the current spatial extent and distribution of rearing habitat used by natural-origin juvenile spring/summer Chinook salmon and steelhead within each population?

Performance metrics: Spawner distribution, redd distribution, spawn timing, and juvenile distribution and density

General Approach: Spatial distribution of naturally produced spawners is assessed using ground and aerial surveys for spawning redds. For spring/summer Chinook salmon, spawning surveys will cover spawning areas within each population (see Approach under Objective 1). The spatial extent and distribution of natural-origin juvenile salmonids will be based on a generalized random tessellation stratified (GRTS) survey design and snorkeling or electrofishing techniques.

Analysis: The ICTRT (2007) defines occupied areas as those in which two or more redds from natural-origin spawners have been observed in all years of the most recent brood cycle (i.e. the most recent generation) and have been observed for at least half of the most recent three brood cycles (approximately 15 years for steelhead and Chinook salmon). A MaSA is regarded as occupied when it has two or more redds within both the upper and lower half of the weighted spawning area within that MaSA over the previously defined time periods (ICTRT 2007).

Juvenile Chinook salmon and steelhead data are evaluated as fish/100 m^2 or fish per area of habitat type within each study reach.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the MPG.

Spring/summer Chinook salmon and steelhead production may be influenced by releases of hatchery fish in populations within this MPG. The artificial propagation of fish includes genetic risks that may reduce the likelihood of recovery (and for integrated hatchery programs, compromise the goal of supplementation). It is important to monitor the genetic characteristics of hatchery and natural-origin fish for several reasons: to insure that artificially-produced fish in integrated hatchery programs resemble the naturally-produced fish genetically; to insure that adequate effective population sizes are maintained to prevent genetic drift; and to insure and that outbreeding depression does not reduce the reproductive success of the populations.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What proportion of spawners are out-of-ESU/DPS hatchery strays?
- What proportion of spawners are out-of-MPG hatchery strays?
- What proportion of spawners are out-of-population hatchery strays?
- What is the origin of strays?
- What is the population-level genetic composition of each population?
- What is the status and trend of life-history patterns and variation within each population?

Performance metrics: Number of hatchery spawners from outside the ESU, outside the MPG, and outside the population; adult run timing; size and age at maturity; effective population size; genetic variation.

General Approach: Evaluation of life history, genotypic, and phenotypic characteristics will be accomplished by sampling live fish at Lower Granite Dam (LGD) and weirs and by sampling carcasses on the spawning grounds. Multiple spawning surveys will be conducted within all spring/summer Chinook salmon populations (see Approach under Objective 1). Carcasses will be sampled for size (fork length), origin (natural vs. hatchery), marks and tags, age (from scales), and genetics (operculum punch or fin tissue for DNA analysis). Live fish will be sampled at LGD for marks and tags, origin, size, age, and genetics. Weirs will be used to sample fish for origin and migration timing by origin.

Analysis: Estimating the proportion of strays is simply based on the number of hatchery-origin spawners (from a specific hatchery program) and the total number of spawners within a population. Associating a hatchery spawner with a specific hatchery program is needed to estimate the proportion of hatchery spawners from outside the ESU, outside the MPG, and outside the population. Parentage Based Tagging (PBT) can be used to identify fish from specific hatchery programs. DNA tissue samples of natural-origin spawners can be used to analyze the population-level genetic composition of each population. Data collected from rotary screw traps can be analyzed to estimate the number of smolts that migrate out of the populations as yearlings, the size of migrants, and the timing of migration (i.e., beginning, peak, and end of yearling migration).

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the MPG.

The abundance, survival, and productivity of spring/summer Chinook salmon and steelhead are affected by the quantity and quality of spawning and rearing habitat. Because the habitat within many populations has been degraded, it is important to monitor changes in habitat conditions over time.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What is the status and trend in habitat quality and quantity for each population within the MPG?

Performance metrics: Stream flows, water quality, habitat access, habitat quality, channel condition, riparian condition, watershed condition. These metrics are consistent with the standardized fish habitat monitoring protocol, the Columbia Habitat Monitoring Program (CHaMP), adopted for Columbia River Basin monitoring programs.

General approach: Habitat status will be measured using the habitat sampling protocol developed for the CHaMP program (CHaMP 2014). CHaMP is a program supported by BPA to measure stream habitat for salmonid populations in the Columbia Basin, related to the tributary habitat-based mitigation strategy for the FCRPS. The protocol was designed to be applied across varying spatial contexts depending on the logistical constrains of the sites. Under BPA's CHaMP program, the protocol will likely be implemented for at least one population per MPG throughout the Columbia basin. Data collected with this protocol can be compared with data collected for populations within other MPGs. Under this Recovery Plan, habitat monitoring should target non-wilderness populations with degraded habitat.

Habitat variables to be measured include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates. CHaMP has a database schema, data dictionary, meta-data support and tools to help local biologists collect, process, and store the habitat data.

Analysis: Using the CHaMP habitat sampling protocol and database will allow analyses at several different spatial scales. Habitat status can be analyzed with the Horvitz-Thompson, or π-estimator and trend can be analyzed with multi-phase regression analyses. The database and GIS formatting of data will also allow associations with land use, land vegetation coverage, and many other attributes at watershed and population scales.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the MPG.

The Plan identifies restoration actions such as habitat restoration and protection, flow augmentation, and passage restoration that should increase natural productivity, abundance, and spatial structure of natural-origin spring/summer Chinook salmon and steelhead. There are several RM&E information needs that must be addressed if the benefits of these management actions are to be effectively detected.

Type of monitoring effort: Status and trend monitoring; implementation and compliance monitoring; action effectiveness monitoring.

Monitoring questions:

- Status and Trend Monitoring: What is the current status and trend of spring/summer Chinook salmon and steelhead habitat within each population (see objective 4)?
- Implementation and Compliance Monitoring—Was the habitat restoration action implemented in the prescribed manner and did it achieve its objectives?
- Action Effectiveness Monitoring—Have the habitat restoration actions improved the viability status of the populations (through changes in VSP parameters—abundance, productivity, or spatial structure)?

Performance metrics: Abundance, distribution, survival, growth, condition, and habitat characteristics.

General approach: Habitat status and trend monitoring was described under Objective 4. The approach relies on GRTS and the CHaMP protocol.

Compliance monitoring of restoration projects includes record keeping and reporting of activities. This type of monitoring is conducted by the implementing party and should include any parameters identified in work statements. All habitat restoration projects need to be monitored for compliance.

Action effectiveness monitoring should be conducted at both the project (reach) and population or watershed scales. Action effectiveness monitoring designs should incorporate a before-after-control-influence (BACI) design or modified BACI designs (e.g., MBACI or MBACI(P)). Control or reference areas should be as similar as possible to the treatment site and must be independent of the influence of the treatment. Before-after designs can be used to monitor effects at larger spatial scales (e.g., population scale), but a long time series of before (pre-treatment) data are generally needed to tease out treatment effects. Entities implementing habitat restoration actions will be encouraged to coordinate with monitoring groups before scheduled activities, preferably years in advance to allow measurement of pre-treatment variables. Temporal scales must account for time lags related to life history and life-cycle timeframes.

Analysis: Fish data collected at the population scale should be compared directly with population recovery criteria (abundance and productivity). Habitat data can also be included in models such as EDT to assess the potential effects of habitat quantity and quality changes on potential fish survival and productivity.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the MPG.

Hatchery fish that stray into non-target tributaries and spawn naturally may represent a serious threat to spring/summer Chinook salmon and steelhead recovery. More than 100 hatchery programs operate in the Columbia River basin upstream from Bonneville Dam, with most

providing fish for harvest to mitigate losses caused by the FCRPS. Some hatchery programs may also provide conservation benefits; however, hatchery programs can pose threats to natural-origin populations in some watersheds. Hatchery-induced genetic change may reduce the fitness of both hatchery and natural-origin fish in the wild, and hatchery-induced ecological effects (competition for food and space) can reduce population productivity and abundance. An understanding of the balance between the adverse long-term fitness impact of hatchery fish and the short-term cushion hatchery fish may provide against demographic extinction is the crux of a successful monitoring and evaluation program.

Type of monitoring effort: Status and trend monitoring; implementation and compliance monitoring; action effectiveness monitoring.

Monitoring questions:

- Do hatchery fish alter the life history or genetic characteristics of the natural populations?
- Do hatchery fish increase the abundance and productivity of the natural populations?
- What is the relative reproductive success of hatchery-origin spawners in individual populations?
- What is the spatial and temporal distribution of hatchery-origin spawners?
- What is the effect of hatchery-origin fish on the productivity of natural-origin fish?
- What effect do changes in phenotypic traits (e.g., size, age, and fecundity) observed in hatchery fish have on population viability?

Performance metrics: Natural and hatchery-origin spawner escapement estimates for each population; distribution of spawners within each population; proportion of hatchery fish, by year, for each population; age composition of spawners; estimated annual harvest from tributary and downstream fisheries (including mainstem Columbia and ocean as appropriate - see Objective 8); number of natural-origin fish removed for hatchery broodstock and proportion of the hatchery broodstock that are natural-origin fish (i.e., pNOB); green egg to smolt survival for each hatchery program; smolt to adult survival for hatchery releases; hatchery strays recovered from other populations based on CWT or PIT recoveries or genetic analyses (e.g. Parentage Based Tagging); size of hatchery smolts relative to natural-origin fish; timing of hatchery smolt releases versus out-migration timing of the natural-origin smolts; an index on how quickly the hatchery smolts migrate after release and how many of them do not migrate (residualize).

General approach: Information needed to address the metrics given above will be available from the monitoring approach described previously for objectives 1, 2, and 3.

Analysis: Analysis approaches for the effects of hatchery programs are the same as those presented earlier for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the MPG.

Idaho Snake River spring/summer Chinook salmon and steelhead are affected either directly (passage at a specific project) or indirectly (primarily through flow releases and water quality affects from upstream projects) by the hydropower system. It is therefore important that all hydro-related effects be monitored.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What is the effect of Columbia and Snake River hydropower operations on outmigrating juvenile spring/summer Chinook salmon and steelhead?
- What is the effect of Columbia and Snake River hydropower operations on returning adult spring/summer Chinook salmon and steelhead?
- What are the effects of Columbia and Snake River hydropower operations on temperature and the chemical composition of the rivers?
- What are the timing and duration of fish passage through the hydropower system?

Performance metrics: Juvenile and adult survival; temperature; total dissolved gas (TDG); smolt-to-adult returns (SAR); travel time through the hydropower system.

General approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Smolts can be PIT tagged as they leave populations within the MPG. These PIT-tagged fish are then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages, with detections archived in the DART and PTAGIS databases. Detection probabilities of juvenile salmonids migrating downstream at FCRPS facilities are modeled using the SURPH analytical tool. Adult detection (assumed 100%) is currently available at ladders on several dams. TDG and temperature should be measured hourly with calibrated electronic instruments at each FCRPS facility during fish passage.

Analysis: Juvenile survivals at each FCRPS facility can be estimated using the SURPH model. Adult survival through the mainstem river migration corridor can be estimated by comparing detections at adult fish ladders at different dam facilities. Rates can be expanded to population-level impacts using the relative number of fish PIT tagged and abundance estimates generated from mark-recapture studies. TDG levels and temperature at each facility will be compared to standards to determine timing and duration of exceedances.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the MPG.

Restoring fishery opportunities is a primary goal of local and regional fisheries managers and is needed to meet tribal and treaty trust obligations. In addition, fisheries are also managed to keep

unintended impacts to natural and hatchery production and non-target species within acceptable limits.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What is the annual harvest rate on natural-origin spring/summer Chinook salmon or steelhead that occurs outside the MPG boundaries?
- What is the annual harvest rate that occurs on natural-origin spring/summer Chinook salmon or steelhead within the MPG boundaries?
- What is the cumulative harvest rate on natural-origin spring/summer Chinook salmon or steelhead due to all fisheries (from within and outside of MPG)?
- What effect does total harvest have on the abundance, productivity, and diversity of natural-origin spring/summer Chinook salmon or steelhead?

Performance metrics: Fisher hours (effort); catch; harvest; stock identification; spawning escapement; recruits/spawner; genetic composition.

General approach: Out-of-MPG harvest contributions are currently grouped by two main fishery areas: ocean and Columbia River. The number of adults harvested by individual hatchery groups and the total number for all hatchery groups by run year are reported. Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish.

Within the MPG, harvest rates will be assessed using catch record cards and creel surveys. Creel surveys should include angler counts; interviews to obtain information on catch rate, harvest rate, and gear types; and collection of biological, mark, and CWT information from the catch. This information will be used to identify spatial and temporal patterns of fishing effort, catch, and harvest.

Analysis: The number of fin-clipped and natural-origin fish caught by interviewed anglers will be totaled and used for an expanded estimate of the number of fin-clipped and natural-origin fish caught throughout the season. Expanded estimates will be based on sample strata and proportional coverage rates. Catch per unit effort (CPUE) will be estimated directly from interview responses and fishing journals. Total fishing effort will be estimated based on time period, week period, and site encounter probabilities. For each population, natural-origin abundance and productivity will be calculated with and without harvest to determine if harvest rates reduce the likelihood of meeting recovery criteria.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations within the MPG.

It is well known that birds, fish, and mammals prey on anadromous salmonids in the Columbia and Snake Rivers. In addition, smallmouth bass in the Salmon River system prey upon juvenile salmon and steelhead within Idaho. Smallmouth bass is an introduced species to the Snake River system/Salmon River system, and currently inhabits the Salmon River system as far upstream as Challis, Idaho. It is important to study and evaluate the effects of predators on the abundance, productivity, and diversity of natural populations within the MPG.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What is the effect of predation from piscine predators in the Columbia and Snake River migration corridor on juvenile Chinook salmon or steelhead originating from the MPG?
- What is the effect of predation from avian predators in the Columbia River migration corridor on juvenile Chinook salmon or steelhead originating from the MPG?
- What is the effect of predation from smallmouth bass in the Salmon River corridor?

Performance metrics: Number of juvenile Chinook salmon or steelhead originating from an MPG; number of predators; number of juveniles originating from the MPG consumed by piscine and avian predators; mortality rates; proportion of smolt-to-adult returns (SAR) associated with predation.

General approach: Conduct annual sampling of piscine predators in the Columbia, Snake, and Salmon River migration corridors to determine abundance of predators and stomach contents. These data are then incorporated into a bioenergetics model to derive a population- or MPG-level consumption estimate imposed by exogenous fishes. Sampling of predatory fish diets will occur during times and locations when and where their distribution overlaps with juvenile spring/summer Chinook salmon and steelhead. Interpretation of the predatory impact in the Columbia, Snake, and Salmon River migration corridor should be conducted with methods established in published literature (e.g., Fritts and Pearsons 2006).

To evaluate avian predation on juvenile salmonids, bird colonies are monitored for the presence of PIT tags originating from specific populations within the MPG. Bioenergetics models are then used to expand tag recoveries at colonies to population-level impacts.

Analysis: Predatory mortality rates can be estimated from the bioenergetics modeling results.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the MPG.

An important goal of the hatchery programs within the MPGs is to release fish into the system that are known to be healthy, to minimize impacts on natural fish and other hatchery-produced fish.

Type of monitoring effort: Long-term status and trend monitoring.

Monitoring questions:

- What are the prevalence and level of pathogens in natural and hatchery-origin spring/summer Chinook salmon or steelhead within the MPG?
- What are the magnitude and pathways of disease transmission between hatchery and natural-origin spring/summer Chinook salmon or steelhead within the MPG?

Performance metrics: Number of infected hatchery and naturally produced fish; spatial distribution of disease.

General approach: The health of hatchery fish will be monitored starting with broodstock and continuing through rearing and release of juveniles. The health of naturally produced fish will be assessed on dead parr, smolts, and spawners encountered during monitoring activities. Dead, naturally produced fish collected as parr or smolts during smolt trapping and juvenile sampling will be examined for diseases, including IHNV and other culturable viruses. All sampling, diagnostic, and statistical analyses will comport with the Integrated Hatchery Operations Team and the Pacific Northwest Fish Health Protection committee guidelines. All disease monitoring will be consistent with IDFG fish health policy.

Analysis: Analysis of samples will follow standard protocols defined in the latest edition of the American Fisheries Society "Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens (Blue Book)."

9.1.3 Research, Monitoring, and Evaluation in Idaho Snake River Spring/Summer Chinook Salmon MPGs

Research, monitoring, and evaluation approaches for the three Idaho Snake River spring/summer Chinook salmon MPGs are described in the following sections. The sections address each MPG separately. For each MPG, approaches are presented that address each objective. These monitoring approaches are intended to represent those actions considered to have potential while recognizing logistical and monetary constraints. A final selection will be updated and refined by the Science Team during implementation of this recovery plan.

9.1.3.1 Monitoring in South Fork Salmon River Spring/Summer Chinook Salmon MPG

Monitoring continues to occur within each of the South Fork Salmon River spring/summer Chinook salmon MPG's four populations (Little Salmon River, South Fork Salmon River, Secesh River and East Fork South Fork Salmon River). Ongoing efforts in the populations could be expanded or revised as needed to provide adequate monitoring for assessing whether desired recovery goals are being achieved.

Monitoring Objectives and Approach

This section summarizes the monitoring objectives and approaches for RM&E in the South Fork spring/summer Chinook salmon MPG. The approaches and metrics for each objective are discussed in more detail in Section 9.1.2.1. Table 9-1 identifies current monitoring activities and needs within each South Fork Salmon River population area.

Objective 1: Determine the current natural population status in terms or abundance and intrinsic productivity for each population within the South Fork Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: IDFG will continue to estimate wild- and hatchery-origin Chinook salmon escapement and age structure passing Lower Granite Dam from adult sampling at the dam. Weirs operated in the Little Salmon, South Fork Salmon and East Fork South Fork Salmon River populations will be used to track abundance (including mark-recapture methods) and estimate escapement above the weir. Managers will continue to conduct redd surveys, with repeat sampling within index areas and a rotating panel design for sampling spawning areas outside the index area or not within spawning areas controlled by weirs. Stock assessments will be conducted through weir and carcass surveys to provide information on size, gender, origin, age, and marks and tags.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for spawner abundance within each population with funding from Idaho, LSRCP, PCSRF and BPA.

Objective 2: Determine the status of the spatial structure of each population in this MPG based on current and historically used habitat.

Priority level: This is a highest priority objective.

Approach: For all populations of spring/summer Chinook salmon within this MPG, spatial distribution of naturally produced Chinook salmon will be assessed using ground and aerial surveys for spawning redds. Spawning surveys will cover spawning areas within each population. The spatial extent and distribution of natural-origin juvenile Chinook salmon will be based on a GRTS survey design and snorkeling or electrofishing techniques.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for spatial spawning distribution within each population with funding from Idaho, LSRCP, and BPA. IDFG currently conducts juvenile Chinook salmon GRTS surveys in the Snake Basin on a rotating

panel basis. Additional funding to survey each population may be necessary depending on desired frequency of repeat visits.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the South Fork Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: Evaluation of life history, genotypic, and phenotypic characteristics will be accomplished by sampling live fish at weirs and carcasses on the spawning grounds. Multiple spawning surveys will be conducted within all populations. Carcasses will be sampled for size, origin, marks and tags, age, and genetics. Weirs located within the Little Salmon, South Fork Salmon and East Fork South Fork Salmon populations will be used to sample fish for origin (based on scales and marks/tags) and migration timing by origin.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for this objective with funding from Idaho, LSRCP, and BPA. Additional funding is needed to evaluation genetic status and trends over time.

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the South Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Habitat status will be measured and evaluated using the CHaMP habitat sampling protocol. Habitat variables include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates.

Status: The USFS conducts long-term streambed substrate and stream temperature monitoring in the mainstem South Fork Salmon River. ISEMP has conducted habitat surveys in the South Fork watershed, and habitat monitoring will continue in the South Fork under the CHaMP program.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the South Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Habitat status and trend monitoring was described under Objective 4. The effects of habitat restoration actions on population VSP parameters will be monitored at the population or watershed scales. Some individual restoration actions will also be monitored for effectiveness at improving habitat conditions at the reach scale.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for this objective with funding from the State of Idaho and BPA.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the South Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Three large hatchery programs operate within this MPG, releasing more than 4 million fish annually. Two hatcheries support segregated harvest programs, while the third (East Fork South Fork - Johnson Creek) is a conservation program. Hatchery fish from segregated harvest programs that stray into non-target tributaries and spawn naturally may represent a serious threat to spring/summer Chinook salmon recovery. The distribution and genetic diversity of both natural and hatchery-origin spawners will be monitored following the approach described previously for objectives 1, 2, and 3.

Status: The status of these monitoring efforts is presented above for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the South Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Chinook salmon smolts can be PIT tagged as they leave populations within the MPG and then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages.

Status: Additional funding is needed to PIT tag emigrating smolts from populations in this MPG.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the South Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish. Within the MPG, harvest rates are assessed using catch record cards and creel surveys.

Status: Monitoring of out-of-MPG fisheries is currently funded. The Nez Perce Tribe and Shoshone-Bannock Tribes monitor tribal harvest and IDFG monitors non-tribal harvest within the MPG. It is important to maintain funding for harvest monitoring. More and improved data are needed to monitor and manage population-specific impacts on natural-origin spring/summer Chinook salmon, including catch and release impacts in recreational fisheries.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations with the South Fork Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Conduct sampling and investigations to monitor predation impacts on juvenile spring/summer Chinook salmon.

Status: Investigations of predation in the migration corridor have been conducted by many agencies with funding from BPA and the USACE. Monitoring predation impacts in the mainstem Columbia River, Snake River, and Salmon River needs to continue. Funding is needed to assess the abundance and stomach contents of migration corridor predators to juvenile Chinook salmon from the South Fork Salmon River MPG.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the South Fork Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Monitor hatchery fish and broodstock for disease; and survey naturally produced fish in streams for disease and pathogen presence.

Status: Currently, hatchery fish and broodstock are monitored for disease. Funding is needed to monitor disease or pathogen presence and prevalence in naturally produced fish in streams.

