Rocky Reach Project Resident Fish Study

Submitted by:

Washington Department of Fish and Wildlife
Large Lakes Research Team
5981 Vantage Hwy. Suite 100
Ellensburg, WA 98926

Final
June 23, 2011

Table of Contents

Section **Page**

List of Figures

Figure **Page**

List of Tables

Table **Page**

I. Introduction

The Rocky Reach Hydroelectric Project, FERC Project No. 2145, which is owned by Public Utility District No.1 of Chelan County (Chelan PUD), was started in 1956 and completed in 1961. In 1969, additional generating units were added and the Rocky Reach Project (Project) reached its present size and configuration in 1971. The Rocky Reach Dam created a 43-mile long reservoir referred to as Lake Entiat. To meet the natural resource requirements, a Natural Resources Working Group was organized to develop a Comprehensive Resident Fish Management Plan (RFMP) for the Project. An outline of this Resident Fish Study Plan was recently released and it has three clear goals to implement within the Project boundary, which are to: 1) protect and enhance resident fish; 2) protect their habitat; and 3) enhance recreational fishing opportunities. In addition, Chelan PUD agreed to implement several resident fish Protection, Mitigation, and Enhancement measures (PMEs). One PME was to conduct "resident fish monitoring to measure relative abundance and species composition in the Reservoir," which is section 4.2 of the RFMP. A second PME is to "evaluate the creation of an additional recreational fishing opportunity in the Reservoir that is compatible with existing fish resources," which is section 4.1.3 of the RFMP.

Implementation and funding of RFMP sections 4.1.3 and 4.2 are being combined in this Rocky Reach Project Resident Fish Study because elements to be conducted in Section IV, Methods and Analysis, would be required for each investigation if conducted separately. In order to maximize efficient use of funding available, not to exceed $60,000 for section 4.1.3 and not to exceed $300,000 for section 4.2, for data collection and timeframe required to complete the investigations, within 1 year for section 4.1.3, the RRFF recommended, and Chelan PUD agreed, to combine implementation of the RFMP requirements for a total not to exceed $360,000. This initial study is designed to satisfy the requirement to evaluate the creation of an additional recreational fishing opportunity, section 4.1.3, and determine next steps for resident fish monitoring, section 4.2: either conducting 2 additional one-year surveys for determining the efficacy of predator control measures; or conducting 3 additional one-year monitoring surveys to monitor any changes in abundance or species composition in the resident fish populations in the Reservoir.

The Chelan PUD contacted the Washington Department of Fish and Wildlife (WDFW) Large Lakes Research Team (LLRT) to develop a study plan that will address resident fishes within the Project. The LLRT has conducted similar studies of resident fishes in a number of eastern Washington lakes and reservoirs and are currently collaborating with the U.S. Geological Survey (USGS) on a Grant County Public Utility District (Grant PUD) funded study in the Priest Rapids Project. Although smaller in scope, the Chelan PUD funded Rocky Reach Project Resident Fish Study will be completed in a manner that will allow comparisons to portions of the Grant PUD funded study. To effectively monitor and assess changes in the resident fish community within the Project, it is imperative that comprehensive baseline data are collected at the beginning of this study and monitored over time.

II. Study Goals

The primary focus of this study will be to conduct scientifically sound repeatable surveys within the Project, specifically for resident fishes. With the data collected we will be able to develop several indices such as relative weights, species composition by weight and number, and areas of dense abundance with respect to other species. A baseline study conducted now will provide biologists and co-managers with an accurate assessment of the current species composition of the Project and identify primary species such as predators of concern relative to spatial and temporal parameters. Conducting index sampling throughout the duration of the current FERC license will allow managers to identify potential changes within the fish assemblage of the Project. Although the current design precludes hypothesis testing with respect to interactions such as predation, we will be able to determine what species are present and theorize what, if any, impacts there would be on sensitive species such as salmon and steelhead.

The potential for the Columbia River fish assemblage to change does exist. Future supplementation programs including salmon, steelhead, and white sturgeon could change the resident fish composition via interspecific interactions. Other changes within the reservoir could be attributed to additions via entrainment, angler introductions, or changes in the physical parameters associated with regional and/or global climate changes. Recent WDFW studies have indicated an increase in the presence of northern pike in the Pend Oreille within a one year period. Should an apex predator become abundant within the Project, a change within the resident and anadromous fish assemblage may occur. As well as the potential for fish to be entrained into the Project, fish can also be relocated by anglers. In 2008 we received a call regarding a Moses Lake tagged walleye that was captured just below Wells Dam and it is believed this fish was moved by an angler. This project will allow us to determine the primary and secondary species of concern within the Project with respect to potential effects on both the resident and non-resident fish assemblages.

The goal of this study is to support the goal of the Rocky Reach RFMP, which is "to protect and enhance resident fish and their habitat within the Project boundary and to enhance recreational fishing opportunities." Tasks within this study were developed to meet the requirements in sections 4.1.3 and 4.2 of the RFMP. One objective of this plan, in accordance with the Settlement Agreement, is to "conduct resident fish monitoring to measure relative abundance and species composition in the [Rocky Reach] Reservoir." The size and the open nature of the Project make abundance estimates difficult to accomplish accurately with reasonable minimum and maximum bounds. Consequently, this objective has been modified to only monitor and assesses ***changes*** in the resident fish community. In addition, because the LLRT is conducting similar work at the Grant PUD's Priest Rapids Project downstream, a goal of the LLRT is that the studies can be completed in a manner that allows comparisons between the two.

Secondarily, we will evaluate fish habitat in areas of heavy aquatic vegetation growth, including water quality, the types of vegetation in these areas (emphasizing native vs. non-native), and the relative abundance of resident predators such as northern pikeminnow (*Ptychocheilus oregonensis*), smallmouth bass (*Micropterus dolomieu*), largemouth bass (*M. salmoides*), walleye (*Sander vitreus*), and channel catfish (*Ictalurus punctatus*).

Third, another objective of the RFMP is to "…evaluate the creation of an additional recreational fishing opportunity in the Reservoir that is compatible with existing fish resources." Results from the study methodologies described following in Section IV, Methods and Analysis, will be used to conduct the Recreational Fishing Evaluation. Art Viola of the WDFW recommended future actions needed to increase angling opportunity for the resident fish in the Rocky Reach Reservoir (Appendix 1). These recommendations were used to develop this scope of work, and most of the WDFW recommendations have been addressed within our tasks.

III. Study Area

The Rocky Reach Project extends from the tailrace of the Rocky Reach Dam approximately 69 km upstream to the Wells Dam tailrace (Chelan PUD 1999). The dam itself is located in north central Washington approximately seven miles from the city of Wenatchee (Figure 1). The large size of the Project dictates we employ a sub-sampling regime.

IV. Methods and Analysis

The LLRT has developed standard operating procedures (SOP's) for all of the methods and operations utilized. Following SOP's ensures that the data we collect are temporally comparable and statistically valid. The LLRT currently has all the necessary State and Federal permits to sample within the Columbia Mainstem. These permits are required on the Columbia River, as there is the potential to impact sensitive species and native resident and non-resident fish species listed under the Endangered Species Act (ESA) (NOAA 1997; NOAA 1999).

