2014 RESIDENT FISH ASSEMBLAGE STUDY PLAN
WELLS HYDROELECTRIC PROJECT

FERC PROJECT NO. 2149

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Prepared by:
Public Utility District No. 1 of Douglas County
East Wenatchee, Washington

1.0 INTRODUCTION

In November 2012 the Federal Energy Regulatory Commission (FERC) issued a new Operating License (License) for the Wells Hydroelectric Project (Project). To ensure active stakeholder participation and support during the relicensing process, the Public Utility District No. 1 of Douglas County (Douglas) developed six Aquatic Resource Management Plans in close coordination with agency and tribal natural resource managers (Aquatic Settlement Work Group or Aquatic SWG) as part of an Aquatic Settlement Agreement (Agreement). During the development of these plans, the Aquatic SWG focused on developing management priorities for resources potentially impacted by Wells Dam (Project) operations. Entities invited to participate in the Aquatic SWG include the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), Washington Department of Ecology (Ecology), Washington State Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (Colville), the Confederated Tribes and Bands of the Yakama Nation (Yakama), and Douglas.

The Resident Fish Management Plan (RFMP) is one of the six Aquatic Resource Management Plans required to be implemented under the Project FERC license. Douglas, in consultation with the Aquatic SWG will direct implementation of measures identified within the RFMP to protect and enhance native resident fish populations in the Wells Reservoir. Objective 2 of the RFMP requires Douglas to conduct a study to determine the relative abundance of resident fish species found in the Wells Reservoir in year 2 and every 10 years thereafter during the new license term. The study objectives will focus on (1) identifying whether there have been major shifts in the resident fish populations resulting from the implementation of the White Sturgeon, Bull Trout, Pacific Lamprey, and Aquatic Nuisance Species (ANS) Management Plans, and (2) collecting information on resident predator fish populations found within the Wells Reservoir. Methodology for monitoring species composition shall remain consistent with the methods described in Beak (1999), allowing for comparisons between previous and future resident fish species assemblage studies. Information collected from these monitoring activities may be used to inform the implementation activities of the other Wells Aquatic Resource Management Plans and the Wells Anadromous Fish Agreement and Habitat Conservation Plan (HCP) predator control activities.

2.0 STUDY GOALS AND OBJECTIVES

Consistent with section 4.2 of the RFMP, the primary goal of the 2014 Resident Fish Assemblage Study will be to determine the relative abundance of the various resident fish species found within the Wells Reservoir. Specific objectives of the study include:

1. Collect resident fish abundance data using previously established methods and make comparisons to results of past studies.
2. Collect baseline resident fish abundance data using alternative sampling methods, with focus on species ineffectively sampled by previously established methods.
3. Compare the effectiveness of previously established and alternative sampling methods for individual resident fish species and develop relationships for comparing results among sampling methods.

4. Use established and alternative sampling methods to determine the abundance and distribution of non-native predator species (walleye, smallmouth bass, and largemouth bass), and native predators (northern pikeminnow and burbot).

3.0 BACKGROUND

3.1 Resident Fish Species

The resident fish assemblage present in the Wells Reservoir is composed of a diverse community of native and introduced, warm and cold-water, and sport and non-sport fish species. Since the construction of Wells Dam several studies have either directly (McGee 1979; Beak 1999) or indirectly (Dell et al. 1975; Burley and Poe 1994) addressed the resident fish assemblage in the Wells Reservoir.

3.1.1 Project Resident Fish Assessments

Many studies in the upper and middle Columbia River have commented either directly or indirectly on resident fish assemblage. For example, during a study assessing the occurrence of gas bubble disease in fish in the mid-Columbia River reservoirs, Dell et al. (1975) observed that the most abundant resident fish species in the Wells Reservoir were suckers (*Catostomus* spp.) northern pikeminnow (*Ptychocheilus oregonensis*), and redside shiners *(Richardsonius balteatus).* These researchers also determined that bluegill (*Lepomis macrochirus)* and pumpkinseed (*Lepomis gibbosus*) were the most abundant resident sport fish, although these two species accounted for less than two percent of the total 32,289 fish sampled. Overall, 27 species of resident and migratory fish were identified in the study area (Table 2.1-1).