Current Monitoring Efforts and Needs

Monitoring continues to occur within each of the four population areas (Little Salmon River, South Fork Salmon River, Secesh River and East Fork South Fork Salmon River), as well as in the mainstem Columbia and Snake Rivers. IDFG, the Payette and Boise National Forests, Nez Perce Tribe and Shoshone-Bannock Tribes currently conduct most of the monitoring and evaluation in the South Fork Salmon River MPG. Mainstem Columbia and Snake River monitoring is conducted by NMFS. Current monitoring includes spawner escapement, smolt-to-adult returns (SAR), juvenile abundance, productivity, distribution, and some habitat condition monitoring.

Table 9-1 shows current monitoring within each South Fork Salmon River population area, the quality and certainty associated with the data, improvements needed, and proposed new monitoring. The evaluations were drawn from work completed by the Columbia River Fish and Wildlife Authority through the Collaborative Systemwide Monitoring and Evaluation Project and through direct participation of the fish co-managers. This evaluation was especially influenced by the participation of the Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes. Numerous acronyms and abbreviations are used in Table 9-1 for the sake of brevity. These acronyms and abbreviations, and the terms they stand for, are discussed in Sections 9.1.2.1 and 9.1.3.1 and explained in a table footnote.

Table 9-1. Current monitoring, data improvement needs and proposed new monitoring for South Fork Salmon River spring/summer Chinook salmon populations[3]. Adapted from CBFWA (2009), http://www.cbfwa.org/ams/SnakeRiver.cfm.

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
South Fork Salmon River MPG -- General				
Adult abundance, Adult productivity, and other VSP criteria	• IDFG estimates wild and hatchery origin Chinook escapement and age structure passing Lower Granite Dam (LGR) from adult sampling at the dam. These ESU-level estimates can be used when MPG/population data is not available. • COE counts at LGR provide a good estimate of the total number of Chinook salmon for the entire ESU. • IDFG does yearly index redd counts throughout the MPG. Data available since 1957. • Smolts per female estimated for natural/wild fish yearly (measured at LGR) for the entire ESU. • IDFG collects tissue and scale samples from wild and hatchery Chinook at LGR for GSI (Genetic Stock Identification). Age composition and sex ratios determined. • Tissue samples collected from all broodstock at all Snake River hatcheries for PBT (Parental Based Tagging). • IDFG estimates Chinook salmon harvest and incidental mortality of wild fish in recreational fisheries using check stations and creel surveys (only hatchery origin adipose clipped fish may be kept).	• Estimates of natural-origin Chinook adult incidental mortality from sport fisheries in non-terminal areas are imprecise at the population level.	• Review, summarize, and synthesize data by population. • Use PBT to identify hatchery origin adults at LGD and in tributaries. • Annual run-reconstruction of hatchery and wild returns, harvest, and escapement to known and unknown population areas. • Develop surveys to determine hatchery spawner fraction in index streams. • Genetic baseline needs to be maintained at regular intervals • Determine the encounter rate of natural adult Chinook salmon and the mortality rate of released adult Chinook salmon in recreational fisheries. • Need an analysis of the accuracy and precision of expanding index redd counts to adult abundance.	• Design and implement a smolt sampling program at LGR to estimate the number of smolts from each population using GSI. • Transition from microsatellite to SNPs technology for GSI and PBT analysis. • Analyze adult and juvenile tissue samples collected by IDFG and Tribes for inclusion in baseline genetic database using SNPs. • Implement a 5-year rotating panel to collect genetic samples to maintain and update baseline genetic database • Estimate natural population incidental mortality from sport fisheries. • Develop yearly smolt to adult survival (SAR) estimates at the population scale.

[3] Abbreviations and Acronyms used in Table 9-1. BPA -Bonneville Power Administration; CHaMP - Columbia Habitat Monitoring Program; GRTS - Generalized Random-Tessellation Stratified, GSI - Genetic Stock Identification; IDFG - Idaho Department of Fish and Game; IMW - Intensively Monitored Watershed; INPMEP - Idaho Natural Production Monitoring and Evaluation Project; ISEMP - Integrated Status and Effectiveness Program; ISMES - Idaho Steelhead Monitoring and Evaluation Studies; ISS- Idaho Supplementation Studies; IMW – intensively monitored watershed; LGR - Lower Granite Dam; LSRCP - Lower Snake River Compensation Plan; NPT - Nez Perce Tribe; MaSA - Major Spawning Area; MiSA - Minor Spawning Area; PBT - Parentage Based Tagging; PIT - Passive Integrated Transponder; PNI - Proportionate Natural Influence; PNOS - Proportion Natural-Origin Spawners; SAR – smolt-to- adult survival; SBT – Shoshone-Bannock Tribes; SNP - Single Nucleotide Polymorphisms

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• NPT and SBT estimate tribal harvest (hatchery and unmarked) within the MPG. • IDFG Idaho Supplementation Studies (ISS) evaluate supplementation as a recovery/restoration strategy for spring/summer Chinook. Control and treatment streams found within this MPG. • NPT and IDFG do multi-pass redd counts for ISS study. • ISEMP IMW project implemented in SF Salmon River and Secesh River beginning 2009, including PIT-tagging, PIT-tag arrays, adult monitoring, juvenile trapping, and collection of adult and juvenile life history data. Tributary habitat measured and evaluated in South Fork Salmon River under CHaMP program. • ISEMP conducts a mark-recapture program that PIT-tags a known, representative fraction of natural-origin adult steelhead and spring/summer Chinook salmon as they pass Lower Granite Dam that are subsequently detected in upstream tributaries at instream PIT-tag arrays. Researchers finding that the decomposition of the Lower Granite Dam runs-at-large of steelhead and spring/summer Chinook salmon into tributary, population, and MPG- specific escapement estimates is a reliable, precise, and efficient alternative to continuous operation of multiple weirs.		• Ensure that redd counts are done in all ICTRT defined MaSAs and MiSAs for spatial structure assessment. • Collect adult life history data at the population scale. • Develop criteria to assess the adequacy of carcass sampling to estimate hatchery fraction, sex ratio, and age structure. • Develop stock specific (wild and hatchery) harvest and incidental mortality estimates in the mainstem Columbia River commercial, sport, and tribal fisheries.	• There is the potential to expand PIT-tagging at Lower Granite Dam to include hatchery origin adults, which would enable estimates of hatchery fraction in populations targeted for supplementation and enable estimates of stray rates into non-target populations that are monitored by PIT-tag arrays.

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
South Fork Salmon River Mainstem Population				
Adult abundance	• IDFG does single pass index redd counts in the mainstem SF Salmon. Data available since 1957. • IDFG has operated a weir at rkm 113 in SF Salmon for McCall Hatchery since 1981. This yields an estimate of adult escapement to weir. Most spawning is downstream, weir captures about 25% of population based on proportion of redds in IDFG index sites. • IDFG has done multiple pass redd counts (since 1997) upstream of the weir for ISS project. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined. • ISEMP has installed PIT tag array readers in mainstem SF Salmon River. South Fork Salmon is an ISEMP IMW.	• IDFG developed corrected redd counts for data before 1993. • SF Weir efficiency has been calculated using mark recapture. • Accuracy of GSI to identify this population needs to be determined.	• Need an analysis of accuracy and precision of expanding index redd counts to adult abundance. • Additional spawning ground surveys downstream of SF Salmon weir to augment index surveys and to collect life history data (sex ratio, age, length, genetics) and proportion of hatchery spawners.	• Monitoring is needed for mandated US v Oregon supplementation activities.
Adult productivity	• Hatchery fish released in SF Salmon River at Knox Bridge for harvest augmentation. All smolts have their adipose fin clipped. • Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure obtained from carcasses surveyed during IDFG ground redd count surveys and from adults trapped at SF Salmon weir. • PIT-tags scanned at LGR, weir, and during ground redd/carcass surveys.	• Estimates of natural-origin Chinook salmon adult incidental mortality from sport fisheries in non-terminal areas are imprecise at the population level.		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG estimates sport harvest of hatchery origin fish and impacts on wild fish using check stations and creel surveys. • Sport fishing for Chinook salmon within population boundaries is limited to mainstem SF Salmon River from EF SF Salmon to hatchery weir. • SBT monitors, estimates, and reports Tribal harvest of hatchery and wild fish. •PNOS =61% • PNI =0.2			
Juvenile productivity	• IDFG has operated a rotary screw trap in SF Salmon River just upstream of adult weir since 1992 as part of ISS. • Juvenile migrant abundance estimated at screw traps using mark recapture. • Survival of juveniles to LGR estimated using PIT tags. • Smolt yield estimated for adults spawning upstream of hatchery weir using screw trap data and downriver PIT-tag detections. • ISEMP rotary screw trap in mainstem SF upstream of EF SF Salmon River. • IDFG fixed site snorkel surveys done 1980 – 2006. In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance.	• Screw trap 95% CI =4.8%-33.9% • Fish upstream of the trap may not be representative of the entire population.		
Spatial distribution	• IDFG does redd surveys in both MaSAs but none in the 2 MiSAs.		• Expand redd surveys to include the Warren Creek and Crooked River MiSAs.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Species diversity	• Data collected from fish sampled at weir, juvenile traps, and spawning ground surveys. • Adult age and diversity data 1999-2008 available from NPM.		Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Little Salmon River Population				
Adult abundance	• IDFG determines hatchery and natural returns to the Rapid River Hatchery weir. Only natural-origin fish are passed upriver of the weir. Hatchery fish are held at Rapid River Hatchery for broodstock. • NPT does a multi-pass ground count in Slate Creek for ISS study. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Weir is 100% efficient. • Accuracy of GSI to identify this population needs to be determined.	• No redd surveys done except in Slate Creek. • Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Hatchery smolts released at Rapid River Hatchery for harvest augmentation. All smolts have their adipose fin clipped. About 50,000 smolts are PIT-tagged annually for comparative survival study (CSS) and harvest management. • Sex ratio, origin, length, age data collected from adults trapped at Rapid River weir and ground redd survey in Slate Creek (ISS). • IDFG estimates age composition and origin at LGR (ESU level estimates, used when MPG/population data not available) • IDFG estimates sport harvest of hatchery origin Chinook and impacts on wild fish using check stations and creel surveys.		• Need more accurate and precise age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Sport harvest of Chinook within population boundaries limited to a portion of the mainstem Salmon River and Little Salmon River. • NPT and SBT estimate tribal harvest of hatchery and wild fish.			
Juvenile productivity	• IDFG operates 1 screw trap in Rapid River upstream of the weir. • IDFG operates a screw trap in the mainstem Salmon River at rm 103. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids; Boulder Creek & Rapid River done in 2007 & 2008.	• Rapid River screw trap in operation since 2006; targets steelhead, Chinook are not tagged. • Salmon River screw trap only operated during the spring. It captures Chinook salmon from many populations in the SF, MF and Upper Salmon MPG's.	• PIT-tag wild Chinook parr and smolts at Rapid River screw trap.	
Spatial distribution	• NPT redd counts in the Slate Creek MiSA for ISS. Planned to end in 2012. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids; Boulder Creek and Rapid River done in 2007 and 2008.		• Assess spawning distribution in Whitebird Creek and Little Salmon River MiSAs.	
Species diversity	• IDFG obtains data from adults trapped at Rapid River weir.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.
East Fork South Fork Salmon River Population				
Adult abundance	• IDFG does index redd counts in EF SF Salmon River and Johnson Creek. Data available since 1957. • NPT does multi-pass redd counts in Johnson Creek.	• Hassemer corrected redd counts in 1993. • Accuracy of GSI to identify this population needs to be determined.		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• NPT operates a weir in Johnson Creek. Assumed to capture about 80% of the population, based on the proportion of redds observed in index areas. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using Genetic Stock Identification beginning 2008. Age composition and sex ratios also determined • NPT monitors effectiveness of Johnson Cr supplementation program by quantification of adult abundance to Johnson Creek (escapement), index of spawner abundance (redd counts), spawner abundance (spawner), fish per redd, hatchery fraction, age class structure, age-at-return, adult spawner sex ratio, prespawning mortality, and in-tributary harvest. • ISEMP/NPT installed PIT tag array in readers in EF SF Salmon River.			
Adult productivity	• Hatchery smolts released in Johnson Creek for NPT supplementation program; Hatchery fish are not adipose fin clipped but other mark (VIE/CWT) is used to identify. • No sport fishing for Chinook salmon within population boundaries is permitted. • NPT and SBT monitor and estimate tribal harvest. • Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during NPT ground redd count surveys and from adults trapped at Johnson Creek weir..IDFG estimates age composition and origin at		• Success of hatchery outplants into East Fork near Stibnite needs to be evaluated.	• Genotyping of all hatchery spawners so PBT can used to identify parr, smolts, and adults.

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	LGR (ESU level estimates, used when MPG/population data not available)			
Juvenile productivity	• NPT operates screw trap in Johnson Creek. • Juvenile migrant abundance estimated at screw traps using mark recapture. • Survival of juveniles to LGR estimated using PIT tags • Smolt yield estimated for adults spawning upstream of Johnson Creek weir using screw trap data and downriver PIT-tag detections. • IDFG fixed site snorkel surveys done 1980 – 2006. Transitioning to a rotating panel probabilistic GRTS design for assessing juvenile abundance.	• Fish upstream of the trap may not be representative of the entire population.		
Spatial distribution	• Redd surveys done in both MaSA's.		•	
Species diversity	• IDFG and NPT collect data from adults and juveniles sampled at weir, screw trap, and spawning ground surveys. • Adult age and diversity data available 1998-2008 from NPM.		• Genetic baseline needs to be maintained at regular intervals. •	• Implement a 5-year rotating panel to collect baseline genetic samples.
Secesh River Population				
Adult abundance	• IDFG conducts yearly index redd counts. Data available since 1957. • NPT conducts multiple pass redd counts 1997-2012 in the upper Secesh River and Lake Creek. These surveys covered most of the Chinook spawning area, as part of the ISS study. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using Genetic Stock	• Accuracy of GSI to identify this population needs to be determined.		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	Identification (GSI) beginning 2008. Age composition and sex ratios also determined • Secesh drainage is a control stream for Idaho Supplementation Study (ISS) (ie- no hatchery supplementation). • NPT operate DIDSON and video camera for escapement estimates in Lake Creek. DIDSON samples 40% of spawning area in Lake Creek. • ISEMP installed a PIT tag array reader in lower Secesh River in 2009.			
Adult productivity	• No hatchery fish released within population boundaries. • PHOS (percent hatchery-origin spawners) estimates using video camera at Lake Creek. PNOS= 96%. • No sport harvest permitted within population boundaries. • Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during NPT and IDFG ground redd count surveys and at the Lake Creek weir (with video camera). • IDFG estimates age composition and origin at LGR. • SBT monitors and estimates Tribal harvest.			
Juvenile productivity	• NPT operates 2 screw traps for ISS. One is on Upper Secesh (near rkm 30) and the other in Lake Creek. Both scheduled to cease operating in 2014. • NPT operates screw trap in lower Secesh River at rkm 7 (ISMEP)	• 95% CI =10.6%-88% in Secesh • 95% CI =5.3%-50% in Lake Creek		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Juvenile migrant abundance estimated at screw traps using mark recapture. • Juvenile survival to LGR estimated using PIT tags • Random snorkel surveys on Lick Creek and lower Secesh River (2004 – 2006 only) • IDFG fixed site snorkel surveys done 1980 – 2006. Transitioning to a rotating panel probabilistic GRTS design for assessing juvenile abundance.			
Spatial distribution	• MaSA has redd survey but the MiSA does not. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Secesh done in 2008. One time only.		• Expand redd survey to include the Lick Creek MiSA.	
Species diversity	• Data obtained from adults and juveniles sampled at weirs and screw traps • IDFG and NPT collecting carcass fin rays as part of supplementation studies • DNA collected by IDFG and NPT during spawning ground surveys. • Adult age and diversity data 1999-2012 available from INPMEP.	• Age structure needs to be validated	• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.

9.1.3.2 Monitoring in Middle Fork Salmon River Spring/Summer Chinook Salmon MPG

Monitoring occurs within all nine of the Middle Fork Salmon River MPG's spring/summer Chinook salmon populations: Big Creek, Lower Middle Fork Mainstem (below Indian Creek), Upper Middle Fork Mainstem (above Indian Creek), Camas Creek, Loon Creek, Sulphur Creek, Bear Valley Creek, Marsh Creek, and Chamberlain Creek. Ongoing efforts in the populations could be expanded or revised as needed to provide adequate monitoring for assessing whether desired recovery goals are being achieved.

Monitoring Objectives and Approach

This section summarizes the monitoring objectives and approaches for RM&E in the Middle Fork spring/summer Chinook salmon MPG. The monitoring approaches under each objective are discussed in more detail in Section 9.1.2.1. Table 9-2 identifies current monitoring activities and needs within each population area.

Objective 1: Determine the current natural population status in terms or abundance and intrinsic productivity for each population within the Middle Fork Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: IDFG will continue to estimate wild- and hatchery-origin Chinook salmon escapement and age structure passing Lower Granite Dam from adult sampling at the dam. Managers will also continue to conduct aerial redd surveys for the entire spawning area of most populations, Stock assessments will be conducted through weir carcass surveys to provide information on size, gender, origin, age, and marks and tags.

Status: IDFG, the Shoshone-Bannock Tribes, the Nez Perce Tribe, and the Rocky Mountain Research Station conduct most of the monitoring for spawner abundance within each population with funding from Idaho, LSRCP, and BPA.

Objective 2: Determine the status of the spatial structure of each population based on current and historically used habitat.

Priority level: This is a highest priority objective.

Approach: For all populations of spring/summer Chinook salmon within this MPG, spatial distribution of naturally produced Chinook salmon will be assessed using spawning ground surveys. Spawning surveys will cover spawning areas within each population (see Approach under Objective 1). Multiple surveys will be made during the spawning period to assess spawn timing. Sampling of carcasses will provide information on origin, marks, and tags.

Status: IDFG, the Shoshone-Bannock Tribes, the Nez Perce Tribe, and the Rocky Mountain Research Station conduct most of the monitoring for spatial spawning distribution within each population with funding from Idaho, LSRCP, and BPA. Additional funding will be needed to complete juvenile Chinook salmon GRTS surveys within each population depending on the frequency of desired sampling.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the Middle Fork Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: Evaluation of life history, genotypic, and phenotypic characteristics will be accomplished by sampling carcasses on the spawning grounds. Carcasses will be sampled for size, origin, marks and tags, age, and genetics. Weirs located within the MPG may be used to sample fish for origin (based on scales and marks/tags) and migration timing by origin.

Status: IDFG, the Nez Perce Tribe and Shoshone-Bannock Tribes conduct most of the monitoring for this objective with funding from Idaho, LSRCP, and BPA. Additional funding needs?

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the Middle Fork Salmon River MPG.

Priority level: This is a low priority objective for this MPG.

Approach: Habitat status will be measured and evaluated using the habitat sampling protocol developed for BPA's CHaMP program. Habitat variables to be measured include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates.

Status: Currently little habitat status and trend monitoring occurs within the MPG.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the Middle Fork Salmon River MPG.

Priority level: This is a low priority objective, given that much of the MPG falls within the Frank Church River of No Return Wilderness.

Approach: Habitat status and trend monitoring was described under Objective 4. Action effectiveness monitoring should be conducted at both the project (reach) and population or watershed scales. Action effectiveness monitoring designs should incorporate a BACI design or modified BACI designs.

Status: Currently, little habitat degradation and restoration monitoring occurs given that much of the MPG falls within wilderness boundaries.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the Middle Fork Salmon MPG.

Priority level: This is a high priority objective.

Approach: Hatchery fish that stray into this MPG, which is managed for natural production, and spawn naturally represent a threat to spring/summer Chinook salmon recovery. Monitoring for hatchery strays will be conducted based on CWT or PIT recoveries. The monitoring approach is described previously for objectives 1, 2, and 3.

Status: Progress in implementing the critical elements of the hatchery effects monitoring is basically the same discussion as presented earlier for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the Middle Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Chinook salmon smolts can be PIT tagged as they leave populations within the MPG and then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages.

Status: Additional funding is needed to PIT tag emigrating smolts from each population. Power analysis can be used to determine the number of fish to be tagged within each population.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the Middle Fork Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish. Within the MPG, harvest rates are assessed using catch record cards and creel surveys.

Status: Monitoring of out-of-MPG fisheries is currently funded. The Nez Perce Tribe and the Shoshone-Bannock Tribes monitor tribal harvest and IDFG monitors non-tribal harvest within the MPG. It is important to maintain funding for harvest monitoring. More and improved data are needed to monitor and manage population-specific impacts on natural-origin spring/summer Chinook salmon, including remaining uncertainty regarding natural-origin spawning escapement and catch and release impacts in recreational fisheries.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations with the Middle Fork Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Conduct annual sampling of non-native fish predators to determine abundance of predators and stomach contents. These data can be used to estimate population-level (or MPG-level) consumption rates by non-native fishes. Bird colonies in the Columbia River estuary will continue to be monitored for the presence of PIT tags originating from specific populations within the MPG to determine population-specific impacts.

Status: Investigations of predation in the migration corridor have been conducted by many agencies with funding from BPA and the USACE. Monitoring predation impacts in the mainstem Columbia, Snake, and Salmon Rivers needs to continue. Funding is needed to assess the abundance and stomach contents of predators to juveniles originating from the Middle Fork Salmon River MPG.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the Middle Fork Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Hatchery-origin strays found within the MPG will be examined for presence of disease or pathogens.

Status: Currently, hatchery fish and broodstock are monitored for disease. Funding is needed to monitor disease or pathogen presence and prevalence in naturally produced fish in streams.

Current Monitoring Efforts and Needs

Monitoring continues to occur within each of the Middle Fork Salmon River MPG's nine population areas, as well as in the mainstem Columbia, Snake, and Salmon Rivers. Current monitoring includes spawner escapement, smolt-to-adult returns, juvenile abundance, productivity, distribution, and some habitat condition monitoring.