Although northern pikeminnow are generally considered the most abundant and deleterious predator within the Columbia River, walleye and smallmouth and largemouth bass have also been documented from the Lower Columbia (Beamesderfer and Reiman 1991; Zimmerman 1999) to the Upper Columbia (Baldwin et al. 2003). Multiple gear types will be used to minimize gear bias with respect to species and sizes of fishes captured (Table 1). However, the different gear types can only be deployed in appropriate habitats. Sites will be randomly selected for each of the sampling techniques from the corresponding suitable habitats. The primary data collected from sampled fishes will include species, length, and weight. If requested, it may be feasible to collect secondary data such as stomach content samples, scales from fish that are alive, and otolith and tissue samples from dead fishes. It should be noted that we would not sacrifice sensitive or ESA listed species during our sampling efforts.

Objective 1: Logistical Planning

- *Task 1: Partition Project waters into 400-meter sites*
- *Task 2: Stratify sites based on habitat type*
- *Task 3: Locate hazardous areas*
- *Task 4: Obtain necessary state and federal sampling permits*

Task 1. Partition Project waters into 400-meter sites

Due to the size of the Project area (Figure 1), we will first divide the littoral length of the Project water into 400-meter (m) adjacent sites and assign the appropriate coordinates. This task will be completed prior to field collections using GIS.

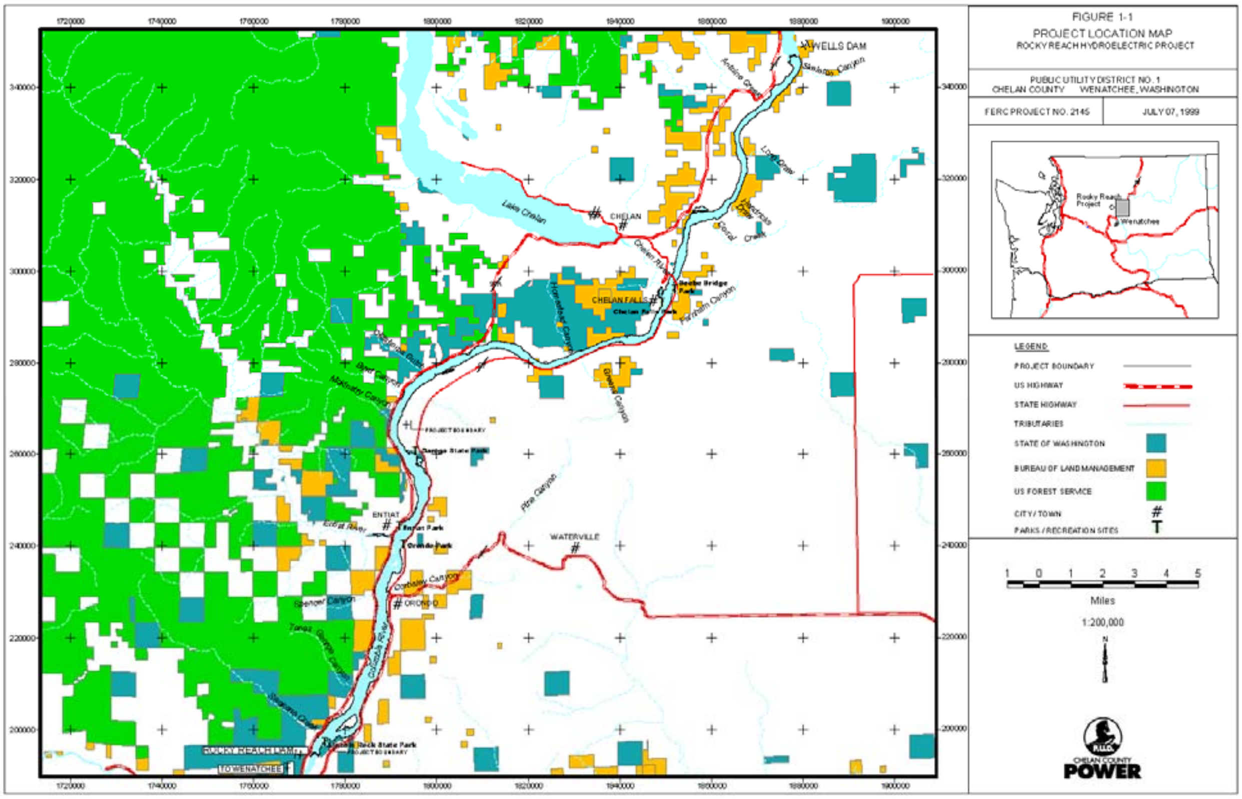

Figure 1. Map of the Rocky Reach Project, Columbia River Washington.

Task 2. Stratify sites based on habitat type

Using previously collected habitat data (Chelan PUD 1999), as well as conducting several reconnaissance trips, we will partition the habitat types into sections that can be sampled using electrofishing, fyke netting, and popnetting. Consequently, sites will be selected based on a stratified random sampling design with proportional representation regarding habitat allocations. Sites will also be designated as suitable for sampling with respect to the different types of sampling gears we employ.

Task 3. Locate hazardous areas

The construction of impoundments on the Columbia River has inundated habitat, some of which is sub-surface and can pose a threat to boat traffic operating within Project waters. In order to decrease the likelihood of striking a submerged structure, LLRT personnel will first consult with Chelan PUD personnel to locate hazardous areas within Project waters. In addition, LLRT personnel will conduct several reconnaissance trips and locate potential hazardous we may encounter during night operations. Finally, due to the potential to encounter high winds while working on the Columbia River, LLRT personnel will identify areas on the river to escape potentially dangerous winds. Submerged structures and locations of refuge will be saved into boat mounted GPS units.

Task 4. Obtain necessary state and federal sampling permits
We currently have our state blanket sampling permit a NMFS 1345 take permit and a renewal of the Section 6 bull trout take permit to sample in the Columbia River using standardized warmwater sampling protocols. Coordination with the USFWS will occur through the Rocky Reach Fish Forum (RRFF) with respect to the type and amount of data they would like collected from bull trout should we contact them during our surveys.

Objective 2: Biological Collections

- *Task 1: Complete standardized warmwater sampling following* WDFW Standard Fish Sampling Guidelines for Washington State Ponds and Lakes (Bonar et al. 2000)
- *Task 2: Fish surveys in areas of dense macrophytes*

Task 1. Complete standardized warmwater sampling following WDFW Standard Fish Sampling Guidelines for Washington State Ponds and Lakes (Bonar et al. 2000)
To assess the resident fish population in the section of the Columbia River impounded by the Project, we will capture fishes during the summer and fall using passive and active methodologies (Table 1) described within the WDFW littoral sampling protocol (Bonar et al. 2000). All sites will be selected in a stratified random method to ensure the selected gear is appropriate for the site. The specifics with respect to the ratio of nets to electrofishing deployments may vary based on the amount of habitat each method can effectively sample.