Table 2.1-1 Native and non-native resident fish species that have been documented in the Wells Reservoir from past resident fish assessments, monitoring efforts, and miscellaneous studies (Dell et al. 1975; McGee 1979; Burley and Poe 1994; Beak 1999; NMFS 2002; BioAnalyst, Inc. 2004).

Native Species	Non-Native Species
White sturgeon *Acipenser transmontanus*[*]	Carp *Cyprinus carpio*
Chiselmouth *Acrocheilus alutaceus*	Black bullhead *Ictalurus melas*
Longnose sucker *Catostomus catostomus*	Brown bullhead *Ictalurus nebulosus*
Bridgelip sucker *Catostomus columbianus*	Pumpkinseed *Lepomis gibbosus*
Largescale sucker *Catostomus macrocheilus*	Bluegill *Lepomis macrochirus*
Prickly sculpin *Cottus asper*	Smallmouth bass *Micropterus dolomieu*
Threespine stickleback *Gasterosteus aculeatus*	Largemouth bass *Micropterus salmoides*
Burbot *Lota lota*	Yellow Perch *Perca flavescens*
Peamouth *Mylocheilus caurinus*	Black crappie *Pomoxis nigromaculatus*
Rainbow trout *Oncorhynchus mykiss*	Walleye *Sander vitreus*
Mountain whitefish *Prosopium williamsoni*	Tench *Tinca tinca*
Northern pikeminnow *Ptychocheilus oregonensis*	Lake whitefish *Coregonus clupeaformis*
Redside shiner *Richardsonius balteatus*	
Dace Rhinichthys spp.	
Bull Trout *Salvelinus confluentus*[*]	

[*] Individual management plans for both white sturgeon and bull trout have been developed and as such, they are not addressed in this Resident Fish Management Plan.

McGee (1979) noted that chiselmouth (*Acrocheilus alutaceus*), redside shiners, and largescale suckers (*Catostomus macrocheilus*) were the most abundant non-sport fish captured during Wells Reservoir surveys while pumpkinseed were the most abundant sport fish caught. Similar sampling design and methodology to the 1974 study (Dell et al. 1975) were employed to ensure that results of the study were comparable with past observations. In total, 2,480 fish were collected during the study using live traps, beach seines and angling. Twenty of the 27 known species previously trapped in other mid-Columbia reservoirs (Dell et al. 1975) were captured in the Wells Reservoir during the study.

In 1998, Douglas conducted an updated Wells Reservoir resident fish assessment (Beak 1999). Again, an effort was made to implement a sampling design similar to the two previous studies (1974 and 1979) to allow comparisons with past results. In total, 22 species of fish were identified with 5,657 fish captured using beach seines and 716 fish observed via diving transects. Beak (1999) reported suckers as the most abundant resident fish captured in beach seining sampling in the Wells study area. These species represented 41% of the beach seining catch and 46% of the underwater diver survey count. Other abundant species in the beach seine catch were bluegill (32%), northern pikeminnow (10%), peamouth (*Mylocheilus caurinus*) (6%), and carp (*Cyprinus carpio*) (5%). Fifteen other species represented the remaining 7% of the total catch of 3,783 fish.

3.1.2 Recreational Fish Species

A number of species of fish with recreational value are either known to exist in the project or are suspected to be present in low numbers. These species are of particular interest given their recreational value. Many of these species are native, while others are considered non-native originating from above Wells Dam or at one time stocked into the project waters. These recreational fish species are summarized below.

