Grant County
PUBLIC UTILITY DISTRICT

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April 10, 2018

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12
888 First Street, N.E.
Washington, D.C. 20426

RE: Priest Rapids Hydroelectric Project No. 2114 License Compliance Filing – Article 401(a)(13) – Native Resident Fish Management Plan Priest Rapids Project Survey and Year 10 Biological Objectives Status Report

Dear Secretary Bose,

Please find enclosed Public Utility District No. 2 of Grant County, Washington (Grant PUD) Native Resident Fish Management Plan Priest Rapids Project Survey and Year 10 Biological Status Report consistent with the requirements of Article 401(a)(13) of the Priest Rapids Project License[1] and the Washington State Department of Ecology 401 Water Quality Water Quality Certification Condition of 6.2(5)(b) and 6.2(5)(d) for the Priest Rapids Project (Project).

This report is a culmination of activities included in the Native Resident Fish Management Plan and related to resident fishes within the Priest Rapids Project beginning in 2008. On February 5, 2018, Grant PUD prepared and disseminated the draft Native Resident Fish Management Plan Priest Rapids Project Survey and Year 10 Biological Status Report to members of the Priest Rapids Fish Forum; including National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Department of Fish and Wildlife, Colville Confederated Tribes, Yakama Nation, the Bureau of Indian Affairs, the Confederated Tribes of the Umatilla Indian Reservation, Wanapum Indians and Grant PUD.

No comments were received by the consulting parties during the review process. A letter of approval for the final plan was received from Washington Department of Ecology on March 9, 2018, and is included in this filing (Appendix F).

[1] 123 FERC ¶ 61,049 (2008)

Federal Energy Regulatory Commission staff with any questions should contact Tom Dresser at 509-754-5088, ext. 2312.

Sincerely,

Ross Hendrick
Manager - License & Environmental Compliance

CC: Breann Zimmerman – WDOE
Priest Rapids Fish Forum

2017
Native Resident Fish Management Plan
Priest Rapids Project Survey and 10 Year Biological Objectives Status Report

Priest Rapids Hydroelectric Project (FERC No. 2114)

Prepared for:
Public Utility District No.2 of Grant County
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Large Lakes Research Team
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Washington Department of Fish and Wildlife, Region 2

April 2018

Executive Summary

In 2008, Public Utility District No. 2 of Grant County, Washington (Grant PUD) received a new Federal Energy Regulatory Commission (FERC) license for the Priest Rapids Project (Project). Under the FERC License Article 401(a)(13) and the Washington Department of Ecology (WDOE) 401 Water Quality Certification [6.2 (5)(b)], Grant PUD was required, in consultation with the Priest Rapids Fish Forum (PRFF), to develop and submit for approval a Native Resident Fish Management Plan (NRFMP) within one year of issuance of the New License. Included in the NRFMP is a provision to evaluate the community structure, presence, relative abundance, and distribution of fishes in the Priest Rapids Project using a sampling method known as the index of biotic integrity (IBI) created by Karr (1981). Biotic integrity is defined as "the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region" (Karr and Dudley 1981). The IBI is designed to assess biotic integrity directly through 12 attributes of fish communities in streams called community metrics (e.g. species richness and composition, trophic composition, fish abundance, condition, etc.) (Fausch et. al. 1984). The goal of the NRFMP is to detect the presence or absence of large–scale changes in population attributes of the resident native fish species present in the Project.