Fish sampling will be conducted in three primary habitats between Wells Dam and Rocky Reach Dam: tailrace, mid-reservoir, and forebay. Because there is risk associated with all methods of collection, we will conduct our sampling in a manner that will reduce the likelihood of negatively impacting sensitive and ESA listed species. Boat electrofishing and fyke netting will only be conducted at night during summer and fall for a number of reasons. A sample session for each season will consist of two weeks or ten nights of electrofishing and fyke netting. From our experiences this is generally the best time to obtain a good representative sample of resident fishes. In addition, smolts will have completed migrating through the system during this time and the likelihood of encountering mass migrations of smolts is greatly reduced. Even though juvenile fish will not be present in large numbers, adult salmon and steelhead will be migrating through the Columbia River during these months. However, boat electrofishing is only effective around the littoral zones and to a depth that adult salmon generally do not migrate through.

During our electrofishing sampling efforts, we may encounter listed bull trout and we will use this time to collect length and tissue samples for genetic analysis. Upon capture, electrofishing will be stopped immediately to facilitate a quick workup and release of the captured bull trout. Although not part of the scope of work, collected tissue samples will be delivered to the USFWS to be used at their discretion.

Table 1. Standard equipment used by the Large Lakes Research Team for fish surveys.

Equipment	Description
Electrofishing Boat	18' Smith Root 5.0 Generator Powered Pulsator (GPP) electrofishing boat with a six-dropper spider array anode on each boom and a cable "whisker' cathode array in front.
Fyke Net	4' tall, with 5 circular hoops, ¼" knotless mesh net with two 25' wings, and a 100' lead line.

a. Boat electrofishing

On a typical night, we can electrofish 4-6 sites depending on variables such as location, travel time, number of fish sampled, and environmental conditions. Prior to launching an electrofishing boat, the selected coordinates are entered into a GPS and verified on a map. After all sites have been entered, we develop a plan of completion that is logistically efficient and requires little or no backtracking. Once we arrive at a site that has been deemed safe and crew preparations have been completed (Appendix 2), sampling will commence downstream. Electrofishing boats will be operated parallel to the shoreline at a rate of 1-1.4 mph, in a depth of water not to exceed 3 m and will continue for 600 seconds (Appendix 3). The goal of boat electrofishing is to sample in a manner that is efficient and safe for crew and fish alike. With respect to fish safety, we will adjust our boat settings to promote galvanotaxis of the fish in our effective electrofishing area. Several parameters such as temperature, dominant species, and specific conductivity will be factored at each site and electrofishing settings adjusted accordingly. All fish will be netted and placed immediately into one of the two live wells. Once the first site has been electrofished for 600 seconds the crew will move to the next site and commence electrofishing again. Fish from the second site will be placed into the other of two live wells not already occupied by fish from the first site. If the distance between the two sites is too great, fish will be worked up at the end of the first site.

Abiotic data collected at each site will include recording the effort (seconds), the actual starting and finishing coordinates (UTM), time started and finished, specific conductance, boat operator and netters, and water temperature. Biological data collected from captured fish will include species identification, individual fish lengths and weights, stomach contents from predatory fishes and a small core of muscle tissue from above the lateral line and anterior to the dorsal fin for stable isotope analysis (SIA).

Stomachs contents will be collected using gastric lavage methods or whole stomach extractions (northern pikeminnow). The gastric lavage pump is constructed from a handheld sprayer with a modified elongated nozzle. The sprayer will be filled with tap water and pressurized. To obtain stomach contents, the nozzle will be inserted into the oral cavity, past the pyloric sphincter, and into the stomach, forcing water into the stomach and causing regurgitation. Samples will be strained and their contents preserved in 95% ethanol. Northern pikeminnow stomachs will be placed on ice and later frozen.

Stable isotope analysis (SIA) has been used to determine point source pollution (Cabana and Rasmussen 1994) and geochemical relationships (Griffiths 1998), and to study food webs and dietary analysis (Hobson 1999; Harvey and Kitchell 2000; Newsome et al. 2004). Prior to SIA, food web investigations were conducted using stomach content analysis. While stomach content analysis provides useful data, such studies are limited, as they are only a 'snap-shot in time' with respect to dietary preference and trophic standing. Therefore, we will concurrently conduct SIA to provide a thorough understanding of prey consumption throughout the Project

Additional collections or procedures may include marking captured predators, and the collection of calcified structures such as scales, otoliths, and opercles for age determinations.

b. Fyke Nets

Fyke nets will be used to intercept fishes moving parallel to the littoral zone and will soak overnight. A proper fyke net set will have the lead line on shore and the first hoop closest to shore just under the water with the wings in a 45-degree angle towards the shore. A large weight will be placed on the cod end along with a bullet buoy to keep the hoops stretched out and the net in place. After a night of soaking, a boat crew will pick up the fyke net from the cod end side and fish will be immediately placed in a live well and worked up once the entire fyke net is onboard. Captured fish will be worked up, data collected, and location using GPS will be recorded.

Task 2. Fish surveys in areas of dense macrophytes *(Only conducted upon successful identification of applicable sampling areas [e.g. depth, flow, etc.]).*

In areas of thick macrophytes and appropriate depths, we will sample using popnets (Morgan et al. 1988). Sites will be selected using a stratified random sampling design (Scheaffer et al. 1996). A popnet consists of a 3.05 x 3.05 m (10 x 10 ft) frame of polyvinyl chloride (PVC) filled with float material and a frame of equal dimensions filled with weights. This sampling covers a 9.29 m^2 (100 ft^2) area per net set (Figure 2). The frames are connected by a 1.83 m (6 ft) net with 6.35 mm (0.25 in) knotless mesh. Upper and lower frames will be pinned together and the nets set flush with the substrate. Contact between the substrate and the bottom frame will be accomplished by placing sandbags over the bottom frame to ensure that fish cannot escape the sample area.

Approximately 24 h after setting a net, we will pull the pins causing the top frame to rapidly float to the surface and enclose the fish within the area of the net. Popnets will be triggered manually via long cords attached to cotter pins that hold the floating frame to the sinking frame that is secured to the substrate. Once a popnet has been deployed, a specialized seine will be pulled through the popnet enclosure to capture all the fish following a depletion method (Everhart and Youngs 1981). We will make no less than three passes with the seine to collect fish. However, we will continue to pass the seine through the area of the popnet until we have collected less than half the number of fish as were collected from the previous pass. Once fish have been captured, biological data will be collected and the location using GPS will be recorded.

Figure 2. Popnet deployed by Large Lakes Research Team personnel in Moses Lake, Washington.

Objective 3: Monitor standard water quality parameters within the Project

- *Task 1. Collect water quality data in areas of dense vegetation associated with popnetting.*

Calibration and quality control.
The LLRT staff has consulted with the Washington State Department of Ecology and has developed SOP's for water quality data collections (Appendix 4). We currently use a YSI 6600 V2 Multiparameter Water Quality Sonde (YSI sonde) unit that measures dissolved oxygen (DO), temperature, specific conductivity, pH, chlorophyll, and turbidity. This unit is calibrated prior to deployment (Appendix 5), and then bench tested after sampling has been completed. Following the calibration, data collection and data entry SOP's ensures we collect the most accurate data possible and allows us to compare pre- and post-data collections.

