

**Protocol Development Summary**  
**River Monitoring Program**  
**March 15, 2007**

**Protocol.**—Long-Term Ecological Monitoring of Fish Assemblages in Rivers.

**Parks Where Protocol Will Be Implemented.**—The protocol will be primarily implemented in OLYM with additional effort in MORA and NOCA.

**Background.**—This protocol development summary outlines the background, rationale, and sampling design for monitoring fish communities and water temperature in rivers in the North Coast and Cascades Monitoring Network (NCCN) during summer months. The protocol also discusses sampling design and methods for monitoring juvenile fish communities in streams co-located with river monitoring sites at OLYM. The NCCN is one of 32 networks of parks in the National Park System that comprises seven national park units in the Pacific Northwest. The NCCN includes Mount Rainier [MORA], Olympic [OLYM], and North Cascades National Parks [NOCA] and four small historic-cultural parks including Ebey's Landing National Historical Reserve, Lewis and Clark National Historical Park, Fort Vancouver National Historical Park, and San Juan Island National Historical Park. This protocol is focused on non-glacial rivers in OLYM, the Stehekin River in NOCA, and the Ohanapecosh River in MORA.

Historically, the monitoring of fish assemblages in rivers and streams has been extremely limited in the NCCN. There are no published studies that describe the monitoring of fish communities in the OLYM, NOCA, and MORA rivers. Generally, the fisheries studies that have occurred at these large parks are limited in duration often to the summer sample season, discontinuous, or focused on a single species and not the entire fish assemblage. Recently, formal fish inventories were conducted in selected river basins in OLYM (Brenkman et al. 2004), and annual monitoring now occurs for selected Pacific salmonid stocks in OLYM rivers.

OLYM, MORA, and NOCA support numerous species of Pacific salmon, trout, and char. OLYM is the only national park in the lower 48 states that contains significant numbers of wild Pacific salmonids. These salmonids are critical to ecosystem function in NCCN rivers, and link freshwater, marine, and terrestrial ecosystems. Pacific salmonids provide food for over 130 species of aquatic and terrestrial wildlife species (Cederholm et al. 2001), and studies have shown that 20 to 40% of the phosphorus, nitrogen, and carbon in freshwater systems may be marine-derived through carcasses of spawned salmon (Kline et al 1990, 1994; Bilby et al. 1996).

There have been substantial declines in distribution and abundance of native freshwater fish species in North America. The decline of Pacific salmonids on the West Coast has been attributed to overharvest, displacement by non-native fish, influence of hatchery fish on wild fish, and habitat degradation (Bottom 1995, Emmett and Schiewe 1997, Francis 1997). Of the 41 salmonid stocks on the Washington coast and Puget Sound, 26 were categorized as being at high risk of extinction, 8 at moderate risk, and 7 of special concern (Nehlsen et al. 1991). In the NCCN, a total of four fish species are listed as threatened under the Endangered Species Act including Puget Sound chinook, Puget Sound steelhead, Puget Sound/Coastal bull trout, and Ozette sockeye salmon. However, the Washington coast and many OLYM coastal rivers are some of the last remaining areas on the West Coast without a federally threatened salmon or steelhead ESU.

There are several specific threats to the persistence of native fish species in NCCN rivers that include overharvest, deleterious effects from hatchery fish, and non-native fish invasions. In OLYM rivers, migratory salmonids are especially vulnerable to harvest because they migrate outside the park for most of their life cycle and are subjected to intensive recreational and commercial gill-net fisheries that exist

most weeks of the year. Recreational fishing is allowed within OLYM, MORA, and NOCA, and is a \$850 million industry each year in Washington State. Ultimately, these fisheries influence the number of fish that return to waters in the parks.

Past and present State and Tribal hatchery practices pose threats to OLYM wild salmonids and hatchery produced fish are used to supplement recreational and commercial fisheries without regard to their influence on park resources. The establishment of hatchery origin fish is of particular concern to NPS based on their deleterious genetic effects on wild populations. Hatchery fish, through interbreeding with wild fish, genetically alter wild populations, reduce fitness, and reduce genetic differentiation among stocks (Reisenbichler and McIntyre 1977; Chilcote et al. 1986).