In 1999, Grant PUD contracted with Parametrix, Inc. and the University of Idaho to conduct a resident fish study to identify and evaluate fish species present in the Project. Data obtained in the study were used to inform management-based decisions during Grant PUD's relicensing process for the Project (Pfeifer et al. 2001). More recently, resident fish data collected by the Washington Department of Fish and Wildlife's (WDFW) Large Lakes Research Team (LLRT) during 2009–2010 were collected as part of a cooperative research effort with the U.S. Department of the Interior, U.S. Geological Survey (USGS) to evaluate the effects of native and introduced predatory fish on migrating juvenile salmon and steelhead. During sampling, all species of resident fish were collected and processed. However, since the objective of the research study focused on predators, collection of these species (e.g., Smallmouth Bass, Walleye, and Northern Pikeminnow) was emphasized over other resident fish. As such, relative abundance of predator species may be biased in the overall resident fish species composition in 2009–2010. Therefore, sampling was conducted again in 2012 by the LLRT to (1) satisfy requirements specified in the NRFMP (sampling every five years beginning in 2012 to accommodate the 5-year report timeframe); and (2) to ensure non–species specific targeting goals compared to sampling in 2009–2010. The LLRT compared only nocturnal boat electrofishing data collected during the baseline 1999 study with data collected in 2009–2010 and 2012, though other collection methods were used to sample resident fishes in 1999 and 2009–2010. A resident fish survey was also conducted by the LLRT in 2017 to mimic efforts of the 2012 survey.

Comparing resident fish assemblage among the 2009–2010, 2012, and 2017 sampling periods to the baseline resident fish survey in 1999 (Pfeifer et. al. 2001) indicates little change comparatively using IBI results. Minor differences in the community metrics scores among the three sample periods was observed for the number of insectivores captured during the 2009–2010 sampling period, which brought the overall IBI score to 46, characterized as "Good–Fair". This was a result of the higher percent of omnivores, specifically, Sucker spp. In 2009–2010 the sampling area included sections below Priest Rapids Dam that were not sampled in 1999 or 2012. Over 55% of the fish captured in 2009–2010 below Priest Rapids Dam consisted of Sucker

spp. (>1,700). During the 2012 and 2017 sampling periods, the IBI score was identical to the initial resident fish survey in 1999, and received a score of 48 or “Good”.

In 2009–2010, approximately 94% of the fish captured were of native origin and 6% were introduced, compared to 97% native and 3% introduced in 1999; 96% native and 4% introduced for results in 2012 and 2017, comparatively. In 2009–2010, species composition of Smallmouth Bass (4%) and Walleye (0.3%) was higher than in 1999, 2012, and 2017. Species composition of Smallmouth Bass (2%) and Walleye (0.1%) was the same in 1999 (Pfeifer et al. 2001), 2012 and 2017, approximately half that sampled during 2009–2010 surveys. The difference between the 2009–2010 sampling period and the 1999, 2012, and 2017 surveys can be attributed to potential sampling bias in 2009–2010 where the primary objective was to target predatory fish. It is likely that the predator–specific nature of the survey contributed to the higher percentage of introduced fish captured, since species composition of introduced fish other than Smallmouth Bass and Walleye did not change noticeably. Decreased numbers of Redside Shiners and increased numbers of Northern Pikeminnow captured in 2009–2010 compared to the 1999 survey were also likely a result of the predator–specific nature of the 2009–2010 surveys, rather than an indication that Redside Shiner abundance decreased or Northern Pikeminnow abundance increased over the ten–year span between surveys. In 1999, far more salmon/steelhead were captured (254) compared to 2009–2010 (22), 2012 (2), and 2017 (10). Although salmon/steelhead are present within the Project, not many were captured because of sampling limitations of ESA–listed fish after 1999, which potentially under–estimated salmon/steelhead relative abundance.

Survey results among years show that boat electrofishing serves as an adequate sampling method due to relative sampling efficiency and cost-effectiveness; however, conducting future resident fish surveys during October is preferable, to early August through mid–September as recommended in the NRFMP. Supplemental sampling in 2012 had to be postponed until October due to high water temperatures within the Project due to permitting limitations of the Endangered Species Act (ESA), which did not allow electrofishing in water exceeding 64 degrees Fahrenheit (Appendix 1). Since 1999, large resident fish surveys have been conducted by the LLRT throughout the Columbia Basin. The best results in previous years have been achieved when fish surveys are conducted in October due primarily to young-of-year fish having recruited and mortality rates, although still high, had stabilized.