Burbot

Burbot (*Lota lota*) are the only freshwater member of the cod family. They are native to Washington State and are found in several lakes in the Columbia River Basin and have also colonized the reservoirs of the Columbia River as dams were constructed. Burbot typically inhabit deep water and are most active at night. Burbot are predatory, feeding on invertebrates as juveniles with fish becoming an increasingly important part of their diet as they reach larger sizes. Spawning occurs during late winter and early spring in shallow bays of lakes and rivers over sand or gravel bottom (Wydoski and Whitney 2003). Burbot are classified as a Washington sport fish with limited recreational harvest occurring in some waters.

Kokanee

Landlocked sockeye (*Oncorhynchus nerka*), known as kokanee are a native fish which occur in several lakes in the mid and upper Columbia basins including Lake Wenatchee, Lake Chelan, Lake Osoyoos, and Lake Roosevelt. Although previous resident fish assessments have not detected the presence of this fish species in the Project, anecdotal information exists indicating that low numbers of kokanee may be present in the Project. These fish likely originate from Lake Roosevelt, above Grand Coulee Dam, and during periods of high spring flow are displaced downstream through Grand Coulee and Chief Joseph dams and into the Wells Reservoir.

Largemouth Bass

Largemouth bass (*Micropterus salmoides*) were widely introduced in Washington State in the late 1800s (Wydoski and Whitney 2003). They are listed as a priority species in Washington State because of their vulnerability to habitat loss or degradation and their recreational importance (WDFW 2002). Largemouth bass prefer clear water habitat with mud and sand substrates, which is best suited for aquatic vegetation production (Wydoski and Whitney 2003). Largemouth bass are known to inhabit the lower 10 miles of the Okanogan River and the Columbia River immediately adjacent to the mouth of the Okanogan River. Little is known about the behavior of largemouth bass in the Wells Reservoir as they were infrequently captured during past resident fish studies (Beak 1999; Duke 2001; Burley and Poe 1994).

Mountain Whitefish

Mountain whitefish (*Prosopium williamsoni)* are assumed to occur in all small-order tributaries to the Methow, Okanogan, Wenatchee and Entiat rivers, and in larger lakes throughout the Columbia River Basin. They are also believed to occur in the mainstem reservoirs, although their behavior patterns are not known. They mostly inhabit riffles in summer and large pools in

winter (Wydoski and Whitney 2003). Spawning typically occurs from October through December, generally in riffles, but also on gravel shoals of lake shores. Mountain whitefish feed primarily on instar forms of benthic aquatic insects, although they also occasionally eat crayfish, freshwater shrimp, leeches, fish eggs and small fish. In lakes, they feed extensively on zooplankton, particularly cladocerans. There is evidence that mountain whitefish still spawn in the lower reaches of some tributaries (NMFS 2002). Mountain whitefish appear to use the Wells Reservoir principally as a migration route between spawning areas in the Methow River and the Wells Dam tailrace (Zook 1983).

Northern Pikeminnow

Northern pikeminnow are a slow-growing, long-lived predator native to the Columbia River Basin. In summer, adult northern pikeminnow prefer shallow, low velocity areas in cool lakes or rivers. During the winter, they use deeper water and pools (Scott and Crossman 1973). Spawning occurs during the summer, in shallow water areas with gravel substrate. Pikeminnow tend to concentrate in tailrace areas downstream of mainstem dams during the juvenile salmonid migration period, holding in relatively slow-moving water areas (less than about 3 feet per second) near passage routes (NMFS 2002). Due to their large numbers and distribution throughout the Columbia River Basin, northern pikeminnow are considered to pose the greatest predation threat to migrating juvenile anadromous salmonids (NMFS 2002). Since 1995, Douglas has implemented a pikeminnow removal program. Since 2004, this program has been a requirement of the Wells HCP. Removal efforts have taken approximately 250,000 from Wells Dam tailrace during the past 10 years of fishing.