Invasions of non-native fish species also pose imminent threats to native fish fauna in NCCN rivers and are cited as a primary factor influencing native fish assemblages throughout western North America. Potentially significant threats to native fish in OLYM may be the invasion of Atlantic salmon, and brook trout that are known to occur in all three large parks. Atlantic salmon are commercially raised in marine net pens in Washington State and British Columbia. Annual escapes of Atlantic salmon from pens are difficult to quantify but may approach 500,000 fish annually in British Columbia where Atlantics have been documented ascending at least 78 coastal rivers ([www.biology.ualberta.ca/faculty/john\\_volpe](http://www.biology.ualberta.ca/faculty/john_volpe)). Atlantic salmon have been observed in Peninsula rivers including the Elwha and Quillayute Rivers, both of which drain from the park. Non-native brook trout were introduced into OLYM (planting ceased in 1975), MORA, and NOCA. Brook trout pose particular threats to federally threatened bull trout.

**Rationale for Selecting to Monitor Fish Assemblages in Rivers.**—In the Pacific Northwest, there is limited information on fish assemblages from pristine rivers such as those in the NCCN large parks. Rivers that drain from OLYM are some of the last remaining free-flowing and unregulated systems in the lower 48 states. These rivers represent some of the largest tracts of contiguous, undisturbed aquatic habitat throughout the range of several west coast fish species, and are regionally important as freshwater habitat refuges for wild salmonids and other native fish species. Habitat conditions in portions of rivers and streams identified in this protocol are generally pristine in condition, and have little to no development, limited to no channelization, no impervious surface, diversions, or hydroelectric projects inside the park.

Fish assemblages that inhabit rivers and streams represent critical components of biological integrity from ecosystem and public interest perspectives (Peck et al. 2000). Fish can serve as excellent indicators of ecological conditions because they are long lived, integrate effects from lower trophic levels, and are reasonably easy to identify (Plafkin et al. 1989). Additionally, life histories of many fish species are well understood, and therefore the presence or absence of specific taxa can be easily interpreted (Flotemersch et al. 2006). Also, trends in young-of-the-year and juvenile salmonids provide useful information on freshwater habitats based on the extended period of rearing in freshwater for many species.

At OLYM, fishery resources are of high ecological and cultural significance, and contribute significantly to recreational, commercial, and tribal fisheries. Fish communities were ranked third among all potential vital signs to monitor in the North Coast and Cascades Network (NCCN). Fish assemblages that inhabit these rivers and streams serve as important benchmarks that define normal limits of variation, allow for future comparisons, and identify where management actions may be necessary (Jenkins et al. 2002). The decline in native fish species in western North America highlights the importance of understanding patterns observed in least-disturbed habitat.

**Monitoring Questions and Objectives**—The primary goal of this monitoring protocol is to determine seasonal and annual trends in fish assemblages in 10 rivers in the NCCN and in wadeable streams at OLYM. Trends are defined as continuing directional change in value of an indicator, generally up or

down within season or among years (Larsen et al. 2004). One primary monitoring objective is determine whether fish communities that inhabit non-glacial rivers are changing in relative abundance, species composition, and size structure. Specific objectives of the river protocol are to determine trends in: 1) juvenile and adult fish species composition; 2) timing of migration; 3) relative abundance with an emphasis on key species that have ecological, cultural, or harvest significance; 4) fish growth; and 5) extent of non-native and hatchery salmonids in park waters. The protocol ultimately will track trends in all but the very rare species in each river. A summary of response variables and periodicity of reporting is found in Table 1.

**Management Implications.**—This protocol is designed to provide an understanding of reference conditions and trends in fish assemblages. Information derived from this monitoring will provide information that is critical to the successful management and conservation of native fishes in national parks. This protocol will allow park managers to detect trends in high priority management issues such as number of fish species increasing and decreasing in abundance, the extent of non-native and hatchery fish invasions and whether fish species become extirpated from park rivers. The protocol also provides information on magnitude of abundance of each fish species (ie-3,000 mountain whitefish, 300 bull trout, 30 summer steelhead), timing of migration of adult fishes, and growth of juvenile salmonids. From a fish assemblage perspective, the protocol tracks changes in fish species composition within a river and allows comparison of fish communities among rivers. Lastly, the protocol will detect trends in federally threatened species such as bull trout.

**Study Area**—This protocol is focused on non-glacial rivers in OLYM, the Ohanapeosh River in MORA, and the Stehekin River in NOCA. Watershed characteristics for rivers in this protocol are in Table 2. The final population of wadeable streams that will be co-located with river sites at OLYM will be selected in Spring, 2007. NOCA and MORA are developing a separate wadeable stream protocol.