Table 9-2 shows current monitoring within each population area, the quality and certainty associated with the data, improvements needed, and proposed new monitoring. The evaluations were drawn from work completed by the Columbia River Fish and Wildlife Authority through the Collaborative Systemwide Monitoring and Evaluation Project and through direct participation of the fish co-managers. This evaluation was especially influenced by the participation of the Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes. Numerous acronyms and abbreviations are used in Table 9-2 for the sake of brevity. These acronyms and abbreviations, and the terms they stand for, are discussed in Sections 9.1.2.1 and 9.1.3.2; they are also explained in a table footnote.

Table 9-2. Current monitoring, needs and proposed monitoring for Middle Fork Salmon River spring/summer Chinook salmon populations. Adapted from CBFWA (2009), http://www.cbfwa.org/ams/SnakeRiver.cfm[4].

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Middle Fork Salmon River MPG – General				
Adult abundance, Adult productivity, and other VSP criteria	• IDFG estimates wild and hatchery origin Chinook escapement and age structure passing Lower Granite Dam from adult sampling at the dam. These ESU-level estimates can be used when MPG/population data is not available. • COE counts at Lower Granite Dam provide a good estimate of the total number of Chinook salmon for the entire ESU. • IDFG does yearly index redd counts throughout the MPG. Data available since 1957. • Rocky Mountain Research Station has a long-term spawning survey program for all of MF drainage. Annual helicopter surveys cover much of the spawning habitat in MF (supplementing IDFG index reaches). • IDFG collects tissue and scale samples from wild Chinook at LGR for GSI and population identification. Age composition and sex ratios determined. • Hatchery fish are not stocked in this MPG. • IDFG Idaho Supplementation Studies evaluate supplementation as a recovery/restoration strategy	• Not all GSI data collected has been synthesized at the population level. • Estimates of natural-origin Chinook adult incidental mortality from sport fisheries in non-terminal areas are imprecise at the population level.	• Review, summarize, and synthesize data by population. • Annual run-reconstruction of hatchery and wild returns, harvest, and escapement to known and unknown population areas. • Genetic baseline needs to be maintained at regular intervals. • Determine the encounter rate of natural adult Chinook salmon and the mortality rate of released adult Chinook salmon in recreational fisheries. • Need an analysis of the accuracy and precision of expanding index redd counts to adult abundance. • Ensure that redd counts are done in all TRT defined MaSAs and MiSAs for spatial structure assessment. • Collect adult life history data at the population scale. • Develop criteria to assess the adequacy of carcass sampling to	• Design and implement a smolt sampling program at Lower Granite Dam to estimate the number of smolts from each population using GSI. • Transition from microsatellite to SNPs technology for GSI and PBT analysis. • Analyze adult and juvenile tissue samples collected by IDFG and Tribes for inclusion in baseline genetic database using SNPs. • Implement a 5-year rotating panel to collect genetic samples to maintain and update baseline genetic database. • Estimate natural population incidental mortality from sport fisheries. • Develop yearly smolt to adult survival (SAR) estimates at the population scale.

[4] Abbreviations and Acronyms used in Table 9-2. BPA -Bonneville Power Administration; CHaMP - Columbia Habitat Monitoring Program; GRTS - Generalized Random-Tessellation Stratified, GSI - Genetic Stock Identification; IDFG - Idaho Department of Fish and Game; IMW - Intensively Monitored Watershed; INPMEP - Idaho Natural Production Monitoring and Evaluation Project; ISEMP - Integrated Status and Effectiveness Program; ISMES - Idaho Steelhead Monitoring and Evaluation Studies; ISS- Idaho Supplementation Studies; IMW – intensively monitored watershed; LGR - Lower Granite Dam; LSRCP - Lower Snake River Compensation Plan; NPT - Nez Perce Tribe; MaSA - Major Spawning Area; MiSA - Minor Spawning Area; PBT - Parentage Based Tagging; PIT - Passive Integrated Transponder; PNI - Proportionate Natural Influence; PNOS - Proportion Natural-Origin Spawners; SAR – smolt-to- adult survival; SBT – Shoshone-Bannock Tribes; SNP - Single Nucleotide Polymorphisms

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	for spring/summer Chinook. Control streams found within this MPG. • Smolts per female estimated for natural/wild fish yearly (measured at LGR) for the entire ESU. • Neville and Thurow published a genetic analysis of several populations in the MF Salmon drainage using different microsatellite loci than currently used. • SBT and IDFG do multi-pass redd counts for ISS study. • SBT conducts multiple pass spawning ground surveys in tributaries not surveyed by the ISS for abundance information. • SBT monitor and estimate Tribal harvest with MPG.		estimate hatchery fraction, sex ratio, and age structure. • Develop stock specific (wild and hatchery) harvest and incidental mortality estimates in the mainstem Columbia commercial, sport, and tribal fisheries. • Install adult fish counting stations within MPG to evaluate adult escapement. Abundance estimates using expanded red counts could also be validated and management assumptions tested.	
Lower Middle Fork Salmon River Population				
Adult abundance	• USFS has done redd surveys for IDFG in mainstem MF Salmon in recent years but funding uncertain for future monitoring. • IDFG has index redd site in MF Salmon. Data available since 1957. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Not much spawning in MF mainstem, most occurs in the tributaries. • IDFG index redd surveys not done every year. • Accuracy of GSI to identify this population needs to be determined.	• Ensure that redd surveys are done yearly and encompass more spawning areas to obtain a better estimate.	
Adult productivity	• Little or no population specific data. No hatchery fish are stocked within population boundaries but mainstem Salmon River used for migrating hatchery origin adults and smolts • No recreational fishing for Chinook salmon allowed within population boundaries.	• No carcass surveys have been done for this population.		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT conduct tribal fisheries within this population			
Juvenile productivity	• Little or no population specific data			
Spatial distribution	• Redd count survey done in recent years in the one MiSA. There are no MaS's.			
Species diversity	• Little or no population specific data		• Genetic analysis of adults and/or juveniles from this population need to be included in baseline genetic database. • Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Chamberlain Creek Population				
Adult abundance	• IDFG does index site redd counts in Chamberlain and WF Chamberlain creeks. Data since 1985. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using Genetic Stock Identification beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined.	• Data limited to the Chamberlain Creek drainage. Expand adult abundance estimates to include other streams in this population. • Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Little or no data. • No hatchery fish are stocked within population boundaries but mainstem Salmon River used for migrating hatchery origin adults and smolts • No recreational fishing for Chinook salmon allowed within population boundaries.	• One-pass redd surveys have sampled few carcass for estimating age structure.	• Need more accurate and precise adult productivity estimates.	
Juvenile productivity	• Little or no data • IDFG fixed site snorkel surveys done 1980 – 2006. Transitioning to a rotating panel probabilistic GRTS design for assessing juvenile abundance.	• Sample size from NMFS PIT-tagging may be too small to obtain accurate and precise estimates.		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• NMFS PIT-tags juvenile Chinook salmon during summer. Data used to determine run timing and survival at LGR.			
Spatial distribution	• Redd surveys done in the one MaSA but not the 3 MiSA s.		• Expand redd surveys to include the three MSA's (Sabe, McCalla, and Bargamin creeks)	
Species diversity	• Age and diversity data for 1999, 2001-2012 available from INPMEP.		• Genetic analysis of adults and/or juveniles from this population need to be included in baseline genetic database. • Genetic baseline needs to be maintained at regular intervals	• Implement a 5-year rotating panel to collect baseline genetic samples.
Big Creek Population				
Adult abundance	• IDFG index redd sites in Big Creek. Data available since 1957. • NMFS operates a PIT-tag array in Big Creek at Taylor Ranch. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using Genetic Stock Identification beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined. • PIT-tag sample size too small to make accurate adult escapement estimates at current level of tagging effort.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Little or no data. • Hatchery fish are not released within population boundaries. • No recreational fishing for Chinook salmon allowed within population boundaries. • SBT conducts tribal fisheries in Big Creek.	• Carcass surveys lacking for most of this population. • Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise adult age structure data.	• Begin ground spawning surveys to augment aerial index counts and to collect life history data.
Juvenile productivity	• IDFG operates a screw trap in Big Creek at Taylor Ranch (rkm 11).	• Short time series for screw trap (since 2007).		

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Juvenile abundance estimated at screw trap using mark recapture. • NMFS PIT-tags juvenile Chinook salmon during the summer throughout Big Creek drainage. • PIT-tag data from NMFS and IDFG screw trap used to determine run-timing and survival at LGR. • PIT antenna array operated by NMFS in Big Creek at Taylor Ranch. • IDFG fixed site snorkel surveys done 1980 – 2006. Transitioning to a rotating panel probabilistic GRTS design for assessing juvenile abundance.			
Spatial distribution	• Two of the 3 MaSAs have redd surveys. No MiSAs.		• Expand redd survey to include the Monumental Creek MaSA.	
Species diversity	• Data collected from juveniles caught in screw trap • Age and diversity data for 2001-2012 available from Idaho Natural Production Monitoring and Evaluation Project (INPMEP) (199107300)		• Genetic baseline needs to be maintained at regular intervals • Obtain diversity data from adults.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Camas Creek Population				
Adult abundance	• IDFG aerial index redd count in Camas Creek. Data available since 1960. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using Genetic Stock Identification beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined. • Adult escapement estimates derived from expanding aerial redd counts highly variable.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	• SBT proposes conducting multiple-pass spawning ground surveys.
Adult productivity	• Little data available. • Hatchery fish are not released within population boundaries. • No recreational fishing for Chinook salmon allowed within population boundaries.	• Need carcass recovery information for age structure. • Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise adult age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT conducts tribal fisheries in Camas Creek. • SBT monitors and estimates Tribal harvest.			
Juvenile productivity	• IDFG fixed site snorkel surveys done 1980 – 2006. Transitioning to a rotating panel probabilistic GRTS design for assessing abundance of juvenile salmonids • NMFS PIT-tags juvenile Chinook salmon during the summer. Data used to determine run-timing and survival at LGR.	• Sample size from NMFS PIT-tagging may be too small to obtain accurate and precise estimates.	• Need juvenile productivity estimate; should be obtained through rotary screw trap.	• SBT propose to operate a screw trap in Camas Creek to monitor juvenile productivity.
Spatial distribution	• IDFG has redd surveys in the one MaSA but not the one MiSA.		• Expand redd survey to the Yellowjacket Creek MiSA.	
Species diversity	• Age and diversity data for 2001-2006 available from NPM		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT propose to collect DNA from juvenile Chinook salmon collected at the rotary screw trap.
Loon Creek Population				
Adult abundance	• IDFG aerial index redd counts in Loon Creek. Data available since 1957. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined. • SBT conducted multiple pass ground surveys in 2007 and 2008.	• Accuracy of GSI to identify this population needs to be determined. • Adult escapement estimates derived from expanding aerial redd counts highly variable.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Little data available • Hatchery fish are not stocked within population boundaries.	• Need carcass recovery information for age structure.	• Need more accurate and precise age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• No recreational fishing for Chinook salmon allowed within population boundaries. • SBT conducts tribal fisheries in Loon Creek. • SBT monitors and estimates Tribal harvest	• Additional sampling of SBT anglers to improve estimates of tribal harvest.		
Juvenile productivity	• Little data available. • NMFS PIT-tags juvenile Chinook salmon during the summer. Data used to determine run-timing and survival at LGR.	• Sample size from NMFS PIT-tagging may be too small to obtain accurate and precise estimates.	• Need juvenile productivity estimate; should be obtained through rotary screw trap.	• SBT propose to install screw trap in Loon Creek to monitor juvenile productivity.
Spatial distribution	• IDFG does a redd count in the one MaSA..		• Multiple pass spawning ground surveys should include all spawning areas.	
Species diversity	• Age and diversity data for 2001-2005, 2007 available from NPM (199107300)		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples. • SBT proposed to collect DNA from juveniles collected at a rotary screw trap.
Upper Middle Fork Salmon River Population				
Adult abundance	• USFS has conducted redd surveys in recent years, however funding for future is uncertain • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined.	• Expand spatial coverage of redd counts. • Ensure that redd surveys are done yearly. • Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Little data available. •Hatchery fish are not stocked within population boundaries	• Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• No recreational fishing for Chinook allowed within population boundaries. • SBT conducts tribal fisheries.			
Juvenile productivity	• Little data available. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Rapid River was done in 2007 and 2008.			
Spatial distribution	• USFS redd surveys in the one MaSA and one of the 2 MiSAs.	• Funding for future USFS surveys uncertain.	• Expand redd counts to include the Marble Creek MiSA. • Ensure redd surveys continue should USFS funding be reduced or eliminated.	
Species diversity	• Little data available.		• Genetic analysis of adults and/or juveniles from this population need to be included in baseline genetic database. • Genetic baseline needs to be maintained at regular intervals. • Adults and juvenile diversity data needs to be obtained.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Sulphur Creek Population				
Adult abundance	• Ground index redd surveys conducted by IDFG. Data available since 1957. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during IDFG ground redd count surveys.	• Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Hatchery fish are not stocked within population area. • No recreational fishing for Chinook allowed within population boundaries. • SBT conducts tribal fisheries.			
Juvenile productivity	• Little data available. • NMFS PIT-tags juvenile Chinook salmon during the summer. Data used to determine run timing and survival at LGR.	• Sample size from NMFS PIT-tagging may be too small to obtain accurate and precise estimates.		
Spatial distribution	• IDFG does redd counts in the one MaSA. There are no MSA's.			
Species diversity	• Age and other diversity data available for 2001-2003, 2008, 2012 from INPMEP.	• Sample size from carcass surveys small.	• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples.
Bear Valley Creek Population				
Adult abundance	• IDFG does index aerial redd counts in Bear Valley and Elk creeks. Data available since 1957. • SBT does multi pass redd counts in Bear Valley Creek for the ISS project, ends in 2014. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined • Bear Valley Creek is a control stream for the ISS study.	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	• SBT propose a DIDSON in Bear Valley Creek to evaluate adult escapement.
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during SBT ground redd count surveys	• Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise age structure data.	

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Hatchery fish are not stocked within population boundaries. • No recreational fishing for Chinook allowed within population boundaries. • SBT conducts tribal fisheries. • SBT monitors and estimates tribal harvest.			
Juvenile productivity	• NMFS PIT-tags juvenile Chinook salmon during the summer in Bear Valley and Elk creeks. Data used to determine run-timing and survival at LGR.			• SBT propose to operate a screw trap in Bear Valley Creek.
Spatial distribution	• All three MSA's have redd count surveys. There are no MSA's.			
Species diversity	• Adult data obtained from carcasses sampled during redd counts. • Age and diversity data available since 1998 from INPMEP.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples. • SBT propose to collect DNA from juveniles collected at the rotary screw trap and adults.
Marsh Creek Population				
Adult abundance	• IDFG does index redd counts throughout the Marsh Creek drainage. Data available since 1957. • IDFG does multi-pass redd counts in Marsh Creek for ISS study. This is a control stream for the ISS study. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	• SBT propose a DIDSON weir in Marsh Creek to evaluate adult escapement.

VSP parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses sampled during IDFG ground redd count surveys. • Hatchery fish are not stocked within population boundaries. • No recreational fishing for Chinook allowed within population boundaries. • SBT conducts tribal fisheries. • SBT monitors and estimates tribal harvest.	• Additional sampling of SBT anglers to improve estimates of tribal harvest.	• Need more accurate and precise age structure data.	
Juvenile productivity	• IDFG has operated a screw trap in Marsh Creek since 1992 for ISS. • NMFS PIT-tags juvenile Chinook salmon during the summer; however, sample size is small. • Juvenile migrant abundance estimated at screw traps using mark recapture. • Survival of juveniles to LGR estimated using PIT tags • IDFG fixed site snorkel surveys done 1980 – 2006. In 2007, IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids. Marsh Creek done in 2007 and 2008			
Spatial distribution	• IDFG does redd survey in the one MaSA. There are no MiSA's.			
Species diversity	• Data obtained from juveniles at the screw trap and from adult carcasses sampled during redd surveys. • Age and diversity data for some years, starting 1998 INPMEP.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples.

9.1.3.3 Monitoring in Upper Salmon River Spring/Summer Chinook Salmon MPG

Monitoring occurs within each of the Upper Salmon River spring/summer Chinook salmon MPG's nine populations: Panther Creek, Lemhi, Pahsimeroi, East Fork Salmon, North Fork Salmon, Yankee Fork Salmon River, Valley Creek, Upper Salmon River Lower Mainstem (below Redfish Lake), and Upper Salmon River Upper Mainstem (above Redfish Lake). Ongoing efforts in the populations could be expanded or revised as needed to provide adequate monitoring for assessing whether desired recovery goals are being achieved.

Monitoring Objectives and Approach

This section summarizes the monitoring objectives and approaches for RM&E in the Upper Salmon River spring/summer Chinook salmon MPG. The monitoring approaches under each objective are discussed in more detail in Section 9.1.2.1. Table 9-3 identifies current monitoring activities and needs within each population area.

Objective 1: Determine the current natural population status in terms or abundance and intrinsic productivity for each population within the Upper Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: IDFG will continue to estimate wild- and hatchery-origin Chinook salmon escapement and age structure passing Lower Granite Dam from adult sampling at the dam. Managers will also continue to conduct redd surveys of spawning areas. Stock assessments will be conducted through weir and carcass surveys to provide information on size, gender, origin, age, and marks and tags. The Upper Salmon River MPG currently has weirs (all used for hatchery broodstock collection) in four populations: Pahsimeroi, Yankee Fork, East Fork Salmon, and Upper Salmon River Upper Mainstem.

Status: IDFG and Shoshone-Bannock Tribes conduct most of the monitoring for spawner abundance within each population with funding from Idaho, LSRCP, and BPA. Much of the spawning ground survey information for Chinook salmon has been collected by the Idaho Supplementation Study (ISS) and funded by BPA.

Objective 2: Determine the status of the spatial structure of each population based on current and historically used habitat.

Priority level: This is a highest priority objective.

Approach: For all populations of spring/summer Chinook salmon within this MPG, spatial distribution of naturally produced Chinook salmon will be assessed using spawning ground surveys. Spawning surveys will cover spawning areas within each population (see Approach under Objective 1). Multiple surveys will be made during the spawning period to assess spawn timing. Sampling of carcasses will provide information on origin, marks, and tags. Screw traps in five populations in this MPG (Lemhi, Pahsimeroi, East Fork Salmon, Yankee Fork, and Upper Salmon River Upper Mainstem) will be used estimate juvenile abundance.

Status: IDFG and Shoshone-Bannock Tribes conduct most of the monitoring for spatial spawning distribution within each population with funding from Idaho, LSRCP, and BPA. Additional funding will be needed to complete juvenile Chinook salmon GRTS surveys within each population.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the Upper Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: Spring/summer Chinook salmon production may be negatively impacted by releases of hatchery fish in several of the populations within this MPG. Evaluation of life history, genotypic, and phenotypic characteristics of natural and hatchery-origin fish will be accomplished by sampling live fish at weirs and carcasses on the spawning grounds. Carcasses will be sampled for size, origin, marks and tags, age, and genetics. Weirs located within the Pahsimeroi, East Fork Salmon, Yankee Fork, and Upper Salmon River Upper Mainstem populations will be used to sample fish for origin (based on scales and marks/tags) and migration timing by origin.

Status: IDFG and Shoshone-Bannock Tribes conduct most of the monitoring for this objective with funding from Idaho, LSRCP, and BPA.

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the Upper Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Habitat status will be measured and evaluated using the habitat sampling protocol developed for BPA's CHaMP program (CHaMP 2014). Habitat variables to be measured include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates.

Status: The Sawtooth National Forest conducts some habitat monitoring in the Sawtooth Basin. ISEMP is conducting an Intensively Managed Watershed (IMW) program in the Lemhi River watershed, as well as CHaMP habitat monitoring. Habitat in the Yankee Fork Salmon River is proposed for population-scale monitoring as part of the CHaMP program.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the Upper Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Habitat status and trend monitoring was described under Objective 4. Action effectiveness monitoring should be conducted at both the project (reach) and population or

watershed scales. Action effectiveness monitoring designs should incorporate a BACI design or modified BACI designs.

Status: ISEMP conducts an Intensively Monitored Watershed project on the Lemhi River to measure impacts of tributary habitat restoration on Chinook salmon and steelhead.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the Upper Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Currently three populations within the Upper Salmon River MPG receive hatchery releases: Pahsimeroi, Yankee Fork, and the Upper Salmon River Upper Mainstem. Releases vary from adults and juveniles in the Yankee Fork, to over one million juveniles in the Pahsimeroi and the Upper Salmon River Upper Mainstem populations. Hatchery fish that stray into non-target tributaries and spawn naturally may represent a threat to Chinook salmon recovery. The monitoring approach is described previously for objectives 1, 2, and 3.

Status: Progress in implementing the elements of the hatchery effects monitoring is described above for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the Upper Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Chinook salmon smolts can be PIT tagged as they leave populations within the MPG and then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages.

Status: Additional funding is needed to PIT tag emigrating smolts from each population. Power analysis can be used to determine the number of fish to be tagged within each population.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the Upper Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish. Within the MPG, harvest rates are assessed using catch record cards and creel surveys.

Status: Monitoring of out-of-MPG fisheries is currently funded. The Nez Perce Tribe and Shoshone-Bannock Tribes monitor tribal harvest and IDFG monitors non-tribal harvest within the MPG. It is important to maintain funding for harvest monitoring. More and improved data are needed to monitor and manage population-specific impacts on natural-

origin spring/summer Chinook salmon, including remaining uncertainty regarding natural-origin spawning escapement and catch and release impacts in recreational fisheries.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations with the Upper Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Conduct annual sampling of piscine predators to determine abundance of predators and stomach contents. These data are then incorporated into a bioenergetics model to derive a population-level (or MPG-level) consumption estimate imposed by exogenous fishes. Bird colonies will continue to be monitored for the presence of PIT tags originating from specific populations within the MPG to determine population-specific impacts.

Status: Investigations of predation in the migration corridor have been conducted by many agencies with funding from BPA and the USACE. Monitoring predation impacts in the mainstem Columbia and Snake Rivers needs to continue. Funding is needed to assess the abundance and stomach contents of predators to juveniles originating from the MPG.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the Upper Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Monitor hatchery fish and broodstock for disease; and survey naturally produced fish in streams for disease and pathogen presence.