Redband Rainbow Trout

Redband rainbow trout (*Oncorhynchus mykiss gairdneri*) are native interior rainbow trout. The resident form remains in freshwater its entire life and the anadromous form migrates to the ocean and is referred to as a steelhead. The life history of rainbow trout appears to be plastic, with some resident forms becoming anadromous, and some offspring of anadromous fish becoming resident (Peven 1990). Resident rainbow and juvenile steelhead are not distinguishable from each other until the steelhead undergo smoltification. The mid-Columbia River tributaries contain a mixture of resident rainbow and ocean-migrating steelhead. Resident rainbow trout are likely present in low numbers in the Wells Reservoir. During the 1998 resident fish assessment, rainbow trout consisted of 0.05% of the relative catch (Beak 1999).

Smallmouth Bass

Smallmouth bass (*Micropterus dolomieu*) are a non-native sport fish that have inhabited the mid-Columbia River reach since at least the 1940s. Preferred habitat for this species includes rocky shoals, banks, or gravel bars. Adult smallmouth bass in the mid-Columbia River are most abundant around the deltas of warmer tributary rivers. In the Wells Reservoir, smallmouth bass are typically found in the lower Okanogan River and the confluence of the Okanogan and Columbia rivers (Beak 1999). They are also abundant upstream of Wells Dam in Lake Roosevelt and in Lake Osoyoos.

Smallmouth bass were the second most abundant predator species captured in the mid-Columbia River during predator assessment sampling conducted in 1994. They were most frequently captured from the forebay sampling sites (Burley and Poe 1994). Similar relative abundance estimates of smallmouth bass were observed in recent sampling programs in other mid-Columbia River reservoirs (Beak 1999; Duke 2001). They are a significant fish predator species in the Columbia River, and are known to prey on juvenile salmonids among other forage items. In the 1994 predator assessment, fish composed 87% of the smallmouth bass diet, with salmonids consisting of 11% of the prey fish.

Walleye

Walleye (*Sandervitreus*) are a cool-water, piscivorous sport fish believed to have moved downstream into the mid-Columbia River reach from a population established for recreational fishing in Lake Roosevelt and Banks Lake in the late 1950s (Zook 1983). They were the least abundant predator species captured in the mid-Columbia River in 1994 (Burley and Poe 1994). They are listed as a priority species in Washington State because of their vulnerability to habitat loss or degradation and their recreational importance (WDFW 2002).

Walleye occur throughout the mainstem reservoirs but are not typically found in the tributaries. Although suitable spawning habitat appears to be plentiful in the mid-Columbia River, peak summer temperatures in this section of river are suboptimal and appear to restrict the recruitment of subyearling walleye to the yearling age class (Zook 1983). Recruitment of walleye into the mid-Columbia River reservoirs is suspected to result from the entrainment of young fish through Grand Coulee and Chief Joseph dams during spring run-off (Zook 1983).

3.1.3 Other Resident Non-sport Species

Resident non-sport species make up the bulk of the fish biomass in the Wells Reservoir. Many of these species are native to the Wells Reservoir, including chiselmouth, peamouth chub, redside shiner, largescale sucker, bridgelip sucker (*C. columbianus*), longnose sucker (*C. catostomus*), prickly sculpin (*Cottus asper*), threespine stickleback (*Gasterosteus aculeatus*), and dace species (*Rhinichthys spp.)* (See Table 2.1-1). Currently, no management actions or active fisheries for these species occur.

4.0 STUDY METHODS

A variety of sampling methods will be used to achieve the study objectives. Due to the reliance of past studies on beach seining, and SCUBA and snorkel observations as primary sampling methods, these methods will again be employed to allow for appropriate comparisons of results. To address possible data gaps for individual species due to sampling gear bias or inefficiency, methods such as boat electrofishing and fishing baited set-lines will also be used.