**OLYM**--Olympic National Park, a designated World Heritage Site and Biosphere Reserve located on the Olympic Peninsula, contains one of the largest contiguous areas of relatively pristine habitat throughout the range of several west coast fish species. OLYM protects 922,000 acres including the upper portions of 12 major river basins and ~3,500 linear miles of streams.

The western portion of the park receives the greatest precipitation in the conterminous United States with annual precipitation that ranges from 180 to 250 cm to greater than 500 cm. Most of the precipitation occurs as rain in lowland areas and snowfall may exceed 1,300 cm. In most rivers, river discharge is strongly influenced by rainfall in winter and snowmelt in spring. Watersheds in the park are generally characterized as having steep slopes, short drainages, and high amounts of annual precipitation that cause river discharges to rise and decline rapidly with frequent high flows in the winter.

We identified four ecoregions within OLYM based on differences in climate, drainage aspect, downstream outlet, and accessibility to anadromous fish. Of the nine rivers in the protocol, four are located in the northwest region, two are located in the southwest region, two are located in the southeast region, and one is located in the northeast region.

Fish fauna in OLYM consists of primarily coldwater species in the families Salmonidae and Cottidae. There are at least 70 populations of Pacific salmonids that inhabit rivers that drain from OLYM. A total of 31 native and 5 non-native freshwater fish species from 11 different Families have been documented in OLYM waters. Both native wild populations and hatchery stocks of Pacific salmonids occur in OLYM. The following species inhabit rivers, streams, lakes, or ponds inside the park: Chinook, pink, chum, sockeye, coho, steelhead, rainbow, kokanee, cutthroat, bull trout, Dolly Varden, Olympic mudminnow, mountain whitefish, pygmy whitefish, longnose sucker, largescale sucker, speckled dace, longnose dace, peamouth, northern pikeminnow, prickly sculpin, coastrange sculpin, shorthead sculpin, torrent sculpin, reticulate sculpin, riffle sculpin, slimy sculpin, Pacific lamprey, Western brook lamprey, redbreast shiner, yellow perch, threespine stickleback, largemouth bass, yellow bullhead, American shad, Eastern brook trout (Appendix ).

**MORA.**—MORA protects 235,625 acres (365 square miles), is 97% designated Wilderness, and has 35 square miles of permanent ice and snow. Eight major rivers drain from MORA that include the: Carbon, Nisqually, Puyallup, Mowich, West Fork White, White, Ohanapecosh, and Muddy Fork Rivers. The Ohanapecosh and Muddy Fork Rivers ultimately drain into the Columbia River and the other six rivers drain into the Puget Sound near Tacoma, Washington. The Ohanapecosh River is the only river at MORA that is conducive to sampling methods outlined in this protocol based on pilot fieldwork conducted in 2005. It is not possible to conduct snorkel methods in such as the Nisqually, White, and Carbon Rivers during summer months due to extreme flows, glacial melt, and low to no visibility.

A total of ???native and ??? non-native freshwater fish species from ?? different Families have been reported to occur in MORA watersheds including coho, sockeye, steelhead trout, cutthroat trout, mountain whitefish, Dolly Varden, several sculpin species, and federally threatened populations of bull trout and Chinook salmon (personal communication, Barbara Samora, March 13, 2007). Other species that inhabit the park from previous hatchery plantings since around 1918 include brook trout, rainbow trout, Yellowstone cutthroat trout, and Westslope cutthroat trout. Brook trout and cutthroat trout inhabit the Ohanapecosh River.

**NOCA.**—NOCA was designated in 1968 and now protects 684,000 acres. The headwaters of the Chilliwack, Skagit, Nooksack, and Stehekin Rivers occur inside the park. The Stehekin River is the only river outlined in this protocol. (AWAITING INFORMATION FROM REED GLESNE).

**Overview of Sampling Design.**—There is a lack of widely accepted sampling methods for monitoring fish communities in river systems. Aquatic environments are inherently difficult to sample, and pose numerous challenges to sampling fish populations. Streams that are considered to be wadeable are relatively easy to sample when compared to sampling in rivers, and consequently the development of protocols for lotic systems has focused on wadeable streams (Peck et al. 2000; Flotemersch et al. 2006). However, many of the sampling techniques for wadeable streams are infeasible in river systems (Flotemersch et al. 2006). In the NCCN, rivers are particularly challenging to sample using traditional fisheries techniques because of prolonged periods of high flow, low visibility from glacial melt, high rainfall, low access, safety concerns, and limitations on sampling methods that are allowed in national park waters. Additionally, these challenges are compounded by the presence of migratory fishes in river systems where extensive movements in rivers add complexity to sampling (Torgersen 2002).