Task 1. Collect water quality data in areas of dense vegetation
Some literature suggests the presence of aquatic vegetation can be advantageous to an aquatic community as mosaic patterns exist and provide forage and predator avoidance habitat (Keast 1977; Savino and Stein 1982; Diehl 1992). Conversely, another study found that fish such as bluegill should move offshore in order to feed optimally and target *Daphnia* (Mittelbach 1981). As well as directly impacting fish, aquatic vegetation can also indirectly impact fish by altering water quality such as pH, temperature, and DO. Following methods from Task 1 we will monitor water quality parameters in the large mats of aquatic vegetation within the Project to investigate the potential impacts. During our other tasks and sampling efforts we will search for and locate areas of dense vegetation. Due to temperatures and other abiotic conditions we will expect to observe highest density of vegetation during the month of August which is when we are planning on completing this task.

Objective 4: Data Analysis of fish and environmental data

- *Task 1. Standardized sampling fish analysis*
- *Task 2. Popnetting analysis*
- *Task 3. Water quality analysis*
- *Task 4. Assessment to develop a recreational fishery*

Task 1. Standardized sampling fish analysis

Catch per unit effort for electrofishing and fyke netting will be calculated separately using the following formulas:

$$CPUE = N / T$$

Where CPUE is catch per unit effort, N is the number of individuals, and T is time (seconds for electrofishing and net-night for fyke netting. This analysis can be completed for the entire data set of like methods or can be partitioned in a number of ways to detect temporal and spatial variation.

Species composition will be calculated based on number and weight for each of the different sampling methods, as an absolute abundance estimate is not reasonable to calculate. Species composition by weight (biomass) is calculated using the following formula:

$$\text{Species comp.} = (\Sigma Spp_{wt} / \Sigma\ T_{wt})*100$$

Where Spp_{wt} is the weight of an individual species and T_{wt} is the total weight of all the species collected. Species composition by number is calculated using the same formula by substituting the sum of the number of a species and the total number of individuals for all species, respectively.

Relative weights (W_r) of predatory fish will also be calculated based on national and regional standard weights (W_s). This will allow us to compare the health of predatory fishes in the Project. The formula to calculate W^r is:

$$W_r = (W / W_s) \times 100$$

Where W is the individual weight of the sampled fish and W_s is the national or regional length specific standard weight.

Additional data analysis will include developing a length frequency histogram for the three primary methods of fish capture.

Task 2. Popnetting analysis

Methods taken from Burgess et al. 2007. (Only conducted upon successful identification of applicable sampling areas [e.g. depth, flow, etc.])

From each individual popnet deployment, a population estimate will be conducted using a multiple removal-depletion method. For each popnet, we will perform a linear regression for each species where catch is a function of the sum of catch. Using these data, we will estimate the number of individuals of each species for ages 0, 1, and 2 in each popnet haul by:

$$N = \frac{a}{b}$$

Where N is the number of individuals of each species in each popnet haul, a is the intercept of the straight-line equation, and b is the slope of the straight-line equation.

Total area of vegetation mats will be estimated and we will use these data, combined with data from fish collected with popnets, to develop an abundance estimate of fishes within the areas of dense macrophytes.

Task 3. Water quality data analysis
Aside from temporal and spatial analysis of water quality data, correlations between habitat and various parameters will also be conducted. For example, areas of high macrophyte densities and embayments may have water quality data considerably different from that of the primary channel of the Columbia River. It is likely variations in many of the water quality parameters will exist. Specific monitoring activities will be developed for inclusion here in conjunction with the water quality monitoring plan to be developed by Ecology and Chelan PUD.

Task 4. Compile all available data to evaluate the current or a potentially supplemented recreational fishery

Compiling all of the available data collected during tasks in Objectives 2-3 will allow us to answer many of the questions surrounding the likelihood of supplementing or promoting a resident fishery, RFMP section 4.1.3. Understanding what species are present and what they are eating will permit us to hypothesize what, if any, resident fish stocking programs will work. Another possible option may be to promote a current fishery and develop an outreach program to recruit additional anglers (VII. Potential Mitigations Options, M7 2).

Objective 5: Database management, reporting, and outreach

- *Task 1. Entering and proofing data*
- *Task 2. Quarterly and annual reports*
- *Task 3. Conduct public / private presentations when required*

Task 1. Entering and proofing data
Collected data will be twice checked when brought back into the office from the field. Should no deficiencies be immediately detected, the sheets of data will be immediately scanned and the electronic copy kept in specific designated folders within the WDFW LLRT network. Data will

then be entered into Microsoft Excel using an exact function, where data are entered into two separate spreadsheets. A third spreadsheet will contain the exact function that will indicate whether the information between the two data spreadsheets is either true or false. Cells that are flagged as false will be crosschecked against the original data sheets to identify where the problem may exist. Completed data sets will be saved in multiple locations on the network as well as on a portable hard drive to reduce the likelihood of data loss.

Task 2. Quarterly and annual reports

Progress reports will be presented to the Chelan PUD on a quarterly basis if required. These will be non-technical reports but will allow the Chelan PUD to track our progress and address any questions they may have. Annual reports will outline the years' data collections and present analysis to fulfill requirements of sections 4.1.3 and 4.2 of the RFMP. However, multiple years of collections will be required to arrive at any conclusions or propose possible management recommendations.

Task 3. Conduct public / private presentations when required

The need may arise to present our study and or results to the Chelan PUD or a specific public or technical forum. The LLRT understands this possible requirement and given ample notice can perform this task.

V. Timeline and Budget

We have created a flow chart that demonstrates the possible trajectories of the Chelan PUD funded Rocky Reach Project Resident Fish Study (Figure 3). We have developed a sampling timeline that will begin in 2012 (Table 2). A budget estimate is provided for the first sampling period in 2012-2013 (Table 3). With approval from the RRFF, the LLRT will contract with Chelan PUD to complete the sampling period in 2012-2013.

As stated previously in this plan, evaluating the creation of an additional recreational fishing opportunity (section 4.1.3) and evaluating resident fish in the Reservoir focusing on predatory fish (section 4.2) are being combined in this Rocky Reach Project Resident Fish Study. Therefore, the funding levels are also being combined not to exceed $360,000 ($60,000 section 4.1.3 and $300,000 section 4.2) to implement both sections of the RFMP over the term of the Rocky Reach license. The initial one-year investigation budget is estimated to be approximately $85,000 (Table 3.) However, budgeting for studies in out-years is not possible at this time due to the uncertainty of results that will be derived from the initial 2012-2013 investigation and how those results will direct future resident fish investigations. The pathway for future resident fish work is described clearly in Section 4.2: either conduct 2 additional one-year surveys for determining the efficacy of predator control measures if a predator fish problem is identified; or conduct 3 additional one-year monitoring surveys to monitor any changes in abundance or species composition in the resident fish populations in the Reservoir if a predator fish problem does not exist. Results from the initial 2012-2013 investigation will determine which path will be taken in the future. Up to the amount of the funding remaining after the initial investigation will be available to conduct those future investigations.

Table 2. A typical annual timeline for the Rocky Reach Project Resident Fish Study.