4.1 Sample Sites and Timing

4.1.1 Sampling locations

Sampling sites will be stratified into five sampling zones. (Figure 1):

1. Wells Forebay – from the face of Wells Dam upstream to the confluence of the Methow River.
2. Pateros-Brewster – from the confluence of the Methow River to the highway 173 bridge in Brewster including the Methow River to the Project boundary at river mile (RM) 1.5.
3. Brewster-Bridgeport Bar – from the highway 173 bridge in Brewster to just upstream of Bridgeport bar at RM 540.
4. Okanogan River – the Okanogan River from the mouth upstream to the Project boundary at RM 15.5.
5. Chief Joseph Tailrace – from RM 540 to the boat restricted zone below Chief Joseph Dam.

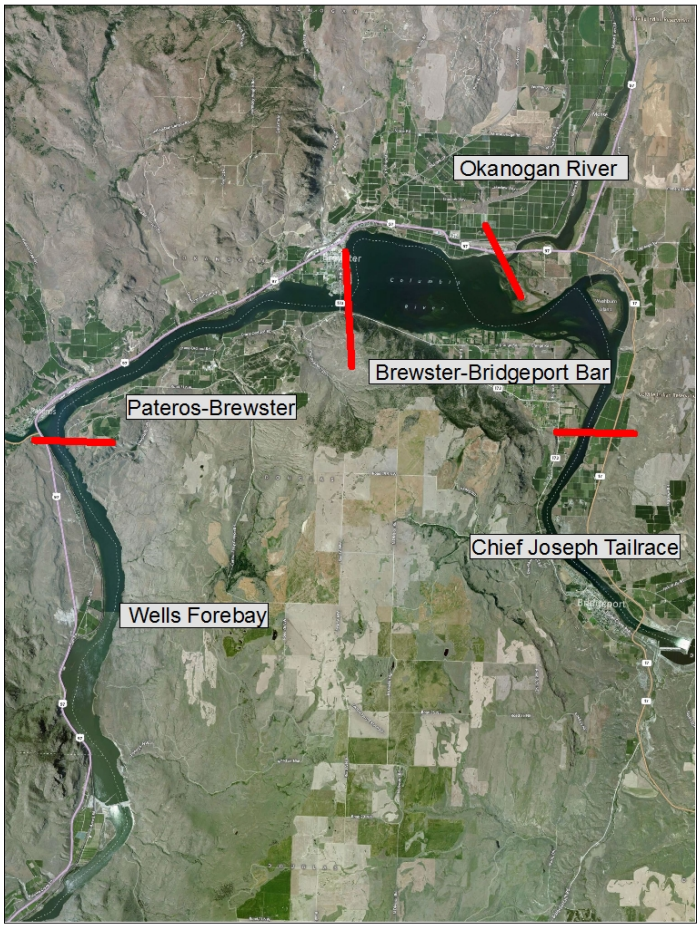

Figure 1. Map of resident fish sampling zones in the Wells Project.

The greatest sampling effort will be focused in the Brewster-Bridgeport Bar zone, where the greatest sampling effort took place in previous resident fish investigations. Specific sample sites in each zone will be in the same general locations sampled by Beak (1999). Information on sampling site characteristics will be collected at each site. The information collected will include: depth, water temperature, Secchi depth, bottom substrate type, presence of aquatic macrophytes, and presence of woody debris.

4.1.2 Seasonal and diel timing of sampling

The most recent resident fish investigation in the Wells Project (Beak 1999) was conducted during the months of August and September. This study will also focus sampling during these months, except when targeting burbot which are sampled most effectively in the late winter and early spring. Previous studies using beach seines and diver observations focused sampling during the night and crepuscular periods. Beach seines and diver observations will again be used during these periods. Other sampling methods may also focus on night time hours, however time of sampling may be dependent on the type of sampling gear employed.