EMAP, AREMP, PNAMP, and NAWQA are existing protocols that focus on monitoring the status of fish, macroinvertebrates, and water quality metrics along disturbance gradients (Peck et al. 1999; Moulton II 2002). These protocols provide an understanding of the status or condition of natural resources, and allow inference over a large geographic area (i.e.-western U.S.). Inferential designs in those protocols necessarily spread sampling across a broad area and focus on short sample reaches that are randomly chosen. However, these protocols are expensive to implement and random sites may be difficult to access when working in roadless areas such as National Parks.

**Allocation of Sampling Effort Relative to Budget**—In the NCCN River Monitoring Protocol, we determine seasonal and annual trends in fish assemblages thru intensive and repeated sampling of five km reference reaches in 10 rivers from May thru September. The protocol emphasizes portions of rivers immediately upstream of the park boundary in OLYM rivers. The concept of “reference condition” is often used to describe the benchmark against which current condition is compared. In this protocol, the term reference is reserved to mean naturalness (ie National Park) of biota and that implies the absence of significant human disturbance or alteration (Stoddard et al. 2006).

The general rationale for the repeated sampling of reference sites is to ensure that we account for the high seasonal variability in fish movements and abundances in rivers. The sample design is repeatable thru time and has minimal observer bias when using snorkel counts in rivers based on pilot fieldwork in 2005 and 2006 and analysis of historic trend data at OLYM (McDonald 2006). To detect trends in fish

assemblages, we rely on a long sampling period, representative monitoring locations, and provide a sampling foundation from which additional five km reference sites within a given river may be added with appropriate funding. One underlying assumption is that the River Monitoring Program is designed in perpetuity, and consequently our capability to detect trends increases dramatically with time.

The sampling of rivers is made difficult because of high costs, difficult logistics, and safety concerns. The sampling design in this protocol was designed to accommodate many of the challenges inherent in working in remote, roadless, and wilderness parks. In all three parks, substantial portions of rivers are rendered essentially inaccessible by prohibitively steep slopes, narrow canyons, periods of high flows, and dangerous river crossings. The portions of rivers that do not present these extreme challenges are typically located near the park boundary and still require great care to access. Personnel at OLYM specialize in sampling relatively remote rivers and have developed and adopted a safety-based work culture that places safety of workers above all project objectives.

Constraints of funding necessitate the allocation of two field crews (of two people) to conduct snorkel and electrofishing surveys in index portions of each river. Substantial portions of the large national parks are many kilometers away from the nearest road and nearest trail. There are portions of rivers in the more remote parts of NOCA and OLYM, in particular, where a single fish sampling survey may require over a week of a crew's time to reach, sample, and return. The protocol is cost effective (\$30,800/year; 2005 dollars) and ensures that we sample an extensive number of sites well under extremely limited budgets. Furthermore, the higher portions of each watershed typically have lower species diversity and may occur upstream of physical barriers and waterfalls that are unsafe to access. Given the tight financial constraints currently anticipated for this project coupled with safety concerns, attempting to reach such remote places would consume an inordinate proportion of available resources and would greatly reduce the number of visits each year (Siegel et al.; Landbird Protocol).

**Number and Location of Sampling Sites.**—The completion of pilot work in OLYM (2004-2006) and MORA rivers (2006) and OLYM streams provided opportunities to test and streamline field methodologies and analytical approaches. The pilot studies also produced datasets that we used to allocate effort and assess statistical power of this monitoring program. There are a total of 10 rivers in the NCCN that were identified as conducive to snorkel methodologies during summer months and subsequently included in this protocol (Table 1). Sample sites were chosen based on safety, access, and budgets constraints. Location of sites at the park boundary has the added advantage of reflecting the integrated conditions of watershed.

Because of the geographic diversity within OLYM, we explored the possibility of a stratified design for sampling rivers in the four regions of OLYM. A stratified design has some promise to intensify the efforts within a river, which would increase the ability to extrapolate to the watershed level. However, the uneven distribution of rivers within regions (n=1-4/region) prevented extensive efficiency gained by stratification. By sampling all rivers within a single year, a large benefit is gained and allows for extrapolation of findings to the lower ends OLYM individual rivers near the park boundary.