Month & Year	Logistical Planning	Electrofishing / Fyke Netting	Popnetting	Data Entry / Reporting
Jan 2012				
Feb 2012				
Mar 2012				
	X			
Apr 2012	X			
May 2012				
	X			
Jun 2012	X			
		X		
Jul 2012		X		
Aug 2012			X	
			X	
Sep 2012				
		X		
Oct 2012		X		
Nov 2012				
Dec 2012				
Jan 2013				
Feb 2013				X
				Report due end of Feb 2013

Table 3. Estimated budget for annual sampling of the Rocky Reach Project Resident Fish Study.
.

	2012-2013
Salaries	44,535.75
Benefits	16,511.99
Salaries + Benefits	*61,047.74*
Travel	1,933.00
Goods and Services	6,140.00
Subtotal	*69,120.74*
Indirect (FY 11=23.32%)	16,118.96
Total	**85,239.70**

VI. Necessary Personnel and Equipment

The LLRT currently has all the necessary gear to complete the tasks. However, certain expendable field materials will need to be purchased on a regular basis. Standard Operating Procedures for water quality monitoring, which are derived from the Washington State Department of Ecology (Ecology), dictate we calibrate the YSI sonde prior to every field-sampling event. Calibration requires approximately $40.00 of standard each session. Additional requirement include intangible items associated with fieldwork such as fuel, field supplies, and travel costs. Personnel necessary to complete this study will include three Scientific Technician II's and a Biologist III currently employed with the LLRT.

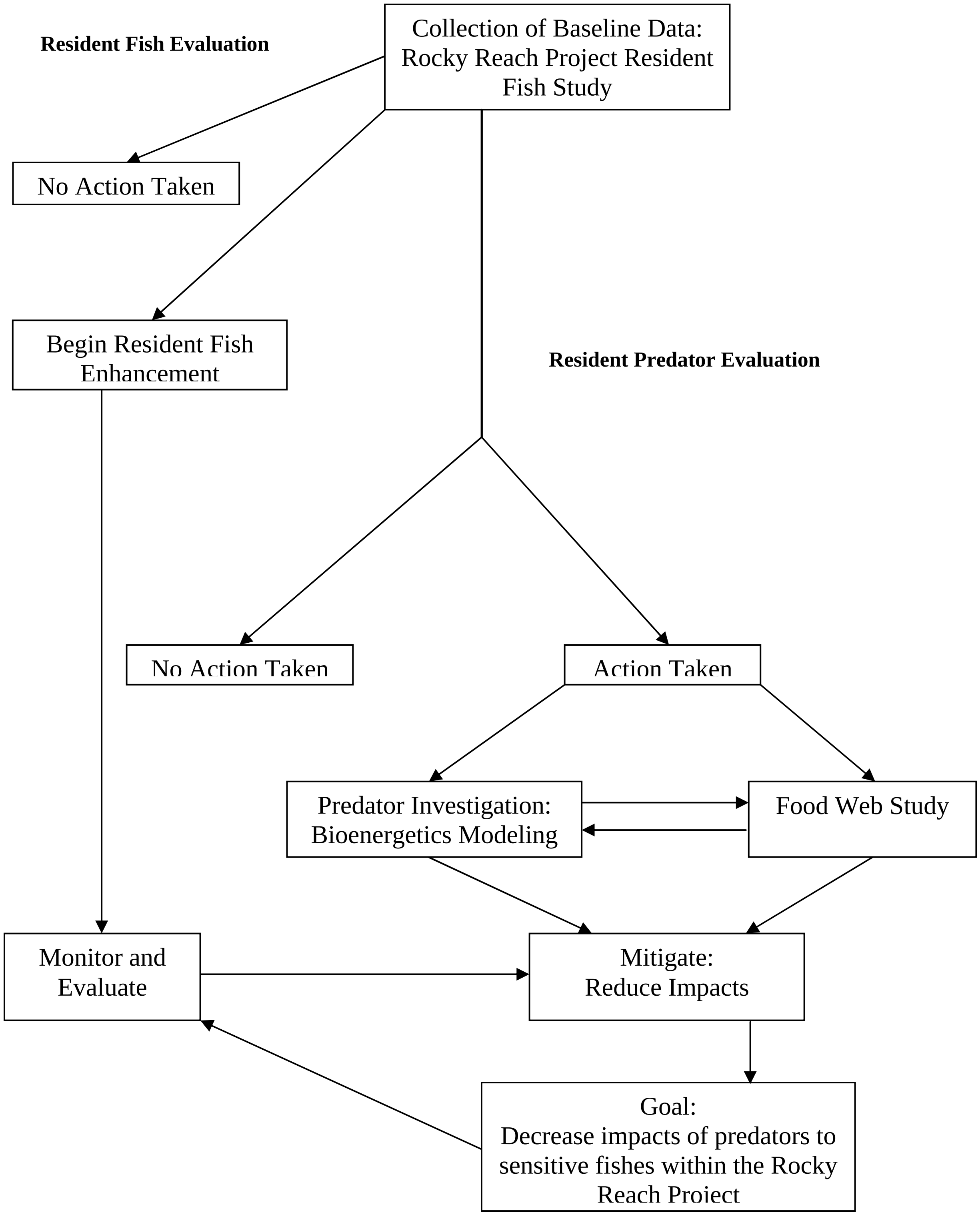

Figure 3. Rocky Reach Project Resident Fish Study flow chart.

VII. Potential Mitigation Options / Outcomes

Results from this study will provide the Chelan PUD with potential management options to increase a resident fishery or improve survival of migratory fishes through the Project. The primary goal and objectives with Art Viola's original study plan have been used to develop the possible mitigation options. Below is a list of possible mitigation actions, although other actions may also become apparent once the collection of data and analysis is conducted.

I. RFMP Section 4.2

a. Predation

M1: Increase northern pikeminnow removal program to include smaller yearling fishes. This may involve mechanical removal using boat electrofishing.

M2: Develop liberal bag limits for deleterious game fish that impact native species.

M3. Identify areas of predator concentrations and promote the fishery. This may include fishing tournaments.

b. Competition

M4: Mechanically remove abundant species that negatively impact sensitive species within the Project.

c. Habitat / Water Quality

M5: Harvest areas of dense aquatic vegetation to improve potentially poor water quality.

d. Long-term Monitoring and Evaluation

M6: Develop a sampling regime designed to monitor the effects of current and additional mitigation programs.

II. RFMP Section 4.1.3

a. Recommend future actions needed to increase angling opportunity for resident fish in the Rocky Reach Reservoir.

M7: 1) Stock an additional game fish species in the Rocky Reach Reservoir that is compatible with existing species in the Reservoir to provide an additional recreational fishing opportunity.

M7: 2) Using collected survey data develop literature for anglers outlining hotspots for selected gamefish in the Project.

VIII. References

Baldwin, C. M, J. G. McLellan, M. C. Polacek, and K. Underwood. 2003. Walleye predation on hatchery releases of kokanees and rainbow trout in Lake Roosevelt, Washington. North American Journal of Fisheries Management 23:660-676.

Beamesderfer R. C. and B. E. Reiman. 1991. Abundance and distribution of northern squawfish, walleyes, and smallmouth bass in John Day Reservoir, Columbia River. Transactions of the American Fisheries Society 120:439-447.