The goal of the NRFMP is to detect the presence or absence of large–scale changes in population attributes of the resident native fish species present in the Project allowing for the adjustment of goals and objectives by the Priest Rapids Fish Forum (PRFF) through a collaborative process, based on new information and ongoing monitoring results (Grant PUD 2009). The results of the resident fish surveys and comparison of IBI scores will be used to (1) identify what level of changes in species assemblage reflected in IBI results constitutes large–scale change. Nevertheless, no notable changes were observed when comparing the IBI results among the baseline resident fish survey in 1999 and the three sample periods, 2009–2010, 2012, and 2017.

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1.0 Introduction

On April 17, 2008, Public Utility District No. 2 of Grant County, Washington (Grant PUD) received a new Federal Energy Regulatory Commission (FERC) license for the Priest Rapids Project (Project). Under the FERC License Article 401(a)(13) and the Washington Department of Ecology (WDOE) 401 Water Quality Certification (401 WQC) Condition 6.2 (5)(b), Grant PUD was required, in consultation with the Priest Rapids Fish Forum (PRFF), to develop and submit for approval a Native Resident Fish Management Plan (NRFMP) within one year of issuance of the New License.

The 401 WQC included in the License for the Project requires that Grant PUD provide funding to mitigate for impacts to resident fish and harvest opportunities on native resident fish species within the Project Boundary and be implemented in two parts, Part A and Part B. Included in Part A, Grant PUD will provide the Washington Department of Fish and Wildlife (WDFW) with $1,500,000 for capital upgrades to the Columbia Basin Hatchery to ensure reliable continued production of 60,000–70,000 pounds of trout annually.

As outlined in Part B, Grant PUD shall provide $100,000 per year to WDFW to purchase, produce, transport, or otherwise obtain trout to meet a production goal of 137,000 pounds of trout per year to be stocked inside the Project (Burkett Lake), or into lakes within Grant County. Funds from this account shall also be directed toward the monitoring of native resident fish species within the Project as described in Part B of the NRFMP. Specifically, these funds shall be used to conduct surveys and inventories of resident fish species within the Project at a frequency of not less than every five years.

The NRFMP as stated in the 401 WQC and incorporated into the new FERC license for the Project, is to detect the presence or absence of large–scale changes in population attributes of the resident native fish species present in the Project. Every five years, following FERC approval of the NRFMP, Grant PUD will examine the community structure, presence, relative abundance, and distribution of resident fish species in the Project. The NRFMP is based on adaptive management, allowing for the adjustment of goals and objectives by the PRFF through a collaborative process, based on new information and ongoing monitoring results.

The NRFMP study utilizes an evaluation tool known as the IBI created by Karr (1981). Biotic integrity is defined by Karr and Dudley (1981) as “the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.” The IBI is designed to assess biotic integrity directly through 12 attributes of fish communities in streams (Fausch et al. 1984). These attributes, called community metrics, fall into several categories, including species richness and composition, trophic composition, fish abundance, and condition (Fausch et al. 1984). The IBI is a sound approach to bio assessment because (1) it is qualitative and provides criteria to determine what is excellent or poor; (2) it uses several attributes to reflect conditions; (3) there is no loss of information in calculating the index value–the metric values are available to pinpoint the ecological attributes that have been altered; and (4) professional judgment is incorporated in a systematic and ecologically sound manner (Miller et al. 1988). The IBI approach will be effective in accomplishing the goal of the NRFMP of detecting the presence or absence of large–scale changes in population attributes of the resident native fish species present in the Project.

1.1 Consultation

Pursuant to the reporting requirements, Grant PUD provided a complete draft of the NRFMP Priest Rapids Project Survey and Biological Objectives Status Report to the PRFF onFebruary 5, 2018 for review. No comments were received. On March 9, 2018, a letter of approval was received from WDOE.