**Frequency and Timing of Sampling.**—The frequency and timing of sampling differs with the gear being used (snorkeling or electrofishing) and with the type of site being sampled (wadeable stream or river). The general approach is to sample five km reference reaches of each river in an area located immediately upstream from the park boundary. Snorkel surveys will be conducted at repeated intervals from June to September throughout the five km reference reach. The reference reaches of rivers outlined in this protocol are comprised of main stem and side channel habitats with multiple types of habitat units (ie-pools, riffles, glides) throughout each reference reach.

**Co-location of Wadeable Stream Sites at OLYM.**—To provide complimentary data on young-of-the-year fish assemblages to that data on adult fish collected during snorkel surveys, we selected one tributary stream within each 5 km section of river in OLYM rivers. A rotating panel design was used to outline the sampling intensity for electrofishing the lower one km of each tributary that is co-located with the river sites. Sampling of wadeable streams by electrofishing will be limited to at most 6 streams per year with each stream sampled once in July and once in September. There will be four fixed streams that will be sampled annually with rotation thru the remaining five wadeable streams.

**Methods.**—This protocol relies on a combination of snorkel and electrofishing methodologies to maximize detection of trends in juvenile and adult fish assemblages in NCCN rivers and wadeable streams. For a long term monitoring program to be designed for National Parks, we did not believe that methods such as boat electrofishing or gill-netting were suitable for trend detection or repeat sampling because of lack of access and vulnerability of native fish to direct and indirect mortality.

**Day Snorkeling in Rivers.**—The seasonal movements, assemblage structure, and relative abundances of riverine fishes during summer months were determined by snorkel counts in each river during pilot studies and previous monitoring efforts. Day snorkeling from June thru September was deemed to be an effective method to determine seasonal movements and enumerate fish based on high water visibility during summer months. Night snorkel surveys in relatively remote portions of rivers were considered too hazardous, and snorkeling during fall, winter, and spring was too difficult because of high flows and low water visibility.

Snorkel surveys are an important tool to study fish populations in lotic systems and are known to provide precise and reliable estimates of fish abundance (Northcote and Wilkie 1963; Schill and Griffith 1984; Thurow 1994). Snorkel surveys are feasible in deep, clear rivers where the effectiveness of other methods are limited and are multi-species focused by design. Snorkel surveys also are feasible in logistically remote terrain and roadless areas because of the relatively small amount of equipment (Thurow 1994). The use of snorkel surveys also is a passive technique that is conducive to sampling fish stocks that are protected, rare, or inhabit natural areas where invasive sampling is less desired. Day snorkel surveys are less effective at enumerating species typically observed at night (ie-juvenile bull trout; citation) or species associated with the benthos such as sculpin.

To address observer variability in snorkel counts, we conducted two pass replicate snorkel counts in six rivers on the same date over the same 5 km reference reach in 2005. The variation of these repeated snorkel surveys was computed as a measure of the reproducibility of snorkel counts. Statistically, this variation was an estimate of the measurement error associated snorkel counts. Variation was computed among replicate counts for each of the primary species, and was reported as both the coefficient of variation (CV) and the ½ width of an approximate 95% confidence interval on the mean count (McDonald 2005). The CV for replicate counts  $x_1$  and  $x_2$  of the same species was,

$$cv(x) = \frac{\sqrt{(x_1^2 + x_2^2) - 0.5(x_1 + x_2)^2}}{0.5(x_1 + x_2)}.$$

The ½ width of an approximate 95% confidence interval was computed as 2 times the standard error, or  $2cv(x)[0.5(x_1 + x_2)]$ .

**Backpack Electrofishing and Fish Handling in Wadeable Streams at OLYM.**—To collect fish in wadeable streams, the electrofishing crew of four will proceed upstream without block-nets from the mouth to 500 m upstream sampling from left to right streambank. One crew member will operate the electrofisher, two-crew members with net fish, and one crew member will handle buckets. When

feasible, up to 50 individuals per species should be collected. In the event that 50 species are not captured in the 500 m, surveyors should assess whether they can attain a total of 50 individuals by sampling a short distance.