4.2 Sampling Methods

4.2.1 Beach seining

Beach seining will be the primary sampling method used during the study in order to make comparisons to results from previous investigations. The specifications of the beach seines will match those used by Beak (1999):

Length	100 feet
Bag Dimensions	10 feet x 10 feet x 10 feet
Panel Depth	6 feet
Mesh	Knotless ¼ inch stretch
Float Spacing	18 inches

Beach seines will be deployed from the bow of a boat with one end attached to shore. The end of the net attached to the boat will be pulled ashore and any fish captured will be quickly removed from the net bag and placed in aerated holding containers filled with fresh water. Captured fish will be identified to species and enumerated. Total length (mm) and weight (g) measurements of each fish will also be taken. For non-sport non-predator species captured in large numbers (>500 per sample) (i.e. stickleback, shiners, etc.) numbers may be estimated and no length and weight measurements taken.

Consistent with sampling efforts of Beak (1999), approximately 50 sites throughout the reservoir will be sampled by beach seine. At least 25 of the sites sampled by beach seines will be within sampling zone 3 (Brewster-Bridgeport Bar). Sample sites will be selected using generalized random tessellation stratified design (GRTS) to ensure a spatially balanced sample.

4.2.2 SCUBA/snorkel diver observations

Underwater diver observations will be conducted in conjunction with beach seining. Underwater diver observations will take place within 400 feet of each of the beach seining locations. Divers will be equipped with SCUBA or snorkeling gear and at least one underwater high-powered light and a clipboard for recording observations. Divers will swim transects parallel to shore at a consistent depth within the sampling depth of the beach seine (approximately 10 ft) and again at a depth greater than 15 ft. The number of each fish species observed will be recorded along with the total length of each transect along with the site characteristics listed above in Section 3.1.1.

Consistent with the sampling efforts of Beak (1999), underwater diver observations will be conducted adjacent to approximately 50% of beach seine sampling sites in each sampling zone and will be randomly selected from the pool of beach seine sites.

4.2.3 Boat electrofishing

Boat electrofishing will be used to sample littoral areas where beach seine and diver observations are conducted in addition to other areas that cannot be effectively sampled by those methods. Boat electrofishing sampling will occur adjacent to approximately 25% of the beach seine sample sites in each zone, except in the Okanogan River zone where additional sample sites will be selected using GRTS. Electrofishing sampling will follow the methods outlined in the Washington Department of Fish and Wildlife Standard Fish Sampling Guidelines for Washington State Ponds and Lakes (WDFW 2000). Sampling sites that are selected will serve as the starting point of the electrofishing session. A boat mounted electrofishing unit with power settings standardized to water conductivity for each sampling area will be used to immobilize and collect fish. Two technicians at the bow of the boat will use long handle dip nets to collect immobilized fish and place them into an aerated live well onboard. Each boat electrofishing sampling occasion will consist of approximately 600 seconds of effort, as recorded by the electrofishing unit, beginning at the selected start point and moving upstream while thoroughly sampling the available habitat. The total sampling effort time will be recorded along with start and end locations. All fish collected will be identified to species, enumerated and have total length (mm) and weight (g) measurements taken. Fish will be checked for fin clips, and any other marks or tags.

4.3 Predator Species of Interest – Burbot, Smallmouth Bass, Northern Pikeminnow, and Walleye

Burbot

Large numbers of adult burbot were observed as bycatch during northern pikeminnow removal efforts in 2012 and 2013 in the Wells Reservoir (Jerald 2013). The numbers observed are dramatically higher than previously encountered during prior pikeminnow removal efforts. Burbot are a native cold-water predator species known to inhabit the upper Columbia River and have previously been documented in the Wells Reservoir. Douglas staff suspects that high spill events at Grand Coulee and Chief Joseph Dams in 2011 and 2012 displaced burbot from Lake Roosevelt into the Wells Reservoir. Other theories include the potential that the gradual reduction in pikeminnow abundance has resulted in higher recruitment success for young-of-the-

year burbot. Past resident fish investigations have failed to record meaningful numbers of adult burbot, possibly due to sampling bias associated with the methods used.