2.0 Project Area

The Project encompasses approximately 56.4 RM of mainstem Columbia River from Rock Island Dam (RM 453.5) downstream to Wanapum Dam (RM 415.5), then downstream to the Priest Rapids Dam forebay (RM 397.1). Both the Wanapum and Priest Rapids reservoirs are divided into three sections. These three reservoir sections are defined by near–surface velocity, habitat type, and physical characteristics (Hjort et al. 1981; Horne and Goldman 1994; Normandeau Associates et al. 2000). The Wanapum and Priest Rapids reservoir complex follows a typical longitudinal impoundment gradient composed of three macrohabitats or reaches (Figure 1). These sections are defined as follows:

Wanapum Reservoir

- Wanapum upper–reservoir is defined as that portion of the reservoir from the tailwater of Rock Island Dam (RM 453.5) downstream to RM 443.0. Tailwater areas are the most riverine habitats within the Project.
- Wanapum mid–reservoir is defined as that portion of the reservoir from RM 442.0 downstream to RM 427.0. The mid–reservoir section is indicative of a transitional area from the lotic (riverine) character of the tailwater, extending downstream to the lacustrine–like forebay.
- Wanapum lower–reservoir is defined as that portion of the reservoir from RM 426.0 downstream to Wanapum Dam forebay (RM 415.8). Lower reservoir and forebay areas are representative of lacustrine microhabitat types.

Priest Rapids Reservoir

- Priest Rapids upper–reservoir is defined as that portion of the reservoir from the base of Wanapum Dam (RM 415.8) downstream to RM 408.0. Tailwater areas are the most riverine habitats within the Project.
- Priest Rapids mid–reservoir is defined as that portion of the reservoir from RM 407.0 downstream to RM 404.0. The mid–reservoir section is indicative of a transitional area from the lotic (riverine) character of the tailwater, extending downstream to the lacustrine–like forebay.
- Priest Rapids lower–reservoir is defined as that portion of the reservoir from RM 403.0 downstream to Priest Rapids Dam forebay (RM 397.1). Lower reservoir and forebay areas are representative of lacustrine microhabitat types.