Status: Currently, hatchery fish and broodstock are monitored for disease. Funding is needed to monitor disease or pathogen presence and prevalence in naturally produced fish in streams.

Current Monitoring Efforts and Needs

Monitoring continues to occur within each of the Upper Salmon River MPG's nine population areas, as well as in the mainstem Columbia, Snake, and Salmon Rivers. Current monitoring includes spawner escapement, smolt-to-adult returns, juvenile abundance, productivity, distribution, and some habitat condition monitoring.

Table 9-3 shows current monitoring within each population area, the quality and certainty associated with the data, improvements needed, and proposed new monitoring. The evaluations were drawn from work completed by the Columbia River Fish and Wildlife Authority through the Collaborative Systemwide Monitoring and Evaluation Project and through direct participation of the fish co-managers. This evaluation was especially influenced by the participation of the Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes. Numerous acronyms and abbreviations are used in Table 9-3 for the sake of brevity. These acronyms and abbreviations, and the terms they stand for, are discussed in Sections 9.1.2.1 and 9.1.3.3; they are also explained in a table footnote.

Table 9-3. Current monitoring, needs and proposed monitoring for Upper Salmon spring/summer Chinook salmon populations. Adapted from CBFWA (2009), http://www.cbfwa.org/ams/SnakeRiver.cfm [5].

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Upper Salmon River MPG – General				
Adult abundance, Adult productivity, and other VSP criteria	• IDFG estimates wild and hatchery origin Chinook escapement and age structure passing Lower Granite Dam from adult sampling at the dam. These ESU-level estimates can be used when MPG/population data is not available. • COE counts at LGR provide a good estimate of the total number of Chinook salmon for the entire ESU. • IDFG does yearly index redd counts throughout the MPG. Data available since 1957. • IDFG collects tissue and scale samples from wild and hatchery Chinook at LGR for GSI and population identification. Age composition and sex ratios determined. • Tissue samples collected from all broodstock at all Snake River hatcheries for PBT. • IDFG Idaho Supplementation Studies (ISS) evaluate supplementation as a recovery/restoration strategy for spring/summer Chinook. Treatment and control streams found within this MPG. SBT and IDFG do multi-pass redd counts for ISS study.	• Not all of the GSI data collected has been synthesized at the population level. • Estimates of natural-origin Chinook adult incidental mortality from sport fisheries in non-terminal areas are imprecise at the population level.	• Review, summarize, and synthesize data by population. • Use PBT to identify hatchery origin adults at LGD and in tributaries. • Annual run-reconstruction of hatchery and wild returns, harvest, and escapement to known and unknown population areas. • Develop surveys to determine hatchery spawner fraction in index streams. • Genetic baseline needs to be maintained at regular intervals. • Determine the encounter rate of natural adult Chinook salmon and the mortality rate of released adult Chinook salmon in recreational fisheries. • Need an analysis of the accuracy and precision of expanding index redd counts to adult abundance. • Ensure that redd counts are done in all ICTRT-defined MaSAs and MiSAs for spatial structure assessment.	• Implement a smolt sampling program at LGR to estimate the number of smolts from each population using GSI. • Transition from microsatellite to SNPs technology for GSI and PBT analysis. • Analyze adult and juvenile tissue samples collected by IDFG and Tribes for inclusion in baseline genetic database using SNPs. • Implement a 5-year rotating panel to collect genetic samples to maintain and update baseline genetic database. • Estimate natural population incidental mortality from sport fisheries. • Develop yearly smolt to adult survival (SAR) estimates at the population scale.

[5] Abbreviations and Acronyms used in Table 9-3. BPA -Bonneville Power Administration; CHaMP - Columbia Habitat Monitoring Program; GRTS - Generalized Random-Tessellation Stratified, GSI - Genetic Stock Identification; IDFG - Idaho Department of Fish and Game; IMW - Intensively Monitored Watershed; INPMEP - Idaho Natural Production Monitoring and Evaluation Project; ISEMP - Integrated Status and Effectiveness Program; ISMES - Idaho Steelhead Monitoring and Evaluation Studies; ISS- Idaho Supplementation Studies; IMW – intensively monitored watershed; LGR - Lower Granite Dam; LSRCP - Lower Snake River Compensation Plan; NPT - Nez Perce Tribe; MaSA - Major Spawning Area; MiSA - Minor Spawning Area; PBT - Parentage Based Tagging; PIT - Passive Integrated Transponder; PNI - Proportionate Natural Influence; PNOS - Proportion Natural-Origin Spawners; SAR – smolt-to- adult survival; SBT – Shoshone-Bannock Tribes; SNP - Single Nucleotide Polymorphisms

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT conducts multiple pass spawning ground surveys in tributaries not surveyed by the ISS for abundance information. • SBT monitor, estimate and report Tribal harvest for hatchery and wild adults within MPG. • Smolts per female estimated for natural/wild fish yearly (measured at LGR) for the entire ESU. • ISEMP conducts a mark-recapture program that PIT-tags a known, representative fraction of natural-origin adult steelhead and spring/summer Chinook salmon as they pass Lower Granite Dam that are subsequently detected in upstream tributaries at instream PIT-tag arrays. Researchers finding that the decomposition of the Lower Granite Dam runs-at-large of steelhead and spring/summer Chinook salmon into tributary, population, and MPG- specific escapement estimates is a reliable, precise, and efficient alternative to continuous operation of multiple weirs.		• Collect adult life history data at the population scale. • Develop criteria to assess the adequacy of carcass sampling to estimate hatchery fraction, sex ratio, and age structure. • Develop population specific (wild and hatchery) harvest and incidental mortality estimates in the mainstem Columbia commercial, sport, and tribal fisheries.	• There is the potential to expand PIT-tagging at Lower Granite Dam to include hatchery origin adults, which would enable estimates of hatchery fraction in populations targeted for supplementation and enable estimates of stray rates into non-target populations that are monitored by PIT-tag arrays.
Panther Creek Population				
Adult abundance	• ICTRT classified this population as extirpated. However, Chinook salmon spawning has been documented in this drainage in recent years. • IDFG does index redd counts in Panther Creek. Data available since 1957. SBT also conducts redd surveys. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning	• IDFG index redd surveys not done every year. • Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	• SBT propose to install a weir in Panther Creek to enumerate Chinook escapement.

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	2008. Age composition and sex ratios also determined.			
Adult productivity	• Little data available. • Some sampling of carcasses is done during ground redd counts. • No hatchery fish are stocked within population. • Recreational fishing for Chinook salmon not permitted within population boundaries (except in 2001 and 2005 when excess hatchery adults from Pahsimeroi Hatchery were outplanted for harvest opportunity). • SBT monitors and estimates tribal harvest (hatchery and wild).		• Need more accurate and precise adult productivity estimates.	• Data would be collected from adults at proposed SBT weir.
Juvenile productivity	• Limited IDFG fixed site snorkel surveys done since 1980. Transitioning to a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids • SBT snorkel at a fixed site since 2004.			• SBT propose to install a screw trap in Panther Creek to monitor juvenile productivity.
Spatial distribution	• Limited to existing redd survey sites.		• Expand redd surveys to include all MaSAs and MiSAs.	
Species diversity	• Adult age and diversity data for 2005 and 2006 available.		• Genetic analysis of adults and/or juveniles from this population need to be included in baseline genetic database. • Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT propose to collect DNA from harvested adults, adults at weir, and juveniles collected at rotary screw trap

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
North Fork Salmon River Population				
Adult abundance	• This is a control stream for ISS, with no hatchery supplementation. IDFG conducts multi-pass index ground counts of redds for ISS. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during IDFG ground redd count surveys. • No hatchery fish are stocked within population boundaries but mainstem Salmon River used for migrating hatchery origin adults and smolts. • No recreational fishing for Chinook salmon allowed within population boundaries. • SBT monitors and estimates Tribal harvest (hatchery and wild).		• Need more accurate and precise adult productivity estimates.	
Juvenile productivity	• Little data available.			• SBT propose to operate a screw trap in NF Salmon River to monitor juvenile productivity.
Spatial distribution	• IDFG redd counts done in the one MaSA. There are no MiSAs.			
Species diversity	• Data obtained from adult carcasses sampled during IDFG ground redd counts. • Adult age and diversity data for selected years starting in 200 available from INPMEP.		• Genetic analysis of adults and/or juveniles from this population need to be included in baseline genetic database. • Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
				• SBT propose to collect DNA from harvested fish and fish caught in screw trap.
Lemhi River Population				
Adult abundance	• IDFG does index redd counts in Lemhi River. Data available since 1957. • IDFG does multi-pass redd counts in upper Lemhi River for ISS study. This is a control stream for ISS, with no current hatchery supplementation. • Lemhi River is an Intensively Managed Watershed (IMW) through ISEMP. PIT tag arrays installed in Hayden, Big Timber, and Kenney Creeks, and Lemhi River. Expanded spatial coverage of redd count surveys included in IMW project. Habitat monitored under BPA's CHaMP program. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI). • IMW study should improve adult abundance data. • Supplementation effectiveness monitoring will be needed if proposed Shoshone-Bannock Tribe (SBT) supplementation program in Lemhi River is implemented.	• SBT propose to supplement spring Chinook salmon in Lemhi River: US v OR 2008 – 2017 Management Agreement. • SBT propose to install a weir in Lemhi River to enumerate Chinook escapement.
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during IDFG ground redd count surveys. • No hatchery fish are stocked within population boundaries but mainstem Salmon River used for migrating hatchery origin adults and smolts. • No recreational fishing for Chinook salmon allowed within population boundaries.		• Need more accurate and precise adult age structure data. • IMW study should improve adult productivity data.	

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT monitors and estimates Tribal harvest (hatchery and wild).			
Juvenile productivity	• IDFG has operated a screw trap in Lemhi River at rkm 49 for ISS since 1992. • IDFG operates a screw trap in lower Lemhi River at rkm5 for IMW project. • IDFG operates screw trap in Hayden Creek for IMW project. • Juvenile migrant abundance estimated at screw traps using mark recapture. • Juvenile survival to LGR estimated using PIT tags. • Juvenile sampling using electrofishing and snorkeling for IMW throughout the drainage. PIT tag arrays installed in Lemhi River drainage as part of IMW.	• Hayden Creek and lower Lemhi River traps began operating in 2006.	• IMW study should improve juvenile abundance data.	
Spatial distribution	• Juvenile sampling using electrofishing and snorkeling for IMW throughout the drainage. • Redd surveys done in one of the 3 MaSA's and one of the 2 MiSA's.		• IMW study should improve adult and juvenile distribution data. • Expand redd surveys to include the Texas and 18 Mile MaSA's and Carmen MiSA.	
Species diversity	• Data obtained from juveniles at screw traps and adult carcasses sampled during IDFG ground redd counts. • Adult age and diversity data available since 1999 (NPM).		• Genetic baseline needs to be maintained at regular intervals. • Diversity data needs to be obtained from adults.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT propose to collect DNA from harvested fish and adults trapped at the proposed Lemhi weir.

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Pahsimeroi River Population				
Adult abundance	• Pahsimeroi Hatchery has a weir at rkm 2 that collects 100% of fish moving upstream to spawning areas. • IDFG conducts multi pass spawning ground surveys in the Pahsimeroi River for ISS study. This is a treatment stream for the ISS study. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Adult estimates are unbiased with high precision. • Accuracy of GSI to identify this population needs to be determined.		
Adult productivity	• PNOS = 0.58 PNI = 0.2 • Adult productivity data is collected from adults trapped at the weir. • Hatchery fish are released at Pahsimeroi Hatchery for harvest augmentation. • Recreational fishing for Chinook salmon allowed only once since 1980 in the mainstem Salmon River only. No recreational fishing for Chinook salmon allowed in the Pahsimeroi River. • SBT monitors and estimates Tribal harvest (hatchery and wild).	• Data quality and quantity is good for this population.		
Juvenile productivity	• IDFG has operated a screw trap for ISS study in the Pahsimeroi River at the hatchery since 1992. • Juvenile migrant abundance estimated at screw traps using mark recapture. • Juvenile survival to LGR estimated using PIT tags.			
Spatial distribution	• IDFG does redd counts in the one MaSA. There are no MiSAs.			

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Pahsimeroi done in 2008. One time survey			
Species diversity	• Age and diversity data available since 1999 from INPMEP.	• Good information from fish sampled at weir, on spawning ground, and screw trap.	• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples.
East Fork Salmon River Population				
Adult abundance	• This is a treatment stream for ISS. • Adults trapped at weir located on EF Salmon River at RKM 25. Weir is part of Sawtooth Hatchery operations. • IDFG does aerial index redd counts in EF Salmon River. Data available since 1957. • SBT does multi-pass ground redd counts in EF Salmon River and Herd Creek for ISS study. • SBT-SRHE conduct multi-pass ground redd counts in Herd Creek, since 1990s. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined. • IDFG and NOAA operated an adult captive rearing program for Chinook in the EF Salmon River. The program has ended, with the last adults stocked in 2010.	• A lot of spawning area is downstream of weir. About 17% of spawners are counted at the weir based upon the proportion of redds counted in IDFG index sites 1999-2006. • Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI). • HSRG recommends relocating weir near the mouth of EF Salmon River.	• IDFG proposed to build a weir near mouth of EF Salmon River to trap adult steelhead and Chinook salmon, to replace upstream weir.
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during SBT ground redd count surveys and from adults trapped at EF Salmon weir.		• Need more accurate and precise adult productivity estimates.	

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• No hatchery fish are stocked within population boundaries except captive adults (up until 2010). Hatchery smolts were released from 1993 – 1995 for ISS study. • No recreational fishing for Chinook salmon allowed within population boundaries. • SBT monitors and estimates tribal harvest (hatchery and wild).			
Juvenile productivity	• SBT operates a screw trap in the EF Salmon River downstream of the weir. • Juvenile abundance estimated at screw trap using mark recapture. • NMFS PIT-tags juvenile Chinook salmon during the summer (not done in 2008). • SBT and NMFS PIT-tag data used to determine run-timing and survival at LGR. • SBT-SRHE snorkel Herd Creek yearly, since 1990s	• Sample size from NMFS PIT-tagging may be too small to obtain accurate and precise estimates.	• Increase PIT tagging sample size.	
Spatial distribution	• The one MaSA has a redd count survey. There are no MiSAs.			
Species diversity	• Data collected from juveniles at screw trap and adults at weir and from carcasses sampled during SBT ground redd counts. • Adult age and diversity data available for 2000-2005, 2007, and 2008 from NPM.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples. • SBT proposed to collect DNA from harvested adults and juveniles collected at screw trap.
Yankee Fork Salmon River Population				
Adult abundance	• IDFG has aerial index redd sites in Yankee Fork and WF Yankee Fork. Data available since 1957.	• Yankee Fork weir started operating in 2008. Data quality and quantity will improve with	• Supplementation effectiveness monitoring is needed for SBT program.	• SBT developing a Chinook supplementation program for the Yankee Fork. Could include

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG and SBT do multi-pass redd counts in WF Yankee Fork for ISS. • SBT do multi-pass counts in Yankee Fork. Intense ground counts since 1980 for SMEP and SRHE (Salmon River Habitat Enhancement) programs. • Weir to capture adult Chinook salmon in Yankee Fork beginning 2008 for SBT supplementation program. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined • IDFG and NOAA have operated an adult captive rearing program for Chinook in the West Fork Yankee Fork. Program is ending and the last adults will be stocked in 2009. • WF Yankee Fork is a treatment stream for the ISS study. Ends in 2014.	time due to adult sampling at the weir. • Accuracy of GSI to identify this population needs to be determined.	• Continue multiple pass intensive ground counts after ISS ends.	permanent trapping facility in Yankee Fork to improve abundance and productivity estimates. • Population-scale habitat monitoring proposed under CHaMP program.
Adult productivity	• Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during SBT and IDFG ground redd count surveys. • Run-timing, age structure, gender, origin, PNI/PNOS/PHOS from adults trapped at Yankee Fork weirs. • Adults from Sawtooth Hatchery stocked in Yankee Fork for SBT supplementation program. Additional supplementation releases planned in the future for SBT program.	• Weir just started operating in 2008. Data quality and quantity will improve with time due to adult sampling at the weir.	•	

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• No recreational fishing for Chinook salmon allowed within population boundaries. • SBT monitors and estimates tribal harvest (Hatchery and wild).			
Juvenile productivity	• SBT operate a screw trap in WF Yankee Fork for ISS. Ends in 2014. • Juvenile abundance estimated at screw trap using mark recapture. • SBT operate rotary screw trap in mainstem lower Yankee Fork starting 2009. • PIT-tag data from trapping used to determine run-timing and survival at LGR. • SBT intensive snorkel surveys done since 1982; stratified, random 3 pass removal electrofishing surveys in Yankee Fork watershed ended 2009.	• Sample size from SBT PIT-tagging at WF Yankee Fork trap is too small to obtain accurate and precise estimates.	• Increase PIT tag sample size in this population.	
Spatial distribution	• IDFG redd counts done in the one MaSA. There are no MiSAs. • SBT conducts redd counts throughout entire Yankee Fork drainage.			
Species diversity	• Data collected from juveniles at screw trap and adults at weir and from carcasses sampled during IDFG and SBT ground redd counts. • Some adult age and diversity data available from INPMEP.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT propose to collect DNA from adults sampled at weirs, spawning ground surveys, harvest surveys and from juvenile caught in screw traps.

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Valley Creek Population				
Adult abundance	• IDFG does aerial index redd counts in Valley Creek. Data available since 1954. • SBT does multi pass spawning ground surveys in 33 km of Valley Creek for ISS. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined. • This is a control stream for the ISS study. • PIT antenna array operated by NMFS in Valley Creek about 1km upstream of mouth.	• Accuracy of GSI to identify this population needs to be determined.	• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI). • PIT-tag array in the stream could provide some adult escapement data.	• SBT propose a DIDSON weir in Valley Creek to evaluate adult escapement.
Adult productivity	• Adult age and diversity data are obtained from carcasses surveyed during SBT and IDFG ground redd count surveys. • No hatchery fish stocked within population area. • No recreational fishing for Chinook salmon allowed within population boundaries. • SBT monitors and estimates tribal harvest (Hatchery and wild).		• Need more accurate and precise adult production estimates.	
Juvenile productivity	• NMFS PIT-tags juvenile Chinook salmon during the summer in Valley Creek. • PIT antenna array operated by NMFS in Valley Creek about 1km upstream of mouth. • PIT-tag data from NMFS used to determine run-timing and survival at LGR.			
Spatial distribution	• Redd counts done in the one MaSA. There are no MiSA's.			

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Species diversity	• Data collected from carcasses sampled during SBT ground redd counts and IDFG carcass surveys. • Adult age and diversity data available since 2000 from INPMEP.	•	• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples. • SBT proposes to collect DNA from harvested adults.
Upper Salmon River Lower Mainstem (below Redfish Lake) Population				
Adult abundance	• IDFG does aerial index redd counts. Data available since 1954. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined	• Accuracy of GSI to identify this population needs to be determined.		
Adult productivity	• IDFG collects data from carcass sampling. • No hatchery fish are stocked within population boundaries but mainstem Salmon River used as migration corridor for hatchery smolts and adults. • Recreational fishing for Chinook salmon was allowed in 2008 (and proposed for 2009) in mainstem Salmon River only. No fishing allowed from 1980 – 2007. • SBT monitors and estimates tribal harvest (hatchery and wild).		• Need more accurate and precise adult abundance data (increased redd surveys, weirs, GSI).	
Juvenile productivity	• No data available.		• Need more accurate and precise adult productivity estimates.	
Spatial distribution	• IDFG redd counts done in the mainstem Salmon River portion of the 3 MaSAs and 1 MiSA.		• Expand redd surveys to include tributaries of each Spawning Area.	
Species diversity	• Adult age and diversity data from IDFG carcass surveys in mainstem Salmon River since 2000, INPMEP.		• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel for baseline genetic samples.

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
				• SBT propose to collect DNA from harvested adults.
Upper Salmon River Upper Mainstem (above Redfish Lake) Population				
Adult abundance	• Weir located on Salmon River at Sawtooth Hatchery captures 100% of salmon bound for the spawning areas upstream. Data available since 1985. • IDFG does aerial index redd counts in Salmon River. Data available since 1954. • IDFG conducted multi pass carcass collections in Salmon River for ISS through 2012. This is a treatment stream for the ISS study. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined. • Hatchery smolts released from Sawtooth Hatchery for harvest augmentation.	• Weir provides unbiased high precision estimates of adult spawner abundance upstream of Sawtooth Hatchery. However, there is a lot of spawning between Redfish Lake Creek and the weir. • Accuracy of GSI to identify this population needs to be determined.	• Improved estimation of hatchery and wild origin adults spawning between Redfish Lake Creek and the Sawtooth weir.	• Effectiveness monitoring is needed for the US v Oregon supplementation activities.
Adult productivity	• PNOS = 0.75 PNI =0.4 • Sex ratio, hatchery proportion, length, percent spawned, DNA, age structure are obtained from carcasses surveyed during IDFG ground redd count surveys and from adults trapped at Sawtooth weir • Recreational fishing for Chinook salmon was allowed in 2008 (and proposed for 2009) in mainstem Salmon River downstream of Sawtooth Hatchery. No fishing for Chinook salmon was allowed from 1980 – 2007.	• Data quality and quantity is very good for this population.	• Improved estimation of hatchery and wild origin adults spawning between Redfish Lake Creek and the Sawtooth weir.	

VPS Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT monitors and estimates Tribal harvest (hatchery and wild).			
Juvenile productivity	• IDFG has operated a screw trap in Salmon River at Sawtooth Hatchery since the fall 1987. Currently operated for ISS, planned to cease trapping in 2014. • IDFG fixed site snorkel surveys done since 1980. Transitioning to a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids.			
Spatial distribution	• IDFG has redd counts in all 3 MaSAs. There are no MiSAs. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP, 199107300) Upper Salmon done in 2007 one time survey.			
Species diversity	• Data collected from carcasses sampled during IDFG ground redd counts and adults trapped at Sawtooth weir. • Adult age and diversity data available since 1999 from IDFG (INPMEP 199107300). • Wild and hatchery origin adults trapped at Sawtooth weir are sampled for genetics.	• Data quality and quantity is very good for this population.	• Genetic baseline needs to be maintained at regular intervals.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT plan to collect DNA from harvested adults.