Smallmouth Bass

Little information is available on the abundance of smallmouth bass in Wells Reservoir. Low numbers of the species were observed in previous resident fish investigations; however, a limited recreational fishery exists in the vicinity of the Okanogan River confluence and upstream to the Project boundary at RM 15.5. Smallmouth bass populations have flourished in the lower Columbia River near John Day Dam especially with efforts dedicated to reducing northern pikeminnow (Carey et al. 2011). Researchers suspect that these fish have a measureable impact on young native salmonids. Consistent with the goals and objectives of the RFMP, Douglas intends to gather more data on smallmouth bass distribution and relative abundance in the Wells Reservoir to monitor their abundance over the course of the new license. Focused sampling within and near the mouth of the Okanogan River will be used to develop a more precise abundance estimate of smallmouth bass in those areas.

Northern Pikeminnow

Northern Pikeminnow are the most abundant predator in the Wells Reservoir based on the most recent resident fish assemblage monitoring efforts (Beak 1999). Ongoing pikeminnow removal efforts in the Wells Project have shown a steady decline in catch per unit effort (CPUE) for set-line caught pikeminnow (Jerald 2013). While results of the removal program suggest a downward trend in relative abundance of northern pikeminnow, these efforts are not designed for estimating the distribution and abundance of the species throughout the reservoir. Mark-recapture methods will be employed in 2014 in an attempt to improve the precision of abundance estimates of northern pikeminnow in the Wells Reservoir and better describe their distribution.

Walleye

The results of previous resident fish investigations, along with the limited number incidental encounters during sampling as part of other fisheries activities, suggest that low numbers of walleye are present in the Wells Reservoir. Some recreational angling effort takes place for walleye in a limited number of locations, but walleye are not thought to be widely distributed throughout the reservoir. No sampling will specifically target walleye in 2014; however, walleye are susceptible to capture by the methods employed during the general resident fish assemblage sampling. If a greater abundance of walleye is observed in 2014 than in previous investigations, or patterns of walleye distribution emerge, more targeted sampling of this species may be warranted in the future.

4.3.1 Methods for estimating burbot abundance

In an effort to better characterize the burbot population in Wells Reservoir, baited set-lines will be used to target burbot. Sample sites will be selected using GRTS. Six sites in each sampling zone (except the Okanogan zone) will be sampled for burbot. Each site will be sampled at least six times in February, March, and April. Captured burbot will have total length (mm) and weight (g) measurements taken and will be marked with an individually numbered Floy® T-bar

anchor tag below the dorsal fin and a passive integrated transponder (PIT) implanted into the body cavity. Any other fish captured using burbot sampling methods will be identified to species, enumerated, have total length (mm) and weight (g) measurements taken, and be released. Tagged burbot that are recaptured will have tag, temporal and spatial information recorded then released. If sufficient numbers of tagged burbot are recaptured a mark-recapture abundance estimate will be calculated.

4.3.2 Methods for estimating smallmouth bass abundance

Smallmouth bass will be sampled in concurrence with the other general resident fish sampling methods, and also by recurring electrofishing sampling at 10 sites in the Okanogan River Zone and in the Columbia River near the mouth of the Okanogan River. Three sampling sessions will be conducted in July, August, and September. The same electrofishing sampling methods used to sample general resident fish sampling sites will be employed to sample additional smallmouth bass sampling sites. Smallmouth bass that are captured will have total length (mm) and weight (g) measurements taken and will be marked with an individually numbered Floy® T-bar anchor tag below the dorsal fin and have a PIT tag implanted then be released. Recaptured smallmouth bass will have total length (mm) and weight (g) measurements taken and have their tag information recorded and be released.