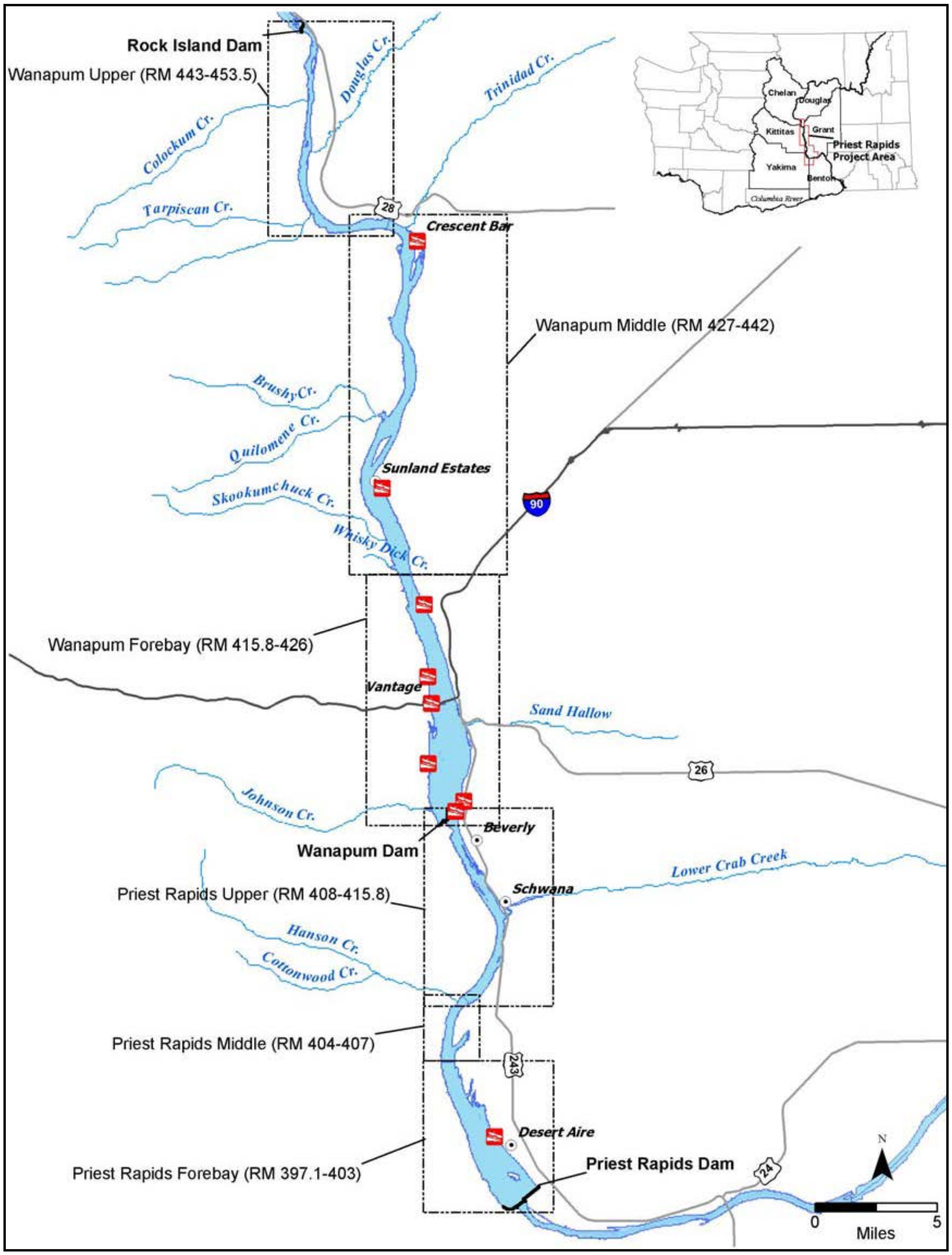

Figure 1 **Established river reaches presented by river mile for the reservoirs of Wanapum and Priest Rapids dams, Priest Rapids Project, mid-Columbia, USA (Grant PUD 2009).**

3.0 Methods

In 1999, Grant PUD contracted with Parametrix, Inc. and the University of Idaho to conduct a study to identify and evaluate fish species present in the Project. Data obtained in the study were used during consultation with resource management agencies, Native–American Tribes, and the public during the relicensing process for the Project (Pfeifer et al. 2001). Resident fish data collected by the WDFW’s Large Lakes Research Team (LLRT) during 2009–2010 and reported here were collected as part of a cooperative research effort with the U.S. Department of the Interior, U.S. Geological Survey (USGS) to evaluate the effects of native and introduced predatory fish on migrating juvenile salmon/steelhead. During sampling, all species of resident fish were collected and processed. However, since the objective of the research study focused primarily on predators, collection of these species (e.g., Smallmouth Bass, Walleye, and Northern Pikeminnow) was emphasized over other resident fish. As such, relative abundance of predator species may be biased comparatively among resident fish species composition in 2009–2010. Therefore, supplemental sampling was conducted in 2012 by the LLRT to (1) satisfy requirements specified in the NRFMP (sampling every five years beginning in 2012 to accommodate the 2013 report deadline); and (2) to ensure non–species specific targeting goals compared to sampling in 2009–2010. The LLRT mimicked the methods outlined for the 2012 survey and conducted a survey in 2017.

The LLRT compared data collected during the baseline 1999 study with data collected in 2009–2010, 2012 and 2017. Though various sampling methods and times were used during surveys in 1999 (nocturnal boat electrofishing, beach seines, set lines, gill nets, and minnow traps), 2009–2010 (tangle netting and diurnal, crepuscular, and nocturnal boat electrofishing), and 2012 and 2017 (nocturnal boat electrofishing), comparisons will be made using data collected via nocturnal boat electrofishing only. Comparisons of data collected in 1999, 2009–2010, 2012, and 2017 were made using the same gear type and sample duration.