Bonar, S. A., B. D. Bolding, and M. Divens. 2000. Standard fish sampling guidelines for Washington State ponds and lakes. Washington Department of Fish and Wildlife. Report No. FPT 00-28. Olympia, WA.

Burgess, D., K. Simmons, R. Shipley, and T. Gish. 2007. Moses Lake Fishery Restoration Project; Factors Affecting the Recreational Fishery in Moses Lake Washington. 2005-2006 Annual Report, Project No. 199502800, 68 electronic pp. (BPA Report DOE/BP-00029385-2).

Cabana, G. and J. B. Rasmussen. 1994. Modeling food chain structure and contaminant bioaccumulation using stable nitrogen isotopes. Nature 372:255-257.

Diehl, S. 1992. Fish predation and benthic community structure. The role of omnivory and habitat complexity. Ecology 73(5):1646-1661.

Everhart, W. H., and W. D. Youngs. 1981. *Principles of Fishery Science.* 2nd Edition. Comstock Publishing Associates, a division of Cornell University Press. Ithaca, NY. 349 pp.

Griffiths, H. (1998). *Stable Isotopes: Integration of Biological, Ecological and Geochemical Processes*. Herndon, VA; Bios Scientific. 438 pp.

Harvey, C. J. and J. F. Kitchell. 2000. A stable isotope evaluation of the structure and spatial heterogeneity of a Lake Superior food web. Canadian Journal of Fisheries and Aquatic Sciences 57:1395-1403.

Hobson, K. A. 1999. Tracing origins and migration of wildlife using stable isotopes: a review. Oecologia 120:314-326.

Keast, A. 1977. Mechanisms expanding niche width and minimizing intraspecific competition in two centrarchid fishes. Pp. 333-395 *in* Evolutionary Biology, M. K. Hecht, W. C. Steere, and B. Wallace, Eds. Plenum Press, New York, 10:1-500.

Mittelbach, G. G. 1981. Foraging efficiency and body size: a study of optimal diet and habitat use by bluegills. Ecology 62(5):1370-1386.

Morgan, R. P. II, K. J. Killgore, and N. H. Douglas. 1988. Modified popnet design for collecting fishes in varying depths of submersed aquatic vegetation. Journal of Freshwater Ecology 4:533-539.

Newsome, S. D., D. L. Phillips, B. J. Culleton, T. P. Guilderson, and P. L. Koch. 2004. Dietary reconstruction of an early to middle Holocene human population from the central California coast: insights from advanced stable isotope mixing models. Journal of Archaeological Science 31:1101-1115.

NOAA. 1997. Endangered and threatened species: Listing of several evolutionary significant units (ESU's) of West Coast steelhead; final rule. Federal Register 62(159):43937-43953.

NOAA. 1999. Endangered and threatened status for three Chinook salmon evolutionary significant units (ESU's) in Washington and Oregon, and endangered status of one Chinook salmon ESU in Washington; final rule. Federal Register 64(56):14308-14328.

Public Utility District No.1 of Chelan County (Chelan PUD). 1999. Fish presence and habitat use survey summary. Summaries from DE & S and RL & L.

Savino, J. F., and R. A. Stein. 1982. Predator-prey interaction between largemouth bass and bluegills as influenced by simulated, submersed vegetation. Transactions of the American Fisheries Society 111(3):255-266.

Scheaffer, R. L., W. Mendenhall, and L. Ott. 1996. *Elementary Survey Sampling*. 5th Edition. Duxbury Press, Boston, MA.

Zimmerman, M.P. 1999. Food habits of smallmouth bass, walleyes, and northern pikeminnow in the Lower River Basin during outmigration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 128:1036-1054.

IX. Appendices

Appendix 1. Comment s from Art Viola regarding the direction of the study submitted to the Chelan PUD.

One of the goals of the Resident Fish Study is:

Goal: Recommend future actions needed to increase angling opportunity for resident fish in the Rocky Reach Reservoir.

Objective 1. Identify current resident fish species composition and relative abundance to one another.

Tasks: These need to be filled in, but are basically the field sampling already detailed in the draft study.

Objective 2. Describe the present habitats preferred by each resident fish species and if these are different or change with age class, time of year, water temperatures, and water flows, D.O. levels, etc.

Task 1. A literature search.

Task 2. Compare and describe preferred habitats of resident fish sampled in the field with literature derived information.

Objective 3. Describe current forage resources and resource abundance in the reservoir including, phytoplankton, zooplankton, macro-invertebrates.

Tasks: These need to be filled in, but are basically the field sampling already detailed in the draft study.

Task. Compared and describe preferred forage of resident fish sampled in the field with literature derived information.

Objective 4. Describe competition in time and location for forage among current resident fish species, potential future resident fish (stocked) and anadromous species.

Task 1. Compare and describe preferred forage of resident fish sampled in the field with literature derived information.

Objective 5. Describe predation in time and location among present resident fish species, potential future resident (stocked) and anadromous species.

Task 1. A comparison of field survey results with literature derived information.

Objective 6. Based on data collected in the field and literature derive information evaluate if an ecological niche exits capable of supporting the addition (by stocking) of a new resident fish species e.g. (cutthroat, kokanee or some other species) and whether this niche can be occupied without adding excessive competition for forage or predation to the present day assemblage of resident and anadromous fishes.

Task 1. A comparison of field survey results with literature derived information.

Objective 7. Provide a summary of your recommendations of future actions needed to increase angling opportunity for resident fish in the Rocky Reach Reservoir.

Appendix 2. Standard Operating Procedures for Boat/Towing Operations, Safety, and Gear Types Used for Fish Collections.

<u>Boat Operations and Towing</u>

All permanent LLRT personnel are required to complete both the U.S. Department of the Interior's Motorboat Operators Certification Course (MOCC) as well as the Smith-Root, Inc. Principles of Electrofishing class. Operators and crew are required to wear U.S. Coast Guard approved PFD's (type I, II, III, IV) at all times. All LLRT vessels are equipped with mapping GPS; however, operators should not rely on these systems during operations and always be on the lookout for hazards. While operating a vessel with the LLRT it is important that you adhere to the MOCC student manual as well as the Washington State Parks Adventures in Boating Washington Handbook. Prior to trailering a boat, it is the responsibility of the crew to conduct a thorough safety check of both the tow vehicle and trailer.

<u>Safety checklist</u>

Tow Vehicle

- Tire pressure
- Oil
- Coolant
- Lights and indicators

Trailer and Boat

- Safety chain properly secured
- Lights hooked up and operational
- Everything inside vessel is secured
- Boat is secured to trailer
- Tire pressure
- Greased bearing buddies
- Motor up and locked
- Batteries turned off
- Plug is out during trailering

Towing

- Maintain longer distances between yourself and car in front
- Frequently check mirrors and status of boat

Launching Boat

- Do not unstrap and unchain boat until down the ramp
- Make sure plug is in
- Batteries turned on
- Motor lifted and unlocked
- Trailer lights unplugged
- When stopped on ramp leave truck in gear or park and engage parking brake

- When making final launching approach take off seatbelt and open windows for communications between yourself and crew members outside of vehicle

<u>Gear Types used for Fish Collections</u>

GPS coordinates (UTM) for all sampling gears are collected at each location

Adapted from Bonar et al. (2000)

Fyke Nets

4' high, 3/8" diameter aluminum or stainless steel circular hoops with two 25' wings and up to a 100' lead. Mesh size is 0.25".