9.1.3.4 Key Information Needs for Idaho Snake River Spring/Summer Chinook Salmon

Several critical uncertainties for Idaho's salmon and steelhead currently limit the ability to make informed management decisions. The following are examples of research needs specific to Idaho's Snake River spring/summer Chinook salmon populations.

Abundance and Productivity Research

- Differentiate population-specific migration survival through the FCRPS. Research suggests that populations that spawn and rear at high elevations and produce relatively small yearling smolts that migrate during June and July could be experiencing higher mortality rates in the migration corridor than populations that spawn at lower elevations and produce relatively larger yearling smolts. Likewise, populations that produce substantial numbers of sub-yearling smolts that migrate during June and July also could be experiencing higher mortality rates in the migration corridor than populations with primarily yearling smolts migrating in the spring.
- Chinook salmon egg-to-migrating juvenile and egg-to-smolt survival studies are needed. Most existing data on juvenile and smolt production is from supplementation studies, so study streams from the existing research have substantial hatchery influence, which may confound results.
- Investigate factors contributing to the sub-yearling life history pattern of spring/ summer Chinook salmon, the effects of this life-history type on viability, and the limiting factors that determine adult returns. Understand where this is happening in the over-wintering life stage.
- Reach-specific juvenile migration and rearing survival in the Salmon River mainstem is needed. Survival of juveniles migrating or rearing in reaches that are heavily impacted by water withdrawal, mostly upstream of the North Fork Salmon River, may be reduced by diversion structures, low flows, and increased water temperature.
- Research on juvenile Chinook salmon survival in the Snake River from the mouth of the Salmon River to the head of Lower Granite Reservoir is needed.
- Research on juvenile Chinook salmon survival between John Day Dam and the Columbia River estuary is needed. Information is also needed on the duration and intervals of juvenile movement and holding, presumably for resting and feeding, in free-flowing and reservoir mainstem reaches.
- Investigate factors contributing to the unexplained loss of adult spring/ summer Chinook salmon between Bonneville and Lower Granite Dams.
- Identify the effect that hatchery-origin Chinook salmon have on natural-origin Chinook salmon productivity in natal streams.

- Conduct life-cycle monitoring to evaluate density dependence and other impacts on populations, and at what specific life stages and populations, to ensure that we are targeting restoration efforts at appropriate geography and life stage.
- Conduct research on the impacts of local climate change on populations and habitats, and identify areas (such as cold-water refugia) that can be protected and restored to improve population resiliency to climate change.

Habitat Research

- Identify rearing and overwintering habitats used by juveniles that have migrated downstream out of their native streams (e.g. into the Salmon River mainstem or farther downstream).
- Identify stream reaches in the Salmon River drainage that produce the highest egg-to-fry survival ratio and highest fry-to-returning adult ratio. Determine which habitat features lead to these higher survival rates.
- Investigate use of beaver to increase juvenile rearing habitat (beaver ponds).
- Identify the importance of salmonid carcasses as a food source for migrating and over-wintering juvenile Chinook salmon. Determine level of risk for disease transmission from hatchery carcass outplants to wild juveniles.
- Identify current impacts and predict future impacts to Chinook salmon and their habitat due to climate change.
- For the Clearwater and Upper Salmon River basins, identify whether there is a need to implement a tributary habitat assessment and prioritization process (similar to the Atlas process in the Catherine Creek and Upper Grande River basins). Such an effort would integrate scientific data on habitat quality, habitat potential, and fish distribution to determine a strategy of prioritized and sequenced site-specific treatments to maximize habitat and population response.

9.1.4 Research, Monitoring, and Evaluation in Idaho Snake River Basin Steelhead MPGs

Research, monitoring, and evaluation approaches for the two Idaho Snake River Basin steelhead MPGs are described in the following sections. These monitoring approaches are intended to represent those actions considered to have potential while recognizing logistical and monetary constraints. A final selection will be updated and refined by the Science Team during implementation of this recovery plan.

9.1.4.1 Monitoring in Clearwater River Steelhead MPG

Monitoring occurs within five of the Clearwater River steelhead MPG's six populations (Lower Mainstem Clearwater River, Selway River, Lochsa River, Lolo Creek, and South Fork Clearwater). Access to the North Fork Clearwater population is blocked by Dworshak Dam and

the population currently serves only as a hatchery population. Ongoing efforts in the five populations will be revised and/or expanded as needed to provide adequate monitoring for assessing whether desired recovery goals are being achieved.

Monitoring Objectives and Approach

This section summarizes the monitoring objectives and approaches for RM&E in the Clearwater River steelhead MPG. The approaches and metrics for each objective are discussed in more detail in Section 9.1.2.1. Table 9-4 identifies current monitoring activities and needs within each Clearwater steelhead population.

Objective 1: Determine the status and trend of each natural population in terms of abundance and intrinsic productivity.

Priority level: This is a highest priority objective.

Approach: IDFG will continue to estimate wild- and hatchery-origin steelhead escapement and age structure passing Lower Granite Dam from adult sampling at the dam. Population-specific abundance estimates will become possible for some populations with the installation of PIT tag arrays in tributaries (currently on Lolo Creek and the South Fork Clearwater River), and may also become possible based on genetic analyses of returning adult fish sampled at LGD. Weirs in the Lower Mainstem Clearwater River, South Fork Clearwater River and Lochsa River populations will also aid in population-specific abundance and productivity estimates. Stock assessments will be conducted through weir surveys to provide information on size, gender, origin, age, and marks and tags.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for spawner abundance within each population with funding from Idaho, LSRCP, and BPA.

Objective 2: Determine the status of the spatial structure of each population in this MPG based on current and historically used habitat.

Priority level: This is a highest priority objective.

Approach: For all steelhead populations within this MPG, spatial distribution of naturally produced steelhead will be estimated based on presence of juvenile fish (steelhead redd counts in Idaho are not feasible because spawn timing overlaps with spring snowmelt). The spatial extent and distribution of natural-origin juvenile steelhead will be based on a GRTS survey design and snorkeling or electrofishing techniques. In addition, screw traps in four populations in this MPG (Lower Mainstem Clearwater, South Fork Clearwater, Lolo Creek and Selway River) will be used to estimate juvenile abundance. Adult detection at PIT tag arrays and weirs will also help determine the spatial distribution of steelhead in some populations.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for spatial distribution within each population with funding from Idaho, LSRCP, and BPA. Additional funding will be needed to complete juvenile steelhead GRTS surveys within each population.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the Clearwater River MPG.

Priority level: This is a highest priority objective.

Approach: Steelhead production may be influenced by releases of hatchery fish in several of the populations within this MPG. The artificial propagation of fish includes genetic risks that may compromise the goal of supplementation and reduce the likelihood of recovery. Evaluation of life history, genotypic, and phenotypic characteristics will be accomplished by sampling live fish at weirs and Lower Granite Dam. Weirs located within the Lower Mainstem Clearwater, South Fork Clearwater, and Lochsa River populations will be used to sample fish for origin (based on scales and marks/tags) and migration timing by origin. PIT tag arrays will record migration timing.

Status: IDFG and the Nez Perce Tribe conduct most of the monitoring for this objective with funding from Idaho, LSRCP, and BPA.

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the Clearwater MPG.

Priority level: This is a high priority objective.

Approach: Habitat status will be measured and evaluated using the habitat sampling protocol developed for the CHaMP program (CHaMP 2014). Habitat variables to be measured include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates.

Status: Although habitat monitoring following the standard protocols developed by ISEMP has just begun, the NPT and USFS have been monitoring steelhead habitat in select watersheds for multiple decades.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the Clearwater River MPG.

Priority level: This is a high priority objective.

Approach: The Plan identifies restoration actions such as habitat restoration and protection, flow augmentation, and passage restoration that should increase natural productivity, abundance, and spatial structure of natural-origin steelhead. RM&E information will be gathered to support these investments. Habitat status and trend monitoring was described under Objective 4. The effects of habitat restoration actions on population VSP parameters will be monitored at the population or watershed scales. Some individual restoration actions will also be monitored for effectiveness at improving habitat conditions at the reach scale. Action effectiveness monitoring designs should incorporate a BACI design or modified BACI designs. Compliance monitoring is conducted by the implementing party (IDFG, Nez

Perce Tribe, USFS, etc.) and should include any parameters identified in work statements. All habitat restoration projects need to be monitored for compliance.

Status: The Potlatch River system serves as a steelhead Intensively Monitored Watershed within the Clearwater River drainage.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the Clearwater River MPG.

Priority level: This is a high priority objective.

Approach: Several large hatchery programs exist within the Clearwater River steelhead MPG, releasing approximately 2.8 million fish annually. Hatchery fish that stray into non-target tributaries and spawn naturally may represent a serious threat to steelhead recovery. The monitoring approach for this objective is described previously for objectives 1, 2, and 3.

Status: Progress in implementing the critical elements of the hatchery effects monitoring is basically the same discussion as presented earlier for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the Clearwater River MPG.

Priority level: This is a high priority objective.

Approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Steelhead smolts can be PIT tagged as they leave populations within the MPG and then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages using DART and PTAGIS databases. Detection probabilities of juvenile salmonids migrating downstream at FCRPS facilities are modeled using the SURPH analytical tool. Adult detection (assumed 100%) is currently available at ladders on several dams and at PIT-tag arrays in Lolo Creek and the South Fork Clearwater. TDG and temperature should be measured hourly with calibrated electronic instruments at each FCRPS facility during fish passage.

Status: Additional funding is needed to PIT tag emigrating smolts from each population. Power analysis can be used to determine the number of fish to be tagged within each population.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the Clearwater River MPG.

Priority level: This is a high priority objective.

Approach: Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish. Within the MPG, harvest rates are assessed using catch record cards and creel surveys.

Status: Monitoring of out-of-MPG fisheries is currently funded. The Nez Perce Tribe monitors tribal harvest and IDFG monitors non-tribal harvest within the MPG. It is important to maintain funding for harvest monitoring. More and improved data are needed to monitor and manage population-specific impacts on natural-origin steelhead, including remaining uncertainty regarding natural-origin spawning escapement and catch and release impacts in recreational fisheries.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations within the Clearwater River MPG.

Priority level: This is a moderate priority objective.

Approach: Conduct annual sampling of piscine predators to determine abundance of predators and stomach contents. These data are then incorporated into a bioenergetics model to derive a population-level (or MPG-level) consumption estimate imposed by exogenous fishes. Bird colonies will continue to be monitored for the presence of PIT tags originating from specific populations within the MPG to determine population-specific impacts.

Status: Investigations of predation in the migration corridor have been conducted by many agencies with funding from BPA and the USACE. Monitoring predation impacts in the mainstem Columbia and Snake River needs to continue. Funding is needed to assess the abundance and stomach contents of predators to juveniles originating from the MPG.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the Clearwater River MPG.

Priority level: This is a moderate priority objective.

Approach: An important goal of the steelhead hatchery programs within the Clearwater River MPG is to release fish into the system that are known to have a healthy disease history during rearing to minimize impacts on naturally and other hatchery-produced fish.

Status: Currently, hatchery fish and broodstock are monitored for disease. Funding is needed to monitor disease or pathogen presence and prevalence in naturally produced fish in streams.

Current Monitoring Efforts and Needs

Monitoring continues to occur within each of the Clearwater River MPG's five extant population areas, as well as in the mainstem Columbia and Snake Rivers. Current monitoring includes spawner escapement, smolt-to-adult returns, juvenile abundance, productivity, distribution, and some habitat condition monitoring.

Table 9-4 shows current monitoring within each population area, the quality and certainty associated with the data, improvements needed, and proposed new monitoring. The evaluations were drawn from work completed by the Columbia River Fish and Wildlife Authority through the Collaborative Systemwide Monitoring and Evaluation Project and direct participation of the fish co-managers. This evaluation was especially influenced by the participation of the Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes. Numerous

acronyms and abbreviations are used in Table 9-4 for the sake of brevity. These acronyms and abbreviations, and the terms they stand for, are discussed in Sections 9.1.2.1 and 9.1.4.1; they are also explained in a table footnote.

Table 9-4. Current monitoring needs and proposed monitoring for Clearwater River steelhead populations. Adapted from CBFWA (2009), http://www.cbfwa.org/ams/SnakeRiver.cfm [6].

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Clearwater River MPG -- General				
Adult abundance, Adult productivity, and other VSP criteria	• Idaho Steelhead Monitoring and Evaluation Studies (ISMES) estimates wild adult steelhead escapement and age structure passing LGR. • COE counts at LGR provide a good estimate of the total number of hatchery and wild steelhead adults for the entire DPS. • Natural-origin Snake River Basin Steelhead abundance estimated at LGR using GSI began in 2008. Age composition and sex ratios also determined. Using GSI, adults assigned to population/watershed. IDFG Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • IDFG estimates steelhead harvest in recreational fisheries using a telephone survey (only hatchery origin adipose clipped fish may be kept). • Estimates of tribal harvest (hatchery and unmarked) supported by LSRCP evaluation contract and BPA. •The Nez Perce Tribe operates four remote Biomark PIT tag arrays in the Clearwater River Basin as part of the Integrated Status Effectiveness Monitoring Project	• The ICTRT was unable to make population-specific adult abundance estimates for any population in Idaho. • Not feasible to get MPG or population scale adult abundance data using traditional methods (redd counts or weirs). • Not all GSI data collected has been synthesized at the population level. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows; therefore juvenile estimates are important as a proxy for adult productivity. • Estimates of natural-origin steelhead adult incidental mortality from sport fisheries are imprecise.	• Collect adult life history data at the population scale. • Develop alternative methods to estimate spatial distribution. • Develop surveys of hatchery spawner fraction in index streams. • Genetic baseline needs to be maintained at regular intervals. • Refine characterization of A-run and B-run populations based on population specific data. • Validate unmarked hatchery production identification by fin shape or estimates of origin by other methods. • Determine encounter rate of natural adult steelhead and the mortality rate of released adult steelhead in recreational fisheries.	• Implement a smolt sampling program at LGR to estimate the number of smolts and the age composition from each population using GSI and scale analysis. • Transition from microsatellite to SNPs technology for GSI and PBT analysis. • Analyze adult and juvenile tissue samples collected by IDFG and Tribes for inclusion in baseline genetic database using SNP's. • Implement a 5-year rotating panel to collect genetic samples to maintain and update baseline genetic database. • Estimate natural population incidental mortality from sport fisheries.

[6] Abbreviations and Acronyms used in Table 9-4. BPA -Bonneville Power Administration; CHaMP - Columbia Habitat Monitoring Program; GRTS - Generalized Random-Tessellation Stratified, GSI - Genetic Stock Identification; IDFG - Idaho Department of Fish and Game; IMW - Intensively Monitored Watershed; INPMEP - Idaho Natural Production Monitoring and Evaluation Project; ISEMP - Integrated Status and Effectiveness Program; ISMES - Idaho Steelhead Monitoring and Evaluation Studies; ISS- Idaho Supplementation Studies; IMW – intensively monitored watershed; LGR - Lower Granite Dam; LSRCP - Lower Snake River Compensation Plan; NPT - Nez Perce Tribe; MaSA - Major Spawning Area; MiSA - Minor Spawning Area; PBT - Parentage Based Tagging; PIT - Passive Integrated Transponder; PNI - Proportionate Natural Influence; PNOS - Proportion Natural-Origin Spawners; SAR – smolt-to- adult survival; SBT – Shoshone-Bannock Tribes; SNP - Single Nucleotide Polymorphisms

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	(ISEMP) to monitor juvenile and adult salmon and steelhead abundance. Arrays are located on SF Clearwater (Site Codes SC1 and SC2) and Lolo Creek (LC1 and LC2). • ISEMP conducts a mark-recapture program that PIT-tags a known, representative fraction of natural-origin adult steelhead and spring/summer Chinook salmon as they pass Lower Granite Dam that are subsequently detected in upstream tributaries at instream PIT-tag arrays. Researchers finding that the decomposition of the Lower Granite Dam runs-at-large of steelhead and spring/summer Chinook salmon into tributary, population, and MPG- specific escapement estimates is a reliable, precise, and efficient alternative to continuous operation of multiple weirs. • Tissue samples collected from all broodstock at all Snake River hatcheries for PBT (Parental Based Tagging). PBT used to identify hatchery origin adults at Lower Granite Dam and in tributaries. • IDFG providing additional status monitoring to ensure a majority of Snake River B-Run steelhead populations are being monitored for population productivity and abundance. • Snake River Basin steelhead annual run-reconstruction of hatchery and wild returns, harvest, and escapement to known and unknown population areas, starting with 2010/2011 steelhead spawning run.			

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Lower Mainstem Clearwater River Population				
Adult abundance	• Hatchery fish released at Kooskia Hatchery (Clear Creek) and Dworshak National Fish Hatchery for harvest augmentation. • Four temporary weirs (Big Bear, Little Bear, West Fork and East Fork) operated by IDFG count adult steelhead using mark recapture in the Potlatch drainage (IMW). • Potlatch River has been designated as an Intensively Monitored Watershed (IMW) by IDFG and is being treated for improved instream structure, channel diversity, and other habitat improvements. NOAA Funded PCSRF Contract $187K/yr. • One hatchery weir on Clear Creek operated by USFWS/NPT for Chinook is not efficient during high flows (operation not planned for 2009). • Natural-origin Snake River Basin Steelhead MPG and population abundance via GSI at LGR began in 2008 $150K/yr (ISMES). • ISEMP PIT tag arrays in Potlatch and Lapwai Creeks will allow escapement estimates in these streams.	• Potlatch River is intensively monitored and has good data quality starting in 2006. • Clear Creek has longer-term index data, no mark-recapture. • Accuracy of GSI to identify this population needs to be determined. • No coefficient of variation (CV) estimates.	• Ensure that redd surveys are done yearly and encompass more spawning areas to obtain a better estimate.	• Snake River Basin steelhead annual run-reconstruction of hatchery returns, harvest, and escapement to known and unknown population areas.
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at IMW weirs. • Hatchery percentage estimated at PIT tag arrays. • PIT-tags scanned at IMW weirs; however, sample size is too small for precise estimates.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from recreational fisheries are imprecise.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted in mainstem Clearwater River and MF Clearwater (to Clear Creek) only. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population.	• Estimating adult steelhead abundance cannot be done accurately using current methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• Two screw traps and two PIT tag arrays operated by IDFG in upper Potlatch River (IMW). • One screw trap in Clear Creek (USFWS/NPT) operated 2-3 months mainly for Chinook. ISS trap planned to cease operation in 2014. • PIT tagging occurs throughout Potlatch drainage using a variety of capture methods (IMW). Used for juvenile survival and SARs. • Juvenile migrant abundance estimated at all screw traps using mark recapture (IMW, ISS). • Survival of juveniles (within basin and to LGR) estimated using PIT tags (IMW) estimated from scale analysis at all screw traps (IMW, ISMES). • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP, BPA#1999107300), Potlatch done in 2008. • NPT estimating juvenile density and distribution using GRTS design in all tributaries except Potlatch and Clear Creek (BPA 200723300). Single year estimates.	• Short time frame for Potlatch trap data. • Representativeness of Potlatch to entire population. • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating? • No Trap CV estimates.	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of sampling smolts at LGD for GSI and age composition.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Spatial distribution	•In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Potlatch done in 2008 but reducing scope in future. • NPT estimating juvenile density and distribution using GRTS design in all tributaries except Potlatch and Clear Creek. Single year estimates. • Juvenile distribution estimated by NPT yearly in Lapwai and Big Canyon Creeks until 2006, and in Lawyers Creek until 2012. • IMW Project, NOAA Funded PCSRF Contract.	• Adult spawner distribution limited to Potlatch. • Inference of spawner distribution from parr is uncertain. • Extensive parr distribution data for Potlatch River drainage from IDFG electrofishing surveys (2003-2008). • Parr distribution data for all tributaries except Potlatch and Clear Creek from NPT electrofishing surveys (2003-2006; 2008-2012)	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Genetics samples from Upper and Lower Potlatch River adults being analyzed annually at IDFG Eagle Lab (IMW). • There appear to be sufficient samples being collected to provide good baseline for future ESA status review diversity. Since 2000, ISMES has collected tissue samples from populations across all the various populations in the Clearwater and Salmon basins. • In 2007, 678 genetics samples across Idaho were analyzed. • Juvenile and adult life history characteristics estimated at weirs and screw traps (i.e., scales, lengths, PIT tags, gender).	• Representativeness of index streams to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
South Fork Clearwater River Population				