3.1 Sample Site Selection

3.1.1 2009-2010

Sample site selection methods used in 2009–2010 are adapted from Counihan et al. (2012). Sampling was conducted in the 64 river miles of the Columbia River from the tailrace of Rock Island Dam (RM 453) downstream to the tailrace of Priest Rapids Dam (RM 389) from May1–August 27, 2009 and May 19–September 3, 2010. The study area was divided into longitudinal strata (north to south) in 2009: tailrace, mid–reservoir, and forebay and boat restricted zones (BRZs) near either side of Wanapum and Priest Rapids dams (Figure 2). In 2010, the same strata were sampled as in 2009, and additional strata were added immediately upstream of the forebay and downstream of the tailrace BRZs for a near–BRZ stratum (Figure 3). A geographic information system (GIS) was used to generate a systematic grid of points spaced every 50 ft. with a depth criterion of less than 10 ft. within each of the longitudinal strata. Points were then randomly selected for electrofishing sites each week and the sample design was such that the entire study area would be sampled each week. This equated to sampling 521 sites in the study area in 2009–2010 (Figure 4) and exceeded the minimum number of sampling sites required by the NRFMP (112 sites, 2 per river mile).

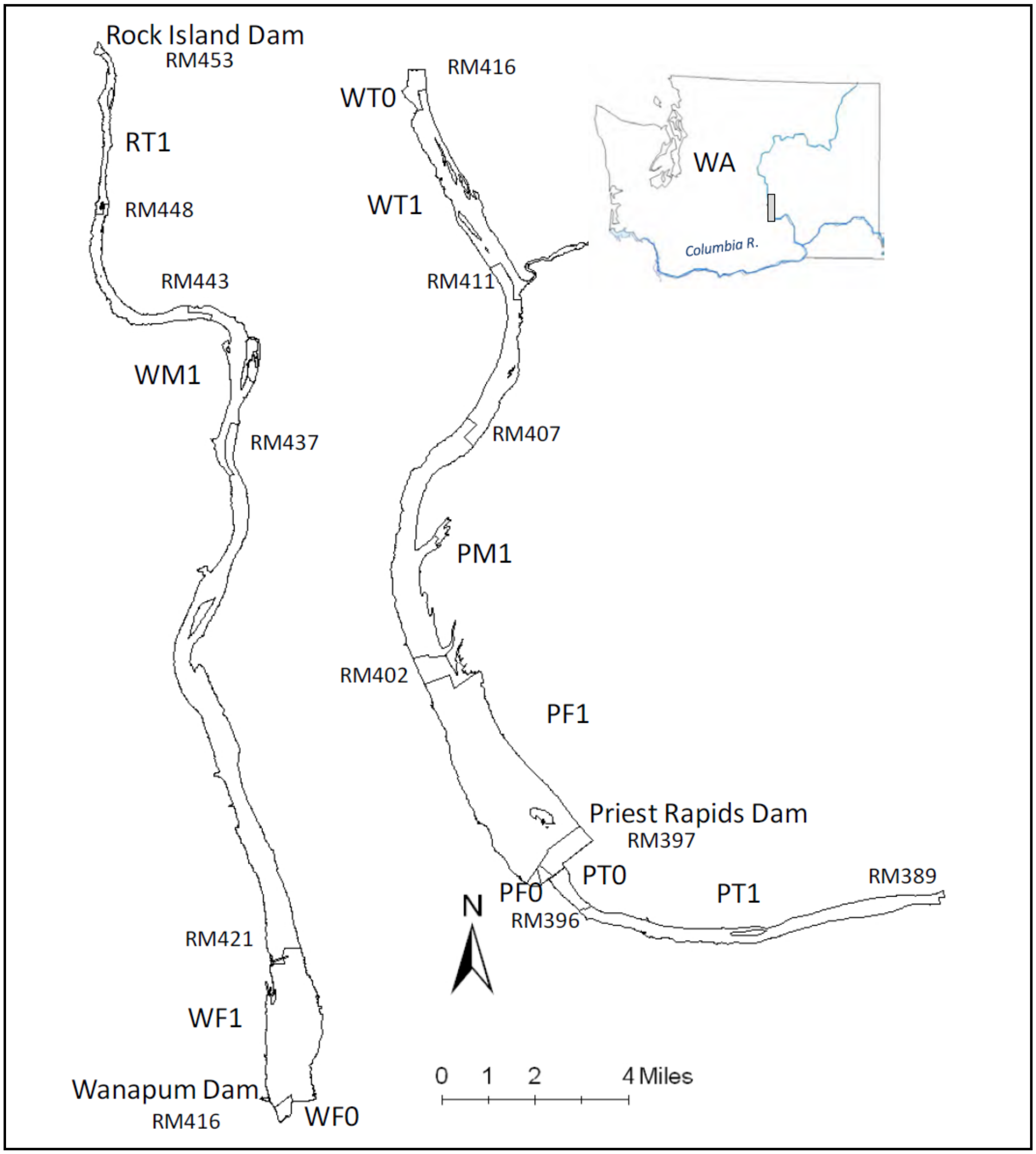

Figure 2 Study area sampled in the Priest Rapids Project, mid-Columbia River, USA in 2009. Reach locations: PT1, Priest Rapids Tailrace; PT0, Priest Rapids Tailrace BRZ; PF0, Priest Rapids Forebay BRZ; PF1, Priest Rapids Forebay; PM1, Priest Rapids Mid-Reservoir; WT1, Wanapum Tailrace; WT0, Wanapum Tailrace BRZ; WF0, Wanapum Forebay BRZ; WF1, Wanapum Forebay, WM1, Wanapum Mid-Reservoir, RT1, Rock Island Tailrace. RM = river mile. Map from Counihan et al. (2012).