- Fyke nets should be set perpendicular to shore.
- Nets should be set in the evening/late afternoon before electrofishing starts and retrieved the next morning.
- Record set time and pick up time.
- Try to set the net so the top of the first hoop is no more than about 1 foot under the water's surface.

Electrofishing

18 ft Smith Root 5.0 Generator Powered Pulsator (GPP) electrofishing boat.

- Electrofishing should be conducted with pulsed DC, high range 100-1000 volts, 120 cycles per second.
- Standardize power output of the electrofishing unit based on the specific conductivity of each lake.
- Electrofish starting at each randomly chosen sampling point for 600 seconds as measured by the timer on the electrofishing unit12. Always record on data sheets the actual number of seconds electrofished (e.g., 578 sec, 600 sec, 605 sec, etc.).
- Electrofish in the same direction from the sampling point for all samples.
- Electrofish pedal operations (continuous or intermittent) are at the discretion of the operator, and should be designed to capture the highest number of fish. Use intermittent electrofishing when approaching structure such as beaver lodges, downed trees, docks, and weed patches.
- Stay off the pedal until close to structure, and then hit the pedal.
- A minimum of two dippers and one driver should be in each electrofishing boat.
- Dippers should attempt to net everything, even young-of-year (YOY).
- We have found that catch rates go down if you electrofish the same section over again.
- Make sure that when fish are worked up, they are released back at the start of the section, and not near the end where they can stray into the next section to be electrofished again. Electrofish at night to have the highest catch rates.

LLRT Amendment to Boat Electrofishing Operations

- Low power, 100-500 volts, and 42-48% range at 30 Hz DC. We have found that fishes respond better to and exhibit galvanotaxis more frequently at lower power settings. In addition, the probability of injury is lessened when fish exhibit taxis compared to tetany.

References

Bonar S.A., B.D. Bolding, and M. Divens. 2000 Standard fish sampling guidelines for Washington State ponds and lakes. Washington Department of Fish and Wildlife. Report No. FPT 00-28. Olympia WA.

Morgan, G.E. 2002. Manual of Instructions - Fall Walleye Index Netting (FWIN). Percid Community Synthesis Diagnostics and Sampling Standards Working Group. Cooperative Freshwater Ecology Unit, Department of Biology, Laurentian University. Sudbury, Ontario P3E 2C6. 38 pp.

Appendix 3. Standard Operating Procedures for Boat Electrofishing (specific methods used for Grant PUD funded Priest Rapids Project Study).

Purpose
To provide guidelines for physical capture of predatory fish using an electrofishing boat.

Area of Applicability
For USGS and WDFW LLRT personnel collecting fish using an electrofishing boat for the investigation of predator-prey interactions within the Mid-Columbia River.

Materials Needed
- Electrofishing boat with live wells and depth finder
- GPS receiver
- Fiberglass handled nets, rubber gloves, rubber boots, and PFDs
- Data sheets, pens, field notebook
- Timepiece
- Specific conductivity meter
- Back-up headlamps
- Marine radio and or cell phone

Procedures
1. Prior to electrofishing boat deployment, alert KitCom and Grant Co. dispatch and inform them WDFW LLRT / USGS boats will be conducting research on the Columbia River.
2. Make sure all personnel onboard the electrofishing boat wear rubber boots and PFDs. In addition, netters should wear rubber gloves and use fiberglass handled nets to capture fish.
3. Navigate to selected transect using a GPS receiver and a laptop equipped with GIS software or a paper map with a list of transect coordinates.
    a. Verify that the GPS start point is within the correct reservoir, site strata (i.e. forebay, tailrace, tailrace BRZ, etc.) and depth strata (less than 3 m depth).
    b. If sample point is not in correct reservoir or site strata, randomly select a different site from the provided list of alternate sample points.
    c. If GPS point is onshore or too shallow for electrofishing, move outwards from the GPS start point perpendicular to shore until a depth is reached that can be sampled.
    d. If GPS point is too deep for electrofishing, from GPS start point move perpendicular towards shore until a depth is reached that can be sampled.
    e. Estimate whether the entire electrofishing transect will be within the specified depth strata (less than 3 m). If the entire transect will likely not fit within the specified depth strata, randomly select a different site from the provided list of alternate sample points, such that the entire transect will be within the less than 3 m depth strata. Repeat steps 2a-2d if necessary.
    f. If a GPS site is located such that the crew determines the site is not safe to sample, then the safety issue will be recorded, and a different site from the provided list of alternate sample points will be chosen randomly. Repeat as necessary.

4. Record the following information on the data sheet before electrofishing begins: Outing Start Date (MM/DD/YYYY), Reach & Location (e.g. WM1; Character (C) 1 is reach/Project (R=Rock Island, W=Wanapum or P=Priest Rapids), C2 is location within reach (F=forebay, M=mid, T=tailrace), C3 is 0=BRZ or 1=non-BRZ)), Net #, Start Date/Time (HH:MM in military time), Assigned UTM coordinates, Assigned Depth Strata, Boat Operator, Netters, Temperature (°Celsius [°C]), and Specific conductivity (in microsiemens per cm).
5. At the start of sampling, using the GPS receiver, record the Actual UTM Start (in UTM zone 10N WGS84) on the data sheet.
6. Moving in an upstream direction in waters between 0.5-3 m, perform low-power electrofishing using 50-500 volts and 42-48% range at 30 Hz DC, to produce 1-2 amps. Standardize power output of the electrofishing unit based on the specific conductivity of the water. If fish display severe tetanus, adjust settings to induce taxis and minimize tetanus.
7. Electrofish pedal operations (continuous or intermittent) are at the discretion of the operator, and should be designed to capture the highest number of fish. Use intermittent electrofishing when approaching structures such as beaver lodges, downed trees, docks, and weed patches. Stay off the pedal until close to structure, and then hit the pedal.
8. Never cover the same section that you have electrofished over again, as catch rates decrease.
9. Electrofishing is discontinued in any transect where excessive numbers of salmonid juveniles or adults are incidentally shocked. When adult salmon are encountered, temporarily turn off the electric power allowing the adult to swim free and escape. Non-target species should be counted but not netted.
10. Place netted fish in circulating live wells until they can be processed.
11. At the end of the transect (600 electrofishing seconds) record Actual UTM End, End Date/Time, Effort (the actual number of seconds electrofished - from the boat’s counter), Power (high or low, Hz and % Range), Minimum (Min) Actual Depth (in meters), and Maximum (Max) Actual Depth (in meters).
12. Make sure that after fish are worked up, they are released back at the start of the section, and not near the end where they can stray into the next section to be electrofished again.

Appendix 4. Standard Operating Procedures for Water Quality Data Collection.

Purpose
To provide guidelines for conducting water quality surveys.

Area of Applicability
For WDFW LLRT personnel conducting water quality surveys.