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Adult abundance	• Hatchery fish released for supplementation and harvest augmentation. • Two hatchery weirs operated by IDFG count steelhead using mark recapture in Crooked and Red River. • Natural-origin Snake River Basin Steelhead MPG and population abundance via GSI at Lower Granite Dam began in 2008 $150K/yr (ISMES). • Natural and hatchery adults monitored at PIT tag array (NPT/IDFG)	• No evaluation of mark-recapture at hatchery weirs. No collection of kelts. Weirs designed for Chinook and not efficient at high flows. • Both weirs upstream and only intercept a small portion of population. • Accuracy of GSI to identify this population needs to be determined. • No CV estimates made.	• Snake River Basin steelhead annual run-reconstruction of hatchery returns, harvest, and escapement to known and unknown population areas. • Integrate wild steelhead monitoring at Red and Crooked Rivers with state-wide monitoring program.	• Snake River Basin steelhead annual run-reconstruction of hatchery returns, harvest, and escapement to known and unknown population areas.
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at weirs. • PIT-tags scanned at weirs; however, sample size is too small for precise estimates of adult productivity. • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted in mainstem SF Clearwater River only. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • NPT B-run steelhead supplementation effectiveness monitoring in SF Clearwater. • ISMES (BPA 199005500) $784K/yr • ISEMP PIT tag array installed in South Fork Clearwater mainstem.	• Need better estimates of natural cohort age and sex structure. • Population is heavily influenced by hatchery steelhead; hatchery fraction data are lacking. • Estimates of natural population incidental mortality from recreational fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using current methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Juvenile productivity	• IDFG /NPT operate 3 screw traps, in American, Crooked and Red Rivers (all scheduled to cease operation in 2014). • NPT operates 1 screw trap in Newsome Creek. • Juvenile migrant abundance estimated at screw traps using PIT Tag mark recapture (ISS 198909800). • Survival of juveniles to LGR estimated using PIT tags. • Age structure estimated from scales collected at screw traps. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP, BPA#1999107300).	• Representativeness of index streams to entire population. • Imprecision of SAR estimates at population level. • No CV estimates made.	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	•wq
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Crooked River done in 2008 and will be repeated. • NPT estimating juvenile density and distribution using GRTS design in all tributaries up to Butcher Creek (BPA 200723300). Single year estimates; concluded in 2012.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• There appear to be sufficient samples being collected to provide good baseline for future ESA status review of genetic diversity. Since 2000, Idaho Steelhead Monitoring and Evaluation Studies has collected tissue samples from populations across all the various populations in the Clearwater and Salmon basins.	• Representativeness of index streams to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• In 2007, 678 genetics samples across Idaho were analyzed. • Crooked River adult steelhead genetics collected and processed at IDFG Eagle Lab (2007-2008). • Juvenile and adult life history characteristics estimated at weirs and screw traps (i.e., scales, lengths, PIT tags, gender).			
Lolo Creek Population				
Adult abundance	• Hatchery fish released for supplementation. • No adult steelhead weirs. (Seasonal weir used only during Chinook migration.) • Natural-origin Snake River Basin Steelhead MPG and population abundance via GSI at LGR began in 2008. • Natural and hatchery adults monitored at ISEMP PIT tag arrays (NPT/IDFG) • IDFG providing increased monitoring of B-run steelhead.	• Genetic samples not included in baseline. This is a gap in the overall GSI baseline database. • Supplementation with Dworshak origin hatchery smolts will increase to 200K per year in 2010 and may confound methods to estimate natural spawners. • No CV estimates made.	• Collect genetic samples. • Investigate Genetic Parentage Analysis Techniques to Estimate Spawner Abundance in ESA-listed Steelhead Populations.	• NPT proposes constructing steelhead/Chinook weir in conjunction with increased B-run steelhead supplementation effectiveness research in Lolo Creek.
Adult productivity	• No Lolo Creek specific data. • IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • Sport fishing for adult steelhead not permitted within population boundaries. • NPT and IDFG B-run steelhead supplementation effectiveness monitoring in Lolo Creek.	• Lacking estimates of natural cohort age and sex structure. • Population is influenced by hatchery steelhead; hatchery fraction data are lacking. • Estimates of natural population incidental mortality from recreational fisheries are imprecise.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from other populations. • Need to be able to identify adults returning from supplementation smolt releases. • Supplementation effectiveness M&E is needed. • NPT hatchery monitoring and evaluation weir construction.	.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
		• Estimating adult steelhead abundance cannot be done accurately using current methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity.		
Juvenile productivity	• No Lolo Creek specific data. • NPT operates a juvenile screw trap located at rkm 21 that targets Chinook. Steelhead are not PIT-tagged.	• Estimates of smolt immigration with trap efficiency available. No CV estimates made. Area below trap not considered a spawning area for steelhead.	• Increase number of PIT tags. • PIT-tag steelhead at screw trap. • Scale collection for determining age structure and genetic profile. • Parr density monitoring is needed.	• Explore feasibility of sampling smolts at LGD for GSI and age composition. • Monitor parr density.
Spatial distribution	• No Lolo Creek specific data.			• NPT proposes supplementation effectiveness study including GRTS juvenile distribution and density sampling.
Species diversity	• No Lolo Creek specific data.		• Collect data at screw trap. • Collect samples for genetic baseline database.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Lochsa River Population				
Adult abundance	• No hatchery fish released. • IDFG operates one temporary weir on Fish Creek with mark recapture estimates that provides index for population. • Natural-origin Snake River Basin Steelhead MPG and population abundance via GSI at Lower Granite Dam began in 2008 $150K/yr (ISMES). • IDFG providing increased monitoring of B-run steelhead (Columbia Basin Fish Accords).	• Fish Creek has good data quality starting in 1992. • It is expected that GSI will accurately identify this population; however this must be verified. • No CV estimates made.	• Snake River Basin steelhead annual run-reconstruction of hatchery returns, harvest, and escapement to known and unknown population areas.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at weir. • PIT-tags scanned at weir; however, sample size is too small for precise estimates in some years. • No hatchery fish stocked into watershed. Hatchery strays are not passed upstream of weir in Fish Creek. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • Sport fishing for adult steelhead is not permitted within population boundaries.	• Need better estimates of natural cohort structure via GSI. • Population is not heavily influenced by hatchery steelhead; hatchery fraction data are lacking except for Fish Creek. • Estimates of natural population incidental mortality from recreational fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately at the population scale using current methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from other populations. • Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates.	
Juvenile productivity	• IDFG operates 2 screw traps. One in Crooked Fork and one in Colt Killed Creek. These traps will cease operation in 2014. • IDFG operates 1 screw trap in Fish Creek (ISEMP). • Age structure estimated from scale analysis. • Juvenile migrant abundance estimated at screw traps using mark recapture (ISMES). • Survival of juveniles to LGR estimated using PIT tags. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Fish	• Determine representativeness of Fish Creek SAR estimates to entire population. • Dispersed PIT tagging conducted in Lochsa tributaries 1993-2006. Fish Creek has precise estimates because sample size is large enough. • No CV estimates have been provided for this analysis.	• Increased PIT tagging in other streams or roll up SARs to larger scale. • Explore alternative method of estimating SARs.	• Explore feasibility of sampling smolts at LGD for GSI and age composition.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	Creek done in 2007 and 2008 ongoing annual sampling (ISMES). • Random snorkel surveys in Crooked Fork Creek (INPMEP). • IDFG providing increased monitoring of B-run steelhead (Columbia Basin Fish Accords).			
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Fish Creek done in 2007 and 2008 ongoing annual sampling (ISMES). • Random snorkel surveys in Crooked Fork Creek (INPMEP).	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile and adult life history characteristics estimated at weir and screw traps (i.e., scales, lengths, PIT tags, gender). • There appear to be sufficient DNA samples being collected to provide good baseline for future ESA status review of genetic diversity. Since 2000, ISMES has collected tissue samples from populations across all populations in the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Representativeness of index streams to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Selway River Population				
Adult abundance	• No steelhead weirs. • No hatchery fish released. • Natural-origin Snake River Basin Steelhead MPG and population abundance via GSI at Lower Granite Dam began in 2008.	• Data very limited. • It is expected that GSI will accurately identify this population; however this must be verified. • No CV estimates made.	• Need adult abundance and age structure data for index subpopulation.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG providing increased monitoring of B-run steelhead (Columbia Basin Fish Accords).			
Adult productivity	• IDFG Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • Sport fishing for adult steelhead is not permitted within population boundaries.	• Population is not heavily influenced by hatchery steelhead; hatchery fraction data are lacking. • Estimates of natural population incidental mortality from recreational fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately at the population scale using current methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity.	• Need adult abundance and age structure data for index subpopulation. • Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from other populations.	
Juvenile productivity	• NPT operates screw trap in Meadow Creek. Steelhead not PIT-tagged. • In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Upper Selway done in 2008 other portions are planned for sampling as well. • IDFG providing increased monitoring of B-run steelhead (Columbia Basin Fish Accords).	• Imprecision of SARs at population level. • Dispersed PIT tagging conducted in 1995-2006. • No CV estimates made.	• Increased PIT tagging or roll up SARs to larger scale. • PIT-tag juvenile steelhead at Meadow Creek screw trap. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of sampling smolts at LGD for GSI and age composition.
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids upper Selway done in 2008.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Species diversity	• Limited life history data. • There appear to be sufficient DNA samples being collected to provide good baseline for future ESA status review of genetic diversity. Since 2000, Idaho Steelhead Monitoring and Evaluation Studies has collected tissue samples from populations across all the various populations in the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed. • DNA collected in upper Selway in 2008.	• Representativeness of index streams to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.

9.1.4.2 Monitoring in Salmon River Steelhead MPG

Monitoring occurs within the Salmon River steelhead MPG's 12 populations (Little Salmon, South Fork Salmon, Secesh, Chamberlain, Lower Middle Fork Salmon, Upper Middle Fork Salmon, Panther, North Fork Salmon, Lemhi, Pahsimeroi, East Fork Salmon, and Upper Mainstem Salmon). Ongoing efforts in the populations will be revised and/or expanded as needed to provide adequate monitoring for assessing whether desired recovery goals are being achieved.

Monitoring Objectives and Approach

This section summarizes the monitoring objectives and approaches for RM&E in the Salmon River steelhead MPG. The approaches and metrics for each objective are discussed in more detail in Section 9.1.2.1. Table 9-5 identifies current monitoring activities and needs within each Salmon River steelhead population.

Objective 1: Determine the status and trend of each natural population in terms or abundance and intrinsic productivity.

Priority level: This is a highest priority objective.

Approach: IDFG will continue to estimate wild- and hatchery-origin steelhead escapement and age structure from adult sampling at Lower Granite Dam. Population-specific abundance estimates are now possible for some populations based on data from PIT tag arrays (recently installed in the South Fork Salmon, Secesh, East Fork Salmon, and Lemhi Rivers; and Big Creek and Valley Creek). Weirs in the Little Salmon (Rapid River), Pahsimeroi, East Fork Salmon, and Upper Mainstem Salmon steelhead populations will also aid in population-specific abundance and productivity estimates. Stock assessments will be conducted through weir surveys to provide information on size, gender, origin, age, and marks and tags.

Status: IDFG, the Nez Perce Tribe and Shoshone-Bannock Tribes conduct most of the monitoring for spawner abundance within each population with funding from Idaho, LSRCP, and BPA.

Objective 2: Determine the status of the spatial structure of each population in this MPG based on current and historically used habitat.

Priority level: This is a highest priority objective.

Approach: For all steelhead populations within this MPG, spatial distribution of naturally produced steelhead will be estimated based on presence of juvenile fish. The spatial extent and distribution of natural-origin juvenile steelhead will be based on a GRTS survey design and snorkeling or electrofishing techniques. In addition, screw traps in nine populations in this MPG (Lower Middle Fork Salmon, Upper Middle Fork Salmon, South Fork Salmon, Little Salmon, Lemhi, Pahsimeroi, East Fork Salmon, Upper Mainstem Salmon, and Secesh populations) will be used to estimate juvenile abundance. Adult detection at PIT tag arrays and weirs will help determine the spatial distribution of steelhead in some populations.

Status: IDFG, the Nez Perce Tribe and Shoshone-Bannock Tribes conduct most of the monitoring for spatial spawning distribution within each population with funding from Idaho, LSRCP, and BPA. Additional funding will be needed to complete juvenile steelhead GRTS surveys within each population.

Objective 3: Determine the current status and change in future status of life history, genotypic, and phenotypic diversity for each population within the Salmon River MPG.

Priority level: This is a highest priority objective.

Approach: Steelhead production may be influenced by releases of hatchery fish in several of the populations within this MPG. Releases of hatchery-origin steelhead occur in the Pahsimeroi, East Fork Salmon, and Upper Mainstem Salmon population areas. Steelhead from other populations in this MPG are also exposed to hatchery fish in the mainstem Salmon River. The artificial propagation of fish includes genetic risks that may compromise the goal of supplementation and reduce the likelihood of recovery. Evaluation of life history, genotypic, and phenotypic characteristics will be accomplished by sampling live fish at weirs and Lower Granite Dam. Weirs located within the Little Salmon (Rapid River), Pahsimeroi, East Fork Salmon, and Upper Mainstem Salmon populations will be used to sample fish for origin (based on scales and marks/tags) and migration timing by origin. PIT tag arrays will record migration timing.

Status: IDFG, the Nez Perce Tribe and Shoshone-Bannock Tribes conduct most of the monitoring for this objective with funding from Idaho, LSRCP, and BPA.

Objective 4: Determine the status and trend in conditions of current and historically used habitat within each population in the Salmon MPG.

Priority level: This is a high priority objective.

Approach: Habitat status will be measured and evaluated using the CHaMP habitat sampling protocol (CHaMP 2014). Habitat variables to be measured include riparian cover, sinuosity, valley form, gradient, solar input, bankfull distance and height, geomorphic channel unit type, thalweg profile, channel depth, wetted width, substrate composition, undercut banks, woody debris, fish cover, pool tail fines, subsurface fines, conductivity, alkalinity, and macroinvertebrates.

Status: The USFS conducts habitat monitoring in certain watersheds. ISEMP is conducting an Intensively Managed Watershed (IMW) program in the Lemhi. Habitat monitoring will continue in the South Fork Salmon River and Lemhi River under the CHaMP program.

Objective 5: Determine the effects of habitat degradation and habitat restoration actions on the abundance, productivity, and spatial structure of the natural populations within the Salmon River MPG.

Priority level: This is a high priority objective.

Approach: The Plan identifies restoration actions such as habitat restoration and protection, flow augmentation, and passage restoration that should increase natural productivity, abundance, and spatial structure of natural-origin steelhead. RM&E efforts will support these investments. Habitat status and trend monitoring was described under Objective 4. The effects of habitat restoration actions on population VSP parameters will be monitored at the population or watershed scales. Some individual restoration actions will also be monitored for effectiveness at improving habitat conditions at the reach scale. Parties implementing restoration projects will also conduct compliance monitoring.

Status: The IDFG conducts an Intensively Monitored Watershed project on the Lemhi River to measure impacts of tributary habitat restoration on steelhead and Chinook salmon.

Objective 6: Determine the influence of the current hatchery programs on the abundance, productivity, spatial structure, and diversity of the natural populations within the Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Several large hatchery programs within the Salmon River MPG currently release approximately 4 million steelhead annually. In many of the areas where B-run steelhead are released, they are not native. The MPG was historically a mix of A- and B-run populations. Approximately 1 million of the hatchery fish currently released into the basin are B-run, and these are released only into naturally A-run populations. These B-run releases were originally from an out-of-MPG source, the Dworshak National Fish Hatchery, but have now been transitioned to a locally-adapted broodstock. Many fish are also released in mainstem areas and not acclimated, further increasing the likelihood of straying into areas where they can spawn with natural-origin fish (both A- and B-run). Hatchery fish that stray into non-target tributaries and spawn naturally may represent a serious threat to steelhead recovery. Information needed to address the metrics given above will be available from the monitoring approach described previously for objectives 1, 2, and 3.

Status: Progress in implementing the critical elements of the hatchery effects monitoring is basically the same discussion as presented earlier for monitoring objectives 1, 2, and 3.

Objective 7: Determine the effect of mainstem hydropower operations and operational improvements on viability of populations within the Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Survival of migrating salmon is usually estimated with tags (PIT tags, radio tags, or acoustic tags). Steelhead smolts can be PIT tagged as they leave populations within the MPG and then monitored for detections at FCRPS facilities along the migration corridor at both juvenile and adult life stages using DART and PTAGIS databases. Detection probabilities of juvenile salmonids migrating downstream at FCRPS facilities are modeled using the SURPH analytical tool. Adult detection (assumed 100%) is currently available at ladders on several dams. TDG and temperature should be measured hourly with calibrated electronic instruments at each FCRPS facility during fish passage.

Status: Additional funding is needed to PIT tag emigrating smolts from each population. Power analysis can be used to determine the number of fish to be tagged within each population.

Objective 8: Determine the effect of harvest on the abundance, productivity, and diversity of the natural populations within the Salmon River MPG.

Priority level: This is a high priority objective.

Approach: Fishery-related mortality is reported for tribal and non-tribal ocean and Columbia River fisheries by the TAC of the Columbia River Compact. Harvest of natural-origin fish is estimated based on exploitation rates of hatchery-origin fish. Within the MPG, harvest rates are assessed using catch record cards and creel surveys.

Status: Monitoring of out-of-MPG fisheries is currently funded. The Nez Perce Tribe and Shoshone-Bannock Tribes monitor tribal harvest and IDFG monitors non-tribal harvest within the MPG. It is important to maintain funding for harvest monitoring. More and improved data are needed to monitor and manage population-specific impacts on natural-origin steelhead, including remaining uncertainty regarding natural-origin spawning escapement and catch and release impacts in recreational fisheries.

Objective 9: Determine the effect of predation on the abundance and productivity of the natural populations within the Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: Conduct annual sampling of piscine predators to determine abundance of predators and stomach contents. These data are then incorporated into a bioenergetics model to derive a population-level (or MPG-level) consumption estimate imposed by exogenous fishes. Bird colonies will continue to be monitored for the presence of PIT tags originating from specific populations within the MPG to determine population-specific impacts.

Status: Investigations of predation in the migration corridor have been conducted by many agencies with funding from BPA and the USACE. Monitoring predation impacts in the mainstem Columbia and Snake Rivers needs to continue. Funding is needed to assess the abundance and stomach contents of predators of juveniles originating from the MPG.

Objective 10: Determine the transmission and effect of disease on the abundance, productivity, and diversity of the natural populations within the Salmon River MPG.

Priority level: This is a moderate priority objective.

Approach: An important goal of the steelhead hatchery programs within the Salmon River MPG is to release fish into the system that are known to have a healthy disease history during rearing to minimize impacts on naturally and other hatchery-produced fish.

Status: Currently, hatchery fish and broodstock are monitored for disease. Funding is needed to monitor disease or pathogen presence and prevalence in naturally produced fish in streams.

Current Monitoring Efforts and Needs

Monitoring occurs within each of the Salmon River MPG's 12 population areas, as well as in the mainstem Salmon, Snake and Columbia Rivers. Current monitoring includes spawner escapement, smolt-to-adult returns, juvenile abundance, productivity, distribution, and some habitat condition monitoring.

Table 9-5 shows current monitoring within each population area, the quality and certainty associated with the data, improvements needed, and proposed new monitoring. The table reflects work completed by the Columbia River Fish and Wildlife Authority through the Collaborative Systemwide Monitoring and Evaluation Project and through direct participation of the fish co-managers. This evaluation was especially influenced by the participation of the Idaho Department of Fish and Game, Nez Perce Tribe, and the Shoshone-Bannock Tribes. Numerous acronyms and abbreviations are used in Table 9-5 for the sake of brevity. These acronyms and abbreviations, and the terms they stand for, are discussed in Sections 9.1.2.1 and 9.1.4.2; they are also explained in a table footnote.

Table 9-5. Current monitoring, needs and proposed monitoring for Salmon River steelhead populations. Adapted from CBFWA (2009), http://www.cbfwa.org/ams/SnakeRiver.cfm [7].

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Salmon River MPG -- General				
Adult abundance, Adult productivity, and other VSP criteria	• COE counts at Lower Granite Dam provide a good estimate of the total number of hatchery and wild steelhead adults for the entire DPS. Up until recently, little data existed to assess adult abundance at the MPG or population level. • IDFG estimates wild adult steelhead escapement and age structure passing Lower Granite Dam. • PIT tag arrays in Big Creek, Valley Creek, Lemhi River, South Fork Salmon, and Secesh now provide some population- or watershed-level abundance estimates. • Natural-origin Snake River Basin steelhead abundance estimated at LGR using Genetic Stock Identification (GSI) began in 2008 $150K/yr (ISMES). Age composition and sex ratios also determined. Using GSI, adults assigned to population/watershed, allowing population abundance estimates. • IDFG estimates adult steelhead harvest in recreational fisheries using a telephone survey (only hatchery origin adipose clipped fish may be kept). • Estimates of tribal harvest (hatchery and unmarked) supported by LSRCP evaluation contract and BPA.	• The ICTRT was unable to make adult abundance estimates for any population. • Unlikely to get MPG or population level adult abundance data using traditional methods (redd counts or weirs). • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows; juvenile estimates are important as a proxy for adult productivity. • Estimates of natural population incidental mortality from sport fisheries are imprecise.	• Collect adult life history data at the population scale. • Develop alternative methods to estimate spatial distribution. • Develop surveys of hatchery spawner fraction in index streams. • Genetic baseline needs to be maintained at regular intervals. • Refine characterization of A-run and B-run populations based on population specific data. • Validate unmarked hatchery production identification by fin shape or estimates of origin by other methods. • Determine the encounter rate of natural adult steelhead and the mortality rate of released adult steelhead in recreational fisheries.	• Shoshone-Bannock Tribes (SBT) propose to build Crystal Springs Fish Hatchery for Chinook salmon and steelhead supplementation projects in the upper Salmon River (funded through Columbia Basin Fish Accords). SBT proposing steelhead supplementation in Yankee Fork, East Fork, Panther Creek, and Indian Creek. Effectiveness M&E would be necessary to assess the program. • Implement a smolt sampling program at LGR to estimate the number of smolts and the age composition from each population using GSI and scale analysis. • Transition from microsatellite to SNP's technology for GSI and PBT analysis.