Fish will be collected by backpack electrofisher and immediately placed in aerated 5 gallon buckets. Fish held in buckets need to be regularly monitored to minimize stressful conditions. If necessary, fish will be lightly anesthetized with 50 mg/L MS-222 buffered with an equal amount of sodium bicarbonate. Fish will be weighed to the nearest 0.1 g, and measured for fork length to the nearest mm. All fish should be held in ambient temperature stream water until they fully recover, and then will be released near their point of capture.

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**Development Schedule, Budget, and Expected Interim Products:** The protocol will be written by NPS and USGS and is scheduled for peer review in November, 2007. Products associated with protocol development include: 1) a contract with a statistician to design the sampling frame; 2) a peer reviewed study plan and final protocol that outlines monitoring objectives, sampling design, power to detect trend and methods for monitoring fish communities in large rivers in the NCCN; 3) peer review of the final protocol; 4) establishment of long term monitoring sites in OLYM; and 5) establishment of long term monitoring sites in the Stehekin River, NOCA and Ohanapecosh Rivers, MORA. The protocol will meet NPS standards and will be developed in accordance with Oakley et al. (2003). The goal is to implement the protocol in OLYM rivers, MORA, and NOCA river in June, 2007 as per the implementation schedule in Table 3. The implementation budget for rivers currently is \$30,800 (Table 4), and minimum staff required from NCCN funds includes one GS 06 and one GS 05 for up to 10 pay periods. The implementation budget for wadeable streams that are co-located with OLYM rivers is \$21,811 (Table 5).

Table 1. Summary of response variables to detect seasonal and annual trends in fish assemblages in rivers and wadeable streams.

<b>Monitoring Metric</b>	<b>Response</b>	<b>Data Summary</b>	<b>Reported By</b>	<b>Frequency of Reporting</b>
Fish	Trends in relative abundance (Rivers)	Annual peak count; regression vs. time	Species for each river in each year	Annually
	Age/size (Streams)	Length frequency distribution	Species by month in each year	Annually
	Species composition (Rivers and Streams)	Mean monthly species composition	Species for each river in each month	Annually
	Migration timing (Rivers)	Mean onset, peak, and end of migration; smoothed counts vs. julian date	Species for each river	Annually
	Fish growth (Streams)	Mean fork lengths over time	Species by month	Annually
	Observer variability (Rivers)	Estimate residual standard error; coefficients of variation	Species for each river during dates of replicate surveys.	Once in five years

Table 2. Watershed characteristics for rivers included in this protocol. Missing values NA will be filled in during the writing of the protocol.

River	Watershed Area (acres)	Percent of Watershed in National Park	Elevation at Park Boundary (m)	Elevation at Headwaters (m)	Total River Length (miles)	Total River Length in Park (km)	Mean Annual Summer Flow (cfs)	Anadromous Fish Present/ Hatchery Facility in Basin
Bogachiel, OLYM	81,168	64	103	1,288	46.5	26 miles	1,050	Yes/Yes
Dosewallips, OLYM	74,355	63	326	1,872	28.3	16 miles	445	No/No
E. Fk. Quinault, OLYM	57,520	100	117	NA	NA	NA	NA	Yes/Yes
N. Fk. Quinault, OLYM	51,488	100	115	1,238	19	19 miles	NA	Yes/Yes
N. Fk. Skokomish, OLYM	31,135	NA	225	1,622	15		510	No/Yes
S. Fk. Hoh, OLYM	28,015	NA	244	1,318	NA	15 miles	A	Yes/No
Sol Duc, OLYM	48,040	29	318	1,445	65.2	16 miles	260	Yes/Yes
N. Fk. Sol Duc, OLYM	19,681	100	329	1,520	15	15 miles	NA	Yes/Yes
Stehekin, NOCA	NA	NA	NA	NA	NA	NA	NA	NA
Ohanapecosh, MORA	78,897	85	800	NA	NA	22.3 miles	NA	No/No

Table 3. Projected implementation schedule for River Monitoring Program.

Month	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		
	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	
Week																									
Hiring					X	X																			
Training									X																
Data collection					X		X		X		X	X	X	X	X	X	X	X							
Data entry														X			X								
QA/QC														X			X								
Reporting																			X	X					

**X=OLYM rivers using OLYM crew. OLYM crew responsible for data collection, analysis, and reporting**

**X=Ohanapecosh River using OLYM crew (2-3 annual visits)**

**X=Stehekin River using NOCA crew (3 annual visits). NOCA crew responsible for data collection, analysis, and reporting**

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