4.3.3 Methods for estimating northern pikeminnow abundance

Northern pikeminnow relative abundance will be estimated for each sampling zone using beach seining, diver observation and electrofishing as part of general resident fish sampling. In addition, the northern pikeminnow removal program will continue in the Wells Project in 2014. Total catch and CPUE from baited set-lines used in pikeminnow removal efforts will be compared to previous year's efforts and with the other sampling techniques employed in 2014. To obtain a mark-recapture abundance estimate, pikeminnow captured during burbot sampling using baited set-lines will be marked with individually numbered Floy® T-bar anchor tag below the dorsal fin and have a PIT tag implanted then be released alive at the location of capture. Recaptured northern pikeminnow will have the tag information collected as well then be released.

4.3.4 Summary of Sampling Effort

Sampling Method	Number of Sites	Frequency	Total Effort (days)
Beach Seine	44	Once Aug-Sept	15
Diver Observation	22	Once Aug-Sept	10
Boat electrofishing	15	Once Aug-Sept	5
Boat electrofishing (additional Okanogan Zone)	10	3 times July, Aug, Sept	15
Set lines	24	6 days Feb, Mar, Apr	18

4.3.5 Non-target Fish Species of Concern

ESA-listed steelhead, spring Chinook, and bull trout are known to inhabit the Wells Reservoir, while it is unlikely that these species will be encountered during resident fish sampling, Douglas holds the appropriate permits regarding the incidental capture or harassment of these species and will employ proper fish handling techniques if they are encountered. Any encounter with ESA-listed species during the course of the study will be documented and reported to the appropriate regulating agency in accordance with the permits.

Douglas is actively monitoring the presence of white sturgeon in the Wells Project area. Any sturgeon captured or observed during the resident fish sampling will be examined for scute markings. If captured, PIT tag codes will be recorded and a length measurement taken. Sturgeon seen during visual surveys will be noted, and scute pattern identified if possible. The location of each sturgeon captured will also be recorded.

5.0 DATA ANALYSIS AND REPORTING

5.1 Data Analysis

5.1.1 Comparisons to previous studies

CPUE of each resident fish species for each sampling method will be calculated. The total and relative abundance of each species along with CPUE for beach seine and diver observation methods will be compared to the result of the Beak (1999) resident fish investigation. Using appropriate statistical methods, comparisons will be made for the entire study area and for each of the sampling zones defined in the study where sampling zone is used as an independent variable. In addition to comparisons of abundance indices, comparisons of size distributions for each species will also be made depending on sample size.

5.1.2 Sample method comparisons

Total catch, relative abundance, and CPUE will be compared among sampling methods for each species. Comparisons will be made at the entire study area scale and at the sampling zone scale. When possible, comparisons will also be made at individual beach seining/diver observation sample site level or if appropriate, by pooling data of adjacent sites. Using appropriate statistical methods, relationships between the established beach seine and diver observation and each alternative method used will be described. The analysis will be used to develop predictive curves for sample methods to determine if alternative methods, which may be more effective, can be used in future resident fish studies while still maintaining accurate comparisons to data from previous studies.

5.1.3 Burbot, smallmouth bass, and northern pikeminnow

In addition to total catch and relative abundance, if data are sufficient, an abundance estimate for burbot, smallmouth bass, and pikeminnow will be calculated. The size structure of populations of each species will also be analyzed.

Sampling for burbot, smallmouth bass, and pikeminnow is designed to collect data to be used to model the abundance of each species. If sufficient data are available a mark-recapture abundance estimate will be calculated using a model such as the robust design which combines the features of both closed and open population models. This design involves a long-term study consisting of primary periods, each of which comprised of shorter interval secondary samples (Pollock 1982; Kendall et al. 1997). If data are not sufficient to estimate abundance with the robust design, other less data intensive methods may be used.

5.2 Reporting

A report summarizing the results of the 2014 Resident Fish Assemblage Study will be provided to the Aquatic SWG no later than December 31, 2014. The report will also include a map of resident fish species distribution and relative abundance in the Wells Project.

6.0 REFERENCES

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