[7] Abbreviations and Acronyms used in Table 9-5. BPA -Bonneville Power Administration; CHaMP - Columbia Habitat Monitoring Program; GRTS - Generalized Random-Tessellation Stratified, GSI - Genetic Stock Identification; IDFG - Idaho Department of Fish and Game; IMW - Intensively Monitored Watershed; INPMEP - Idaho Natural Production Monitoring and Evaluation Project; ISEMP - Integrated Status and Effectiveness Program; ISMES - Idaho Steelhead Monitoring and Evaluation Studies; ISS- Idaho Supplementation Studies; IMW – intensively monitored watershed; LGR - Lower Granite Dam; LSRCP - Lower Snake River Compensation Plan; NPT - Nez Perce Tribe; MaSA - Major Spawning Area; MiSA - Minor Spawning Area; PBT - Parentage Based Tagging; PIT - Passive Integrated Transponder; PNI - Proportionate Natural Influence; PNOS - Proportion Natural-Origin Spawners; SAR – smolt-to- adult survival; SBT – Shoshone-Bannock Tribes; SNP - Single Nucleotide Polymorphisms

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• SBT utilizes genetic parentage analysis for all their supplementation activities. • Genotyping of all hatchery spawners in Snake River for Parental Based Tagging (PBT) techniques. Hatchery origin adults identified at LGD. • IDFG providing additional status monitoring to ensure a majority of Snake River B-Run steelhead populations are being monitored for population productivity and abundance. • Tributary habitat in the South Fork Salmon River and Lemhi watersheds intensively monitoring as part of BPA's CHaMP program. • Snake River Basin steelhead annual run-reconstruction of hatchery and wild returns, harvest, and escapement to known and unknown population areas, starting with 2010/2011 steelhead spawning run. • ISEMP conducts a mark-recapture program that PIT-tags a known, representative fraction of natural-origin adult steelhead and spring/summer Chinook salmon as they pass Lower Granite Dam that are subsequently detected in upstream tributaries at instream PIT-tag arrays. Researchers finding that the decomposition of the Lower Granite Dam runs-at-large of steelhead and spring/summer Chinook salmon into tributary, population, and MPG- specific escapement estimates is a reliable, precise, and efficient alternative to continuous operation of multiple weirs.			• Analyze adult and juvenile tissue samples collected by IDFG and Tribes for inclusion in baseline genetic database using SNPs. • Implement a 5-year rotating panel to collect genetic samples to maintain and update baseline genetic database. • Estimate incidental mortality associated with catch and release fisheries (including selective harvest). Specific attention to multiple encounter mortality rate.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Lower Middle Fork Salmon River Population				
Adult abundance	• No weirs. • No hatchery fish stocked. • Natural-origin Snake River Basin steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008 $150K/yr (ISMES). Age and length composition and sex ratios also determined. • PIT tag array in Big Creek at Taylor Ranch.	• Accuracy of GSI to identify this population needs to be determined. • CV not known or not calculated?		
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon Rivers. • ISMES (BPA 199005500). Intensive steelhead monitoring in Big Creek under ISMES. Abundance and life history data collected in Big Creek. • No sport fishing for adult steelhead permitted within the boundaries of this population. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300). • Some adults sampled by angling in Big Creek. • One screw trap operated by IDFG on lower Big Creek. • Juvenile abundance estimated at screw trap using mark recapture. • Survival of juveniles to LGR estimated using PIT tags.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows; juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking. • Current adult sampling not quantitative. • PHOS not estimated.	• Develop surveys of hatchery spawner fraction in index streams (Big Creek). • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale. • Collect enough adults to get quantitative information. • SBT and NPT will need to document harvest impacts in future tribal fisheries if implemented. • Modify PIT antenna array in lower Big Creek for year-round dependability. • Increase PIT tagging or roll up SARs to larger scale.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Age structure estimated from scale analysis. • PIT antenna array at Taylor Ranch.	• Short time frame for screw trap data (starting 2007) CV not known or not calculated? • PIT antenna array in Big Creek operated entire –year (attempted). • Dispersed PIT tagging 2000-06. • Determine representativeness of Big Creek to entire population. • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• Explore alternative methods of estimating SARs.	
Juvenile productivity	• One screw trap operated by IDFG on lower Big Creek. • Juvenile abundance estimated at screw trap using mark recapture (ISMES). • Survival of juveniles to LGR estimated using PIT tags (ISMES). • Age structure estimated from scale analysis (ISMES). • PIT antenna array at Taylor Ranch	• Short time frame for screw trap data (starting 2007) CV not known or not calculated? • PIT antenna array in Big Creek operated entire –year (attempted • Dispersed PIT tagging 2000-06. • Representativeness of Big Creek to entire population? • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What	• Modify PIT antenna array in lower Big Creek for year-round dependability. • Increased PIT tagging or roll up SARs to larger scale. • Explore alternative methods of estimating SARs.	• Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR. • SBT proposes screw trap for Chinook and steelhead in Camas and Loon Creeks.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
		proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?		
Spatial distribution	• INPMEP (BPA 199107300)	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile life history characteristics estimated at screw trap (i.e., scales, lengths, PIT tags, gender). • No adult life history data except from limited hook-and-line sampling in Big Creek. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007 678 DNA samples were analyzed.	• Limited adult life history data collected in lower MFSR in early 1990s (scales, lengths, gender). • Representativeness of Big Creek to entire population.	• Collect adult life history data. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Upper Middle Fork Salmon River Population				
Adult abundance	• No weirs. • No hatchery fish released. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined.	• Accuracy of GSI to identify upper from lower MF Salmon population not yet determined. • CV not known or not calculated?		
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon Rivers. • ISMES (BPA 199005500) $784K/yr. • No sport fishing for adult steelhead permitted within the boundaries of this population.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300) $785K/yr.	methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking.	extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• One screw trap operated by IDFG at Marsh Creek. Slated to end after 2014. (ISS 198909800) • Juvenile abundance estimated at screw trap using mark recapture. • Survival of juveniles to LGR estimated using PIT tags. • Age structure estimated from scale analysis.	• Dispersed PIT tagging 1999-2004. • Representativeness of Marsh Creek to entire population. • Imprecision of SARs at population level CV not known or not calculated? • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR. • SBT propose screw trap for Chinook and steelhead in Bear Valley Creek.
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids. Marsh Creek & Rapid River (MFSR trib) done in 2007 & 2008. Ended in 2008.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile life history characteristics estimated at screw trap (i.e., scales, lengths, PIT tags, gender). • No adult life history data. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Representativeness of Marsh Creek to entire population.	• Collect adult life history data. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to	• Implement a 5-year rotating panel to collect baseline genetic samples.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
			extrapolate from index samples to an appropriate population scale.	
South Fork Salmon River Population				
Adult abundance	• No weirs operated for steelhead; IDFG McCall hatchery operates weir for summer Chinook (not designed or planned to trap steelhead). • No hatchery fish released. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • Expected genetics resolution is for South Fork and Secesh as a unit. • NPT and IDFG ISEMP watershed. South Fork is an intensively managed watershed. Adults estimated using PIT tag array. Habitat monitored under CHaMP. • IDFG increasing B Run monitoring in Clearwater and Salmon river drainages.	• CV not known or not calculated?	• Upgrade SFSR hatchery weir to enable trapping during steelhead spawning; collect age structure information, sex ratios, and hatchery percentage? However, the weir is located in headwaters; most spawning is downstream. Weir would intercept only a small portion of this population. May not be feasible to upgrade this weir to operate during steelhead spawning.	
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon Rivers. • No sport fishing for adult steelhead permitted within the boundaries of this population. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300) $785K/yr.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows;	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG increasing B Run monitoring in Clearwater and Salmon river drainages.	juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking.		
Juvenile productivity	• One screw trap operated by NPT on Johnson Creek. • One screw trap operated by IDFG on upper SF Salmon. Plan to end trapping in 2014. • Juvenile abundance estimated at screw trap using mark recapture. • Survival of juveniles to LGR estimated using PIT tags. • Age structure estimated from scale analysis.	• Representativeness of sampled streams to entire population. • Imprecision of SARs at population level CV not known or not calculated? • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Johnson Creek ave. CV is not known.	• Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR.
Spatial distribution	• In 2009 NPT/IDFG implemented a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids.	• Some redd counts were done in the early 1990s. • No good or ongoing data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile life history characteristics estimated at screw trap (i.e., scales, lengths, PIT tags, gender). • No adult life history data. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Representativeness of index streams to entire population.	• Collect adult life history data. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Little Salmon River Population				
Adult abundance	• One IDFG hatchery weir on Rapid River. • No hatchery fish released in Rapid River. • About 900,000 hatchery smolts (all adipose clipped beginning in 2010) released annually in Little Salmon River for harvest augmentation. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • Expected genetics resolution is for population.	• Weir efficiency is 100% (velocity barrier). • Rapid River weir has adult count data since 1968.		
Adult productivity	• Age structure, sex ratios, and hatchery percentage estimated at Rapid River weir. • PIT-tags scanned at weir. • IDFG Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon Rivers. • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries permitted only in the mainstem Salmon River and Little Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300) $785K/yr. • ISMES: Intensive, high-precision (fish in, fish out) monitoring of steelhead in Rapid River	• Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population heavily influenced by hatchery steelhead; hatchery fraction data are lacking. • Harvest monitoring occurring using creel surveys. IDFG estimates sport harvest with telephone survey.	• Develop surveys of hatchery spawner fraction in index streams below weir. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale. • Assess impacts of hatchery origin adult spawners.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Juvenile productivity	• One screw trap in Rapid River. • Juvenile abundance estimated at screw trap using mark recapture. • Survival of juveniles to LGR estimated using PIT tags. • Age structure estimated from scale analysis.	• Short time frame for screw trap data (since 2006). • Screw trap location below Rapid River Hatchery (trap down time during Chinook smolt releases.) • Dispersed PIT tagging 1999-2006 (Hard, Hazard, Whitebird, Slate, and Little Salmon.) • CV not known or not calculated? • Representativeness of Rapid River to entire population? • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases relative to monitoring natural steelhead.	Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR.
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing juvenile abundance. Boulder Creek and Rapid River done in 2007 & 2008. Intend to continue into future.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile and adult life history characteristics estimated at Rapid River weir and screw trap (i.e., scales, lengths, PIT tags, gender). • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Representativeness of Rapid River to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Chamberlain Creek Population				
Adult abundance	• No weirs. • No hatchery fish released but hatchery smolts and adults use mainstem Salmon River as migration corridor. • Natural-origin Snake River Chinook abundance estimated at LGR by IDFG using GSI beginning 2008. Age composition and sex ratios also determined.	• Some weir counts in WF Chamberlain Creek in 1990s. • Accuracy of GSI to identify this population not yet determined. • CV not known or not calculated?		
Adult productivity	• IDFG Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon Rivers. • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries permitted only in the mainstem Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300) $785K/yr.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population heavily influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• No screw traps.	• Dispersed PIT tagging 1999-2004 (Bargamin, Wind, Chamberlain, WF Chamberlain). • Imprecision of SARs at population level.	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Spatial distribution	• Limited snorkel surveys for juvenile abundance.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• No juvenile or adult life history data. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Limited data except for genetic sampling of juveniles. • Representativeness of data from other populations to this population.	• Collect juvenile and adult life history data. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel for baseline genetic samples.
Panther Creek Population				
Adult abundance	• No weirs. • No hatchery fish released but hatchery smolts and adults use mainstem Salmon River as migration corridor. • SBT operate a steelhead streamside incubator project in Panther Creek. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification (GSI) at Lower Granite Dam began in 2008 $150K/yr (ISMES). Age and length composition and sex ratios also determined.	• Accuracy of GSI to identify this population not yet determined. • CV not known or not calculated?		• SBT proposing to install adult trap in Panther Creek for Chinook salmon. Trap may be used to capture adult steelhead.
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • ISMES (BPA 199005500) $784K/yr.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates.	• SBT proposing to install adult weir and trap.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted only in the mainstem Salmon River. • Annual parr density fixed site monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP	• Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• No screw traps. • SBT operate a steelhead streamside incubator project in Panther Creek.	• Dispersed PIT tagging 1999-2004 (Panther & Horse). • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases relative to monitoring natural steelhead. • Supplementation effectiveness M&E (effectiveness M&E will increase when SBT weir and screw trap begin operation).	• Explore feasibility of sampling smolts at LGR using GSI and (with age analysis) for productivity and SAR. • SBT propose to install a screw trap in Panther Creek and collect juvenile abundance information.
Spatial distribution	• IDFG used watershed level probabilistic GRTS design for estimating the abundance of juvenile salmonids in Panther Creek for one year (2009 or 2010?).	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• No juvenile or adult life history data. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed. • SBT collects genotypes of all parents used for their supplementation program.	• Representativeness of data from other populations to this population.	• Collect juvenile and adult life history data, or use other populations. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT will collect juvenile diversity data from fish captured in

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
			extrapolate from index samples to an appropriate population scale.	proposed Panther Creek screw trap.
North Fork Salmon River Population				
Adult abundance	• No weirs. • No hatchery fish released but hatchery smolts and adults use mainstem Salmon River as migration corridor. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined.	• Accuracy of GSI to identify this population not yet determined. • CV not known or not calculated?		
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • ISMES (BPA 199005500) $784K/yr. • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundary is permitted only in the mainstem Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• IDFG will install Picket weirs in Hughes & Indian Creeks to collect hatchery %, sex size, and genetics.
Juvenile productivity	• No screw traps.	• Very limited data available. • Imprecision of SARs at population level. • CV not known or not calculated?	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of using GSI and age comp. for smolts at LGR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
			• Address hatchery steelhead releases relative to monitoring natural steelhead.	• SBT propose to operate a screw trap in NF Salmon River and will estimate steelhead abundance.
Spatial distribution	• In 2009 or 2010 IDFG used a probabilistic GRTS design for estimating the abundance of juvenile salmonids.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• No juvenile or adult life history data. • No juvenile or adult genetic data.	• Representativeness of data from other populations to this population?	• Collect juvenile and adult life history data, or use other populations. • Genetic baseline needs to be obtained for inclusion in baseline database. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples. • SBT will collect life history data at NF Salmon River screw trap.
Lemhi River Population				
Adult abundance	• No weirs. • No hatchery fish released in the Lemhi River but hatchery smolts are released in the mainstem Salmon River for harvest augmentation within the boundaries of this population. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • Lemhi River is an Intensively Managed Watershed (IMW) through ISEMP. PIT tag arrays installed in Hayden, Big Timber, and Kenney Creeks, and Lemhi	• Limited weir counts in upper Lemhi River in 1960s and 1970s (associated with Bjornn's studies). • Accuracy of GSI to identify this population not yet determined. • Data should improve with implementation of IMW and ISEMP Pit tags.		

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	River. Habitat monitored under BPA's CHaMP program. Adults PIT tagged.			
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • ISMES (BPA 199005500) $784K/yr. • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted only in the mainstem Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP • Picket weir run in 2007 and 2008 in Carmen Cr for hatchery % and abundance. • IDFG picket weirs in Fourth of July & Tower Creeks to collect hatchery percent, abundance, and genetics as part of BLM grant in 2009.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop surveys of hatchery spawner fraction in index streams. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• One screw trap operated on Upper Lemhi by IDFG since 1992 ISS (planned to cease operating in 2014). • Two screw traps operated on Lower Lemhi and Hayden Creek by IDFG for IMW. • Juvenile abundance estimated at screw traps using mark recapture (IMW/ ISEMP/ISMES). • Survival of juveniles to LGR estimated using PIT tags (IMW/ ISEMP/ISMES). • Age structure estimated from scale analysis.	• Representativeness of sampled streams to entire population. • Imprecision of SARs at population level. • CV not known or not calculated? • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and	• Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases relative to monitoring natural steelhead.	• Explore feasibility of using GSI and age comp. for smolts at LGR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Juvenile sampling using electrofishing and snorkeling for IMW throughout the drainage. PIT tag arrays installed in Lemhi River drainage as part of IMW.	tagged at screw traps are smolts and/or actively migrating?		
Spatial distribution	• In 2007, IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP).	• Some redd counts in past. • No good or ongoing data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile life history characteristics estimated at screw traps (i.e., scales, lengths, PIT tags, gender). • No adult life history data. • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.		• Collect adult life history data. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Pahsimeroi River Population				
Adult abundance	• One weir at IDFG Pahsimeroi Hatchery; collects adult spawner abundance, sex ratio, lengths. • Hatchery fish released at Pahsimeroi Hatchery and in mainstem Salmon River for harvest augmentation within the boundaries of this population. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • SBT conduct tribal harvest monitoring.	• Weir is believed to be 100% but needs to be evaluated. • Kelts not collected to estimate weir efficiency. • Accuracy of GSI to identify this population not yet determined. • Cow Creek Ave. CV = 10.8 with a range of 3.9 to 20.5.	• Integrate wild steelhead monitoring at Pahsimeroi hatchery weir more thoroughly with state-wide monitoring program.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at weir. • PIT-tags scanned at weir. • IDFG Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • ISMES • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted only in the mainstem Salmon River. • INPMEP • Picket weirs were run for last 2-3 yrs on Iron and Cow creeks for hatchery % and genetics from BLM grant.	• Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance below weir cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population downstream of the weir influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop surveys of hatchery spawner fraction in index streams below weir. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• One screw trap operated by IDFG in the Pahsimeroi River at the hatchery. Trap will cease operation in 2014. • Juvenile abundance estimated at screw trap using mark recapture (ISMES). • Survival of juveniles to LGR estimated using PIT tags (ISMES). • Age structure estimated from scale analysis (ISMES).	• Representativeness of sampled streams to entire population? • Imprecision of SARs at population level. • Determining “what is a smolt” is very important. Rates of residency may be high here. What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating? • CV not known or not calculated?	• Increase PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases relative to monitoring natural steelhead.	• Explore feasibility of using GSI and age comp. for smolts at LGR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP). Pahsimeroi done in 2008; one time survey.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile and adult life history characteristics estimated at weir and screw trap (i.e., scales, lengths, PIT tags, gender). • Since 2000 ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins. • In 2007, 678 DNA samples were analyzed.	• Good data for the Pahsimeroi River.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
East Fork Salmon River Population				
Adult abundance	• One hatchery weir in EF Salmon River (IDFG Sawtooth satellite facility). • Hatchery fish released in EF Salmon River for supplementation and harvest augmentation. Hatchery fish released in mainstem Salmon River for harvest augmentation within the boundaries of this population. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined.	• Weir located about 27km upstream of the mouth of the EF Salmon River. There is a lot of spawning and rearing habitat downstream. • Weir efficiency thought to be 100% but kelts are not collected to estimate weir efficiency. • Accuracy of GSI to identify this population not yet determined. • CV not known or not calculated?	• HSRG recommends relocating weir near the mouth of EF Salmon River. • DIDSON or a PIT tag array located near mouth could provide abundance data for EF Salmon River. • Integrate wild steelhead monitoring at East Fork hatchery weir more thoroughly with state-wide monitoring program.	• IDFG proposed to build a weir near mouth of EF Salmon River to trap adult steelhead and Chinook salmon, to replace upstream weir.
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at weir. • PIT-tags scanned at weir. • IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River.	• EF Salmon River weir does not intercept the entire population; hence it should be viewed as an index. • Need better estimates of natural cohort age and sex structure.	• Develop surveys of hatchery spawner fraction in index streams below weir. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• ISMES • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted only in the mainstem Salmon River. • SBT monitors tribal harvest in the watershed. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP • Picket weirs run in 2005-06 in Challis and Morgan Creeks for abundance, hatchery proportion and genetics.	• Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows; juvenile estimates are important as a proxy for adult productivity. • Population influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale. • The SBT harvest steelhead in East Fork; however improvement to accuracy and precision of harvest information should be attained to determine harvest of three groups of steelhead present in East Fork (Dworshak stock, East Fork naturals, and East Fork supplementation).	
Juvenile productivity	• One screw trap operated by SBT on lower EF Salmon River targeting Chinook. No steelhead are PIT-tagged. Plan to cease operation in 2014. • Snorkel data since 1982 in upper EF and Herd Creek.	• Currently no estimates of juvenile abundance made due to the low number of juveniles trapped. • Imprecision of SARs at population level. • CV not known or not calculated?	• Collect steelhead data at EFSR screw trap. Relocate trap further downstream from its present location. • Increase PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases relative to monitoring natural steelhead.	• Explore feasibility of using GSI and age comp. for smolts at LGR.
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP). • Some juvenile distribution data available from SBT snorkel surveys.	• No data on adult spawner distribution. • Inference of spawner distribution from parr is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
Species diversity	• Adult life history characteristics collected at the weir (i.e., scales, lengths, PIT tags, gender). • No juvenile life history data collected at screw trap.	• Representativeness of data from other populations to this population.	• Collect juvenile life history data at SBT screw trap, or use other populations. • Additional samples need to be collected from juveniles and adults to include in genetic baseline database. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Upper Mainstem Salmon River Population				
Adult abundance	• One weir in Salmon River at IDFG Sawtooth Hatchery and one in Squaw Creek. • Hatchery fish released for harvest augmentation (at Sawtooth Hatchery and in Salmon River) and supplementation (Yankee Fork, Slate and Valley Creeks). • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • SBT also release supplementation eggs in Yankee Fork and collect juvenile abundance information.	• Sawtooth Hatchery weir designed for Chinook and is not operated during high flow (usually mid-May to late-June). • Squaw Creek weir inefficient. • Kelts are not collected to estimate weir efficiency. • Accuracy of GSI to identify this population not yet determined.	• Integrate wild steelhead monitoring at Sawtooth Hatchery weir more thoroughly with state-wide monitoring program. Current capital design does not allow. • Need supplementation effectiveness M&E for SBT program.	• SBT plan to build a steelhead and Chinook salmon hatchery satellite facility on Yankee Fork to trap, hold, and spawn adults.
Adult productivity	• Age structure information, sex ratios, hatchery percentage estimated at both weirs. • PIT-tags scanned at Sawtooth Hatchery weir.	• Estimates of natural population incidental mortality from sport fisheries are imprecise. • Tribal harvest estimate is limited by funding.	• Develop surveys of hatchery spawner fraction in index streams below weir. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • SBT monitor tribal harvest in the Upper Salmon and tributaries. • ISMES • IDFG phone survey estimates sport harvest in recreational fisheries. • Sport fishing for adult steelhead within population boundaries is permitted only in the mainstem Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP	• Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population heavily influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• One screw trap operated by IDFG in Salmon River at Sawtooth Hatchery. Scheduled to cease operating in 2014. • One screw trap operated by SBT on West Fork Yankee Fork. Only Chinook are PIT-tagged (also planned to cease operating in 2014). • SBT operating screw trap on Yankee Fork, starting 2009. • SBT completed stratified, random 3 pass removal electrofishing surveys in Yankee Fork watershed for steelhead parr 2006-2009. Intensive snorkel surveys done since 1982. • Juvenile abundance estimated at screw trap using mark recapture. • Juvenile survival to LGR estimated using PIT tags.	• Representativeness of sampled streams to entire population? • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating? • Imprecise juvenile abundance estimates from screw trap data due to low number of steelhead trapped and recaptured.	• PIT tag steelhead at West Fork Yankee Fork screw trap. • Modify PIT antenna array in Valley Cr for yr-round dependability. • Increased PIT tagging or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision. • Address hatchery steelhead releases impacts relative to monitoring natural steelhead.	• Explore feasibility of using GSI and age comp. for smolts at LGR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• Age structure estimated from scale analysis. • PIT antenna array operated by NMFS in Valley Cr.			
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP). Upper Salmon (upstream of YFSR) done in 2007 one time survey. • SBT assessing spatial distribution of juveniles in Yankee Fork using techniques described above.	• No data on adult spawner distribution. Inference of spawner distribution from parr is uncertain. • Parr distribution done annually in Yankee Fork and one time only in most other streams.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile and adult life history characteristics estimated at weir and screw trap (i.e., scales, lengths, PIT tags, gender). • Since 2000, ISMES has collected and processed DNA samples throughout the Clearwater and Salmon basins.In 2007, 678 DNA samples were analyzed. • SBT collects information on life history at Yankee Fork trap. • SBT have been collecting tissue samples from Yankee Fork since 2006.	• Representativeness of index streams to entire population.	• Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.
Secesh River Population				
Adult abundance	• No weirs. • No hatchery fish released. • Natural-origin Snake River Basin Steelhead MPG and population abundance via Genetic Stock Identification at LGR began in 2008. Age and length composition and sex ratios also determined. • NPT and IDFG ISEMP watershed beginning in 2009. Adults estimated with PIT tag array installed in Secesh River.	• Will be improving due to implementation of ISMEP. • Expected genetics resolution is for South Fork Salmon and Secesh as a unit. • CV not known or not calculated?	• Need adult abundance information.	