Materials needed
- YSI 6600 V2 Multiparameter Water Quality Sonde, handheld YSI computer and cord
- Secchi disk and line
- Anchor and line
- Bucket
- Static sites
- Data sheets and pencils

Procedures
1. Arrive at specific site using GPS coordinates. Throw anchor and make sure the boat is not moving. Fill bucket 2/3 full of water from the body of water to be sampled. Use the YSI sonde to measure the water quality parameters.
2. Before sampling begins, hold the YSI sonde just below the surface of the water for 40 seconds prior to recording any data to acclimate the YSI sonde and allow it to clean the optic ports. The first reading can then be taken at the surface and then at each meter until the bottom is reached (try not to touch the bottom).
3. Parameters are logged on the handheld YSI computer and recorded on the water quality data sheets (Figure 1). The parameters include depth (m), temperature (°C), specific conductivity (s/cm), dissolved oxygen (mg/L), pH, turbidity (NTU) and chlorophyll (µg/L). Also, record the barometric pressure at the first site.
4. After the last reading is recorded at the bottom of the water column, slowly pull the YSI sonde up and out of the water. Place the YSI sonde in the bucket of water that was previously filled. The bucket should be dumped and refilled periodically throughout the day.
5. Secchi depths are taken at each site. Sunglasses and hats should be removed when taking readings. The Secchi disk is lowered into the water on the shaded side of the boat. Once the disk disappears, pull it back up until it reappears again. Raise the disk up and down until the exact vanishing point is found and record the depth (m) on the data sheet.
6. After all data is recorded and equipment is secured, pull anchor and proceed to the next site.

W.Q. Data Sheet

Page: ____________ Project: ________

Field data check ________

Office data check ________

Bio data check

Date: ________ B.P. ________ Initials: ________

Location	Depth (m)	Temp.	SpC	D.O. mg/L	pH	Turbidity NTU	Chl (µg/L)	Secchi (m)	Zoop. Pull Depth (m)

Calibration date:

Comments

Appendix 5. Calibration Instructions for the YSI 6600 V2 Multiparameter Water Quality Sonde.

Purpose
To provide guidelines for calibration methods to ensure the YSI 6600 V2 Multiparameter Water Quality Sonde is accurate for specific bodies of water.

Area of Applicability
For WDFW LLRT personnel calibrating the YSI 6600 V2 Multiparameter Water Quality Sonde.

Materials needed

- YSI 6600 V2 Multiparameter Water Quality Sonde, YSI computer and cord
- Distilled water
- Known turbidity standard (<0.1, 10, 20, and 40 NTU)
- 4, 7, and 10 pH standards
- Known conductivity solution
- KimWipes®
- Paper towels
- Calibration data sheet

Procedures

1. Fill out a calibration data sheet for the specific body of water to be sampled and gather the proper standards for the calibration.
2. Connect the YSI sonde to the handheld YSI computer with its field cord. Turn on the handheld YSI computer and bring up the calibration menu. Remove the black cap from the calibration cup on the YSI sonde and fill 1/3 of the calibration cup with distilled water. Replace the cap and swish gently to rinse. Empty the distilled water and repeat the rinse step. For the calibration of conductivity and pH, the calibration cup will be attached to the YSI sonde and the probes are pointing up when standards are poured. For the calibrations turbidity, chlorophyll, and dissolved oxygen, the calibration cup is removed from the YSI sonde and inserted so that the probes are now pointing down.
3. On the calibration menu, scroll to the conductivity option and press enter. Choose the SpCond option for specific conductivity and press enter. Enter the value of standard used in this calibration (for most of our water quality surveys we calibrate at 0.5 µm/s). Fill the calibration cup to cover the sensor. Pay close attention that air bubbles are removed from the sensor for an accurate reading. On the handheld YSI computer, press enter to start the calibration and allow some time for the sensor to give an accurate reading. Record this reading in the in the "actual" box on the calibration data sheet and then press the enter key again to calibrate the sensor. A new number should read on the screen. Record this number in the "after calibration" box. The standard should then be transferred into a clean, labeled bottle for benchmarking after the survey is completed. Rinse the calibration cup and sensors with distilled water for the next calibration.
4. Select pH from the calibration menu on the handheld YSI computer. Choose the 3-point calibration option from the menu. Start with the pH 7 standard (press 7 on the numeral keypad). Pour a small amount of the pH 7 standard over the sensor and then swish to

rinse out any existing distilled water and empty. Fill the calibration cup with pH 7 standard to cover the sensor. On the handheld YSI computer, press the enter key and allow some time for the sensor to give an accurate reading. Record the actual reading along with pH MV Buffer reading on the data sheet in the appropriate boxes. Press enter to accept calibration, and record the next readings in the “after calibration” boxes. Once calibration is successful, pour the pH 7 standard into a clean, labeled bottle for benchmarking after the survey is completed. Rinse out the calibration cup with distilled water for the next standard. Repeat step 4 for using pH standards 4 and 10.

5. Next, choose turbidity 3-point calibration on the handheld YSI computer. The calibration will start with a 0 value. To begin, rinse the sensors and calibration cup with distilled water and dry with KimWipes®. Pay close attention to dry between the sensors. The calibration cup should be removed and completely disassembled to dry all parts. Reassemble the calibration cup and pour in a small amount of the <0.1 NTU standard to rinse the calibration cup and the YSI sonde sensors. The calibration cup and instruments must be dried again. Reassemble the calibration cup with the black lid attached to the bottom. Pour <0.1 NTU standard into the calibration cup until it is about 1/3 full. Immerse the sensors carefully into the standard (make sure no bubbles are on the sensor); if the standard does not completely cover the bottom of the sensor add a small amount of <0.1 NTU standard to the calibration cup. Press the enter key to give the actual reading. There will be an option to clean optics; select this for the best calibration results. Once the cleaning is through, record the reading in the in the “actual” box on the calibration data sheet, accept the calibration, and record the reading again in the “after calibration” box on the calibration data sheet. Repeat this process for the next two turbidity calibrations.
6. Rinse the calibration cup and the YSI sonde sensors with distilled water. Choose the chlorophyll option from the calibration menu and then the 1-point calibration from the next menu. Fill the calibration cup 1/3 full with distilled water and immerse the YSI sonde into the calibration cup. Run the optic cleaner to remove any bubbles or debris. Record the actual reading and accept the calibration. Record the next reading also. Empty the distilled water from the calibration cup.
7. Return to the calibration menu and select dissolved oxygen and then %Saturated. Fill the calibration cup 1/3 full with distilled water and set the sensors into the calibration cup. Make sure no water droplets are on the dissolved oxygen membrane and the water level is not touching the membrane. Enter the barometric pressure on the handheld YSI computer located at the bottom of the screen and select enter. Let the meter sit up to ten minutes and then record the actual and calibrated values.
8. Empty the water, replace the wet sponge in the calibration cup, and screw it back onto the YSI sonde. Pack all the components back into the travel bag.
9. Upon return from the water quality sample period, benchmark each standard. Test each standard with the YSI sonde to document the values after the survey. Use distilled water to rinse between each standard. The turbidity samples must be benchmarked with the same procedures as in step 5. The calibration cup and the YSI sonde must be cleaned and dried before each turbidity standard. Each benchmark value should be recoded in the proper space on the calibration data sheet.