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
	• IDFG increased B Run monitoring in Clearwater and Salmon river drainages (Columbia Basin Fish Accords).			
Adult productivity	• IDFG Columbia Basin Fish Accord provides $150,000/yr to do GSI assessments (combined with age and sex comp.) in Clearwater and Salmon River. • Annual parr density monitoring (surrogate for adults) conducted by IDFG within population. • INPMEP (BPA 199107300) $785K/yr. • No sport fishing for adult steelhead permitted within population boundaries.	• Need better estimates of natural cohort age and sex structure. • Estimates of natural population incidental mortality from sport fisheries are imprecise. • Estimating adult steelhead abundance cannot be done accurately using traditional methods in high and turbid flows, juvenile estimates are important as a proxy for adult productivity. • Population may be influenced by hatchery steelhead; hatchery fraction data are lacking.	• Develop surveys of hatchery spawner fraction in index streams below weir. • Reevaluate juvenile sampling design and verify age structure assumptions needed for productivity estimates. • Develop habitat and life-cycle model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	
Juvenile productivity	• Two screw traps operated by NPT for ISS (upper Secesh & Lake Creek, both planned to cease operating in 2014). • One IDFG screw trap in lower Secesh run by IDFG for ISEMP. • Juvenile abundance estimated at screw traps using mark recapture (ISMES/ ISEMP). • Juvenile survival to LGR estimated using PIT tags. • Age structure estimated from scale analysis. • IDFG increased B Run monitoring in Clearwater and Salmon river drainages (Columbia Basin Fish Accords).	• Dispersed PIT tagging 1999-2000. • Representativeness of sampled streams to entire population • Imprecision of SARs at population level. • Determining "what is a smolt" is very important. What are the rates of residency? What proportion of the fish captured and tagged at screw traps are smolts and/or actively migrating?	• ISEMP is increasing PIT tagging and/or roll up SARs to larger scale. • Explore alternative method of estimating SARs with precision.	• Explore feasibility of using GSI and age comp. for smolts at LGR.

VSP Parameter	Current Monitoring	Data Quality and Certainty	Data Improvement Needed	Proposed New Monitoring
		• Ave. CV = 20.9 with a range of 6.9 to 32.3. Traps not operated in winter and represent a minimal estimate.		
Spatial distribution	• In 2007 IDFG adopted a rotating panel probabilistic GRTS design for assessing the abundance of juvenile salmonids (INPMEP). Secesh done in 2008; one time survey.	• No data on adult spawner distribution. • Inference of spawner distribution from parr evaluation sites is uncertain.	• Develop alternative methods to estimate spatial distribution (e.g., fry surveys, radio and acoustic tagging).	
Species diversity	• Juvenile and adult life history characteristics estimated at screw traps (i.e., scales, lengths, PIT tags, gender). • No adult life history data. • Since 2000, ISMES has collected and processed DNA samples throughout Clearwater and Salmon basins. In 2007, 678 DNA samples were analyzed.	• Representativeness of index streams to entire population.	• Collect adult life history data, or use other populations. • Genetic baseline needs to be maintained at regular intervals. • Develop habitat and life history model(s) to synthesize available data to extrapolate from index samples to an appropriate population scale.	• Implement a 5-year rotating panel to collect baseline genetic samples.

9.1.4.3 Key Information Needs for Idaho Snake River Basin Steelhead

Several critical uncertainties for Idaho's salmon and steelhead currently limit the ability to make informed management decisions. The following are examples of research needs specific to Idaho's Snake River Basin steelhead populations.

Abundance and Productivity Research

- Population specific migration survival through the FCRPS is needed. Populations that produce relatively smaller smolts may be experiencing high mortality rates in the FCRPS.
- Steelhead egg-to-migrating juvenile and egg-to-smolt survival studies are needed. Most data on juvenile and smolt production is from supplementation studies, so study streams from the existing research have substantial hatchery influence that may confound results.
- Research on reach-specific migration survival in the Salmon River is needed. Survival of juveniles migrating or rearing in reaches that are heavily impacted by water withdrawal, mostly upstream of the North Fork Salmon River, may be reduced by diversion structures, low flows, and increased water temperature.
- Research on the relationship between A-run and B-run steelhead forms is needed, including on the drivers for the expression of the two forms, their contributions to viability, and sources of loss.
- Examine factors reducing juvenile steelhead survival in the Snake River from the mouth of the Salmon River to the head of Lower Granite Reservoir is needed.
- Research on FCRPS juvenile steelhead survival between John Day Dam and the estuary is needed.
- Investigate factors contributing to the unexplained loss of adult steelhead between Bonneville and Lower Granite Dams.
- Identify the effect that hatchery-origin steelhead have on natural-origin steelhead productivity in natal streams.
- Conduct life-cycle monitoring to evaluate density dependence and other impacts on populations, and at what specific life stages and populations, to ensure that we are targeting restoration efforts at appropriate geography and life stage.
- Conduct research on the impacts of local climate change on populations. Life-cycle modeling and research is needed to assess how the fish respond to alternative management strategies and action under alternative climate scenarios.

Habitat Research

- Identify rearing and overwintering habitats used by juveniles that have migrated downstream out of their native streams (e.g. into the Salmon River mainstem or farther downstream).

- Identify stream reaches in the Salmon River drainage that produce the highest egg-to-fry survival ratio and highest fry-to-returning adult ratio. Determine which habitat features lead to these higher survival rates.
- Investigate use of beaver to restore salmonid habitat.
- Identify the importance of salmonid carcasses as a food source for migrating and over-wintering juvenile steelhead. Determine level of risk for disease transmission from hatchery carcass outplants to wild juveniles.
- Identify current impacts and predict future impacts to steelhead and their habitat due to climate change.
- Use multi-stage life-cycle models to evaluate potential impacts of climate change on key habitats, such as cold-water refugia, and to identify and prioritize efforts to increase population resiliency to climate change.
- For the Clearwater and Upper Salmon River basins, identify whether there is a need to implement a tributary habitat assessment and prioritization process (similar to the Atlas process in the Catherine Creek and Upper Grande River basins). Such an effort would integrate scientific data on habitat quality, habitat potential, and fish distribution to determine a strategy of prioritized and sequenced site-specific treatments to maximize habitat and population response.

9.2 Adaptive Management Framework

Adaptive management provides a mechanism to incorporate the data obtained through RM&E into the ongoing design and implementation of an effective recovery strategy. It allows recovery planners to use monitoring and evaluation results to make adjustments on the path to recovery. Because of the large number of organizations in Idaho, and elsewhere in the basin, that implement management actions affecting Idaho Snake River spring/summer Chinook salmon and steelhead viability, the adaptive management strategy for the species' outlines a collaboration and coordination process that uses the current implementation structures. The process allows for sharing of information and decisions that will influence recovery. What follows is a brief summary of the various management decision processes and associated adaptive management plans that affect management actions for tributary habitat, hatcheries, harvest, and the hydro system as they relate to Snake River spring/summer Chinook salmon and steelhead recovery.

9.2.1 Tributary Habitat

Several funding sources and various entities are involved with implementing tributary habitat restoration actions. In all cases, these entities have well established decision-making processes for prioritizing actions. It is beyond the scope of this document to identify and describe all the processes used. What follows are a few examples that illustrate ongoing decision processes.

Idaho Office of Species Conservation

The state of Idaho Office of Species Conservation (OSC) coordinates policies and programs for the state of Idaho related to the conservation of threatened, endangered and candidate species. The OSC, which is part of the Idaho governor's office, coordinates the state´s actions on all ESA recovery plans, management plans, public comment periods, biological opinions, guidance programs and species-specific recovery projects. Serving primarily as project coordinator, it works with various state natural resource agencies, including IDFG, IDEQ, IDWR, and Idaho Department of Lands, to implement recovery actions consistent with state laws and ongoing efforts. The OSC also coordinates and administers grant-funding programs that fund cooperative salmon habitat restoration for a wide variety of implementers. It leads project prioritization for funding consideration by the NPCC and BPA, and works to increase the reliable use of "best available data" in ESA recovery efforts. Adaptive management is implemented through strategic guidance, project review, and selection and prioritization processes.

Idaho Department of Fish and Game

Idaho Department of Fish and Game (IDFG) protects and manages Idaho's wildlife resources, including salmon and steelhead. IDFG implements projects throughout Idaho to protect, restore, or enhance fish and wildlife habitat.

Shoshone-Bannock Tribes

The Shoshone-Bannock Tribes manages fish programs and land and water uses to contribute to healthy, sustainable natural resources. The tribes implement tributary habitat actions and associated monitoring under an ESA Memorandum of Agreement with federal action agencies for listed salmon and steelhead species. Their projects within the Salmon River basin protect, restore and enhance ecosystem processes.

Nez Perce Tribe

The Nez Perce Tribe manages fish programs and land and water uses to protect natural resources and provide long-term stability. The tribe also implements tributary habitat actions and associated monitoring under an ESA Memorandum of Agreement with federal action agencies for listed salmon and steelhead species. The Nez Perce Tribe's projects within the Salmon and Clearwater basins protect, restore and enhance ecosystem processes.

Bonneville Power Administration and Northwest Power and Conservation Council Columbia Basin Fish and Wildlife Program

The Bonneville Power Administration is a major funding source for salmon and steelhead recovery projects in the Columbia Basin as part of its obligation to mitigate the effects of the operation of the FCRPS on fish and wildlife. The Northwest Power and Conservation Council plays an important role in deciding which projects BPA should fund. Together, the two organizations function as coordinators of RM&E, both in terms of the habitat protection, restoration and RM&E actions they fund within the Salmon and Clearwater drainages, and the information-sharing processes they initiate and approve. Proposed projects undergo a rigorous scientific review (by an Independent Science Review Panel) and revision process to ensure the

implementation of scientifically sound projects that are based on best available science and use state-of-the-art restoration approaches. For more information, see http://efw.bpa.gov/IntegratedFWP/anadfishresearch.aspx and http://www.nwcouncil.org/fw/.

Federal, State and Community-Level Partnerships
Several community-level organizations collaborate with state and federal agencies to implement projects for the protection and restoration of tributary habitat, and to monitor the effectiveness of these efforts. These organizations and agencies include the BLM, USFS, USFWS, NMFS, Natural Resource Conservation Service, Idaho soil and water conservation districts, Upper Salmon Basin Watershed Program, Clearwater Technical Group, Trout Unlimited, The Nature Conservancy, Lemhi Regional Land Trust, Palouse-Clearwater Institute, Salmon Valley Stewardship, and others.

Integration and Coordination
Although there are several funding sources and implementing entities that have prioritization processes and elements of adaptive management, there is a need to integrate and coordinate adaptive management for tributary habitat restoration associated with the recovery plan. This process of integration allows us to track and adjust our efforts effectively. Chapter 7 describes an implementation framework for this recovery plan. The framework is not intended to replace the other processes that are currently used. Rather, the framework is meant to improve coordination, collaboration, and sharing of information for decision-making. Information, including successes and failures, will be shared through the framework (see Figure 9-2). This will result in the implementation of cost-effective projects throughout the basins.

9.2.2 Hatcheries

Hatchery Scientific Review Group (HSRG)
The Hatchery Scientific Review Group, an independent scientific review panel, completed a review of the hatchery programs for Snake River spring/summer Chinook salmon and steelhead in Idaho. The HSRG recommendations were incorporated into the hatchery programs. They are reflected in the hatchery strategies and direction described in Chapters 4 and 5, as well as the RM&E activities identified in this chapter.

Hatchery and Genetic Management Plans (HGMPs)
Take prohibitions do not apply to activities associated with artificial propagation programs, provided a Hatchery Genetic Management Plan has been approved by NMFS as meeting a list of criteria that are specified in the 4(d) rule (65 FR 42422 July 10, 2000). The HGMP must provide adequate monitoring and evaluation to detect and evaluate the success of the hatchery program and any risks potentially impairing the recovery of listed ESUs/DPSs. An adaptive management processes is needed to provide for the evaluation of the data and include the potential to revise the assumptions, management strategies, or objectives of the hatchery program. In addition, NMFS is required to evaluate on a regular basis the effectiveness of the HGMP in protecting and achieving a level of productivity commensurate with the conservation of the listed species. If the HGMP is ineffective, NMFS identifies ways in which the program needs to be altered. NMFS is

currently reviewing HGMPs submitted by IDFG, the for artificial propagation programs in Idaho. NMFS is currently working with the funding agencies and hatchery operators to update and complete HGMPs for all hatchery programs in Idaho.

9.2.3 Harvest

Fishery managers restrict annual mortality rates on Snake River spring/summer Chinook salmon and steelhead and other ESA-listed salmon. They manage fisheries in the Columbia River estuary and mainstem Columbia and Snake Rivers through a combination of laws, policies, and guidelines established to coordinate fisheries and control impacts on ESA-listed Columbia River salmonids. Fisheries in the Salmon and Clearwater drainages are also designed to control impacts on ESA-listed species. The different fishery managers coordinate research, monitoring, and evaluation efforts.

Mainstem Columbia River Fisheries Management
The parties to the 2008-2017 *U.S. v. Oregon* Management Agreement recognize that a research and monitoring program is needed to implement and adaptively manage the harvest regimes that are envisioned in the agreement. The objective of monitoring and research is to improve the accuracy and precision of harvest management. As identified in the agreement, these data are essential for adaptive management. A Technical Advisory Committee, which is comprised of biologists from state, federal, and tribal management agencies, develops, analyzes, and reviews data and provides reports and technical recommendations regarding harvest management. The parties to the agreement agreed to work together to maintain and seek funding for the research and monitoring programs.

Additional monitoring and adaptive management of harvest is provided by ESA Section 7(a)(2) Consultation Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation on Treaty Indian and Non-Indian Fisheries in the Columbia River Basin subject to the 2008-2017 *U.S. v. Oregon* Management Agreement (hereafter referred to here as the Fisheries BiOp). Several Reasonable and Prudent Measures are identified in Section 13.4 of the Fisheries BiOp that emphasize in-season management actions, which ensure that incidental take of ESA-listed species remain consistent with the Fisheries BiOp. The monitoring of harvest impacts on listed species is an essential component of the Fisheries BiOp.

Idaho's Recreational Fisheries Regulation Process
Idaho's Statutes and Rules, Title 36 of the Idaho Code describe procedures for development and implementation of angling regulations. This rule requires the department to continually monitor the status of fisheries resources, and report to the Director and Commission any serious or abnormal changes in health or abundance of the resource. Currently, no state fisheries directly target natural-origin Snake River spring/summer Chinook salmon or steelhead. State regulations require that all caught natural-origin Chinook salmon and steelhead be released unharmed; however, incidental mortalities can occur in fisheries directed on hatchery fish, or resident fish.

State fishery managers conduct substantial monitoring and evaluation during these fisheries and restrict harvest at times when ESA-listed fish are present.

Fisheries Management and Evaluation Plans

Currently no state of Idaho fisheries target Snake River spring/summer Chinook salmon or steelhead. If the fish populations' viability reaches a level that can support harvest, the state would need to complete a NMFS-approved Fisheries Management and Evaluation Plan (FMEP) before implementing a fishery. Take prohibitions do not apply to activities associated with fishery harvest activities provided the fisheries are managed in accordance with a NMFS-approved FMEP, which is implemented in accordance with a letter of concurrence from NMFS. The FMEP must meet several specific criteria described in the 4(d) Rule.

NMFS developed a template for preparing FMEPs that meet the required criteria. Section 3.5 of the template requires the applicant to include a schedule and process for reviewing and modifying fisheries management under the FMEP. There are two evaluation review processes identified in the FMEP: (1) a regular review of fisheries and (2) a comprehensive assessment of the overall effectiveness of the FMEP. The evaluation must assess the effectiveness of the FMEP in meeting the stated objectives over a long time and must account for any new information that may require revision of assumptions or management strategies.

The FMEP describes the process and schedule that is used on a regular basis (annually) to evaluate the fisheries, and, if necessary, revise management assumptions and targets. The FMEP also includes a description of the process and schedule that occurs every five years to evaluate whether the FMEP is accomplishing the stated objectives. Section 3.5 includes the conditions by which revisions to the FMEP will occur and how the revisions will be accomplished.

NMFS also requires that the fisheries managers notify and provide to NMFS any proposed fishery regulation changes that affect fisheries within the FMEP. NMFS then evaluates the proposed changes to determine if the changes constitute additional negative effects that were not contemplated during the review and evaluation of the submitted FMEP. Depending on the species and fishery involved, changes in regulations by IDFG can occur annually or in-season.

Tribal Resource Management Plans

Tribal fisheries on the Idaho Snake River spring/summer Chinook salmon and steelhead occur in areas where the tribes continue traditional fishing practices. While the tribal harvests are generally nonselective for hatchery or natural-origin fish, the tribes limit fishery-related mortality of natural-origin populations by implementing an abundance-based management framework that has been authorized under the ESA. The tribes conduct monitoring and evaluation to assess the abundance of spring/summer Chinook salmon and steelhead and to determine fishery effort and catch. The Shoshone-Bannock Tribes and Nez Perce Tribe will manage tribal fisheries in compliance with NMFS-approved Tribal Resource Management Plans (TRMP) to exert a level of impact on natural-origin populations commensurate with recovery.

9.2.4 Mainstem Hydropower System

The Federal Columbia River Power System Biological Opinion describes steps to integrate adaptive management with hydro system operations.

Federal Columbia River Power System Biological Opinion
The 2008 FCRPS BiOp and 2010 and 1014 Supplemental BiOps requires the federal action agencies (Bonneville Power Administration, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation) to collaborate with states and tribes in the implementation of Reasonable and Prudent Alternatives (RPAs), progress reporting, and adaptive management using regional forums. RPAs 1 through 3 identify the general requirements governing the action agencies' development of implementation plans and reporting requirements. The action agencies are required to submit implementation plans to NMFS in December of 2009, 2013, and 2016 that describe their commitments to implement RPAs. The action agencies are also required to submit Annual Progress Reports to NMFS for the period 2009 through 2018. In addition, in 2013 and 2016, the action agencies will submit Comprehensive RPA Evaluation Reports to NMFS. These reports will review all implementation activities through the end of the previous year and compare them to scheduled completion dates in the BiOp, or as modified through the Implementation Plans. The Comprehensive Evaluation will also describe the status of the physical and biological factors identified in the RPA, and compare these with the expected survival improvements identified in the Comprehensive Analysis. Included in the Comprehensive Evaluation will be a plan to address any shortcomings of current survival improvements as compared to the original survival estimates identified in the Comprehensive Analysis.

The FCRPS BiOp includes RPAs (50 through 73) for research, monitoring, and evaluation. RM&E is required in the following areas: fish population status and trend monitoring, hydropower RM&E, tributary habitat RM&E, estuary and ocean RM&E, harvest RM&E, hatchery RM&E, and predation management RM&E. Data from RM&E will provide information needed to support planning and adaptive management, and to demonstrate accountability related to the implementation of hydropower and offsite actions.

A Regional Implementation and Oversight Group provides a high-level policy forum for discussing and coordinating the implementation of the FCRPS BiOp and related BiOps. The purpose of the group is to inform federal, state, and tribal agencies engaged in recovery efforts. The group will serve as a forum where policy issues and concerns related to the implementation of the BiOps will be discussed in a collaborative manner, and to provide a forum for enhanced accountability and transparency. The group does not supplant existing federal, state, or tribal decision-making authorities, and no agency or sovereign is required to participate in the group. Participation is by interest and choice.

The implementation and oversight group is supported by senior technical teams for hydro, habitat, hatcheries, and RM&E integration and by additional technical teams. Technical

information and recommendations flow from the technical teams to the senior technical teams to the group. Policy guidance and technical assignments flow from the group to the senior technical teams and technical teams. The implementation and oversight group and technical groups ensure that actions required by the FCRPS BiOp are implemented effectively, performance standards are achieved, disputes are resolved, and other regional processes are considered during the period of the BiOp.

9.2.5 Integration of Adaptive Management Processes

Integration of the many adaptive management processes will occur within the implementation management framework described in Chapter 7 and illustrated in Figure 9-2. The Science Team will incorporate new knowledge into future management guidance and direction.

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