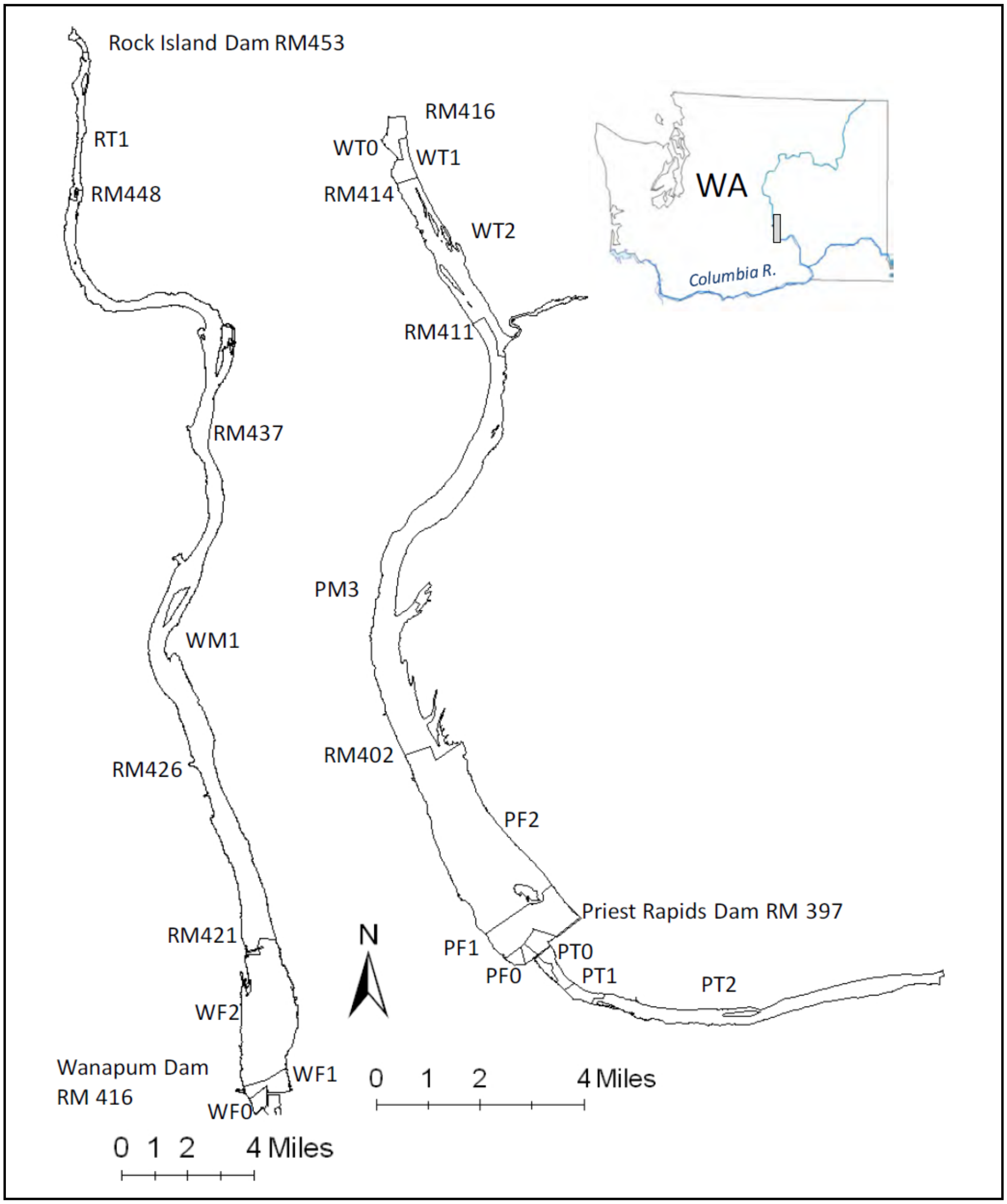

Figure 3 Study area sampled in the Priest Rapids Project, mid-Columbia River, USA in 2010. Reach locations: PT1, Priest Rapids Tailrace; PT0 Priest Rapids Tailrace BRZ; PF0 Priest Rapids Forebay BRZ; PF1, Priest Rapids Forebay; PM1, Priest Rapids Mid-Reservoir; WT1, Wanapum Tailrace; WT0, Wanapum Tailrace BRZ; WF0 Wanapum Forebay BRZ; WF1 Wanapum Forebay; WM1 Wanapum Mid-Reservoir; RT1, Rock Island Tailrace. RM = river mile. Map from Counihan et al. (2012).

3.1.2 Supplemental Sampling

Random GIS generated points were assigned in the middle of the Columbia River every mile upstream from Priest Rapids Dam to Rock Island Dam and were designated as sections (Figure

5). Between river miles, four quadrants were created by drawing a line bisecting the river from north to south, drawing a line perpendicular to each shoreline that intersected point in the middle of the river, and then dividing that distance in half again; consequently, each site had 800 m of shoreline (Figure 6). There were 56 points from Priest Rapids Dam to Rock Island Dam, which yielded 224 sites. Following the WDFW warmwater sampling protocol (Bonar et al. 2000), approximately 400 m of shoreline was sampled within each 800 m site. The sites were assigned non–repeating numbers starting with 1 at Priest Rapids Dam, to 224 at Rock Island Dam and 40 of those sites were randomly selected (Figure 7, 8). Sampling was conducted in October for the 2012 and 2017 surveys.

3.2 Endangered Species Act (ESA) Permits

Because boat electrofishing was conducted in the Columbia River, where several Endangered Species Act (ESA) listed species are likely to be present, permits were issued by the National Oceanic and Atmospheric Administration (NOAA) under Section 10(a)(1)(A) of the ESA to sample salmon and steelhead stocks (Appendix 1); and by the United States Fish and Wildlife Service under Section 6 of the ESA to sample bull trout (*Salvelinus confluentus*) (Appendix 2). Although there were varying levels of take allowed, precautions were made to minimize take by turning off electrofishing equipment when salmonids were observed.

3.3 Boat Electrofishing

During 2009–2010, 2012, and 2017 surveys, electrofishing was conducted along the shoreline at the preselected random sites using one or two, 5.5 m (18 ft.) Smith Root 5.0 Generator Powered Pulsator (GPP) electrofishing boats. Individual electrofishing boats operated parallel to the shoreline at a rate of 1–1.4 m/h, maintained a distance from shore that allowed the inshore boom to fish entirely in the water, and avoided areas that exceeded 3 m in depth. To initiate fish galvanotaxis, the GPP unit was operated at approximately 1–2 amperes (amps) using a low power setting (50–500 volts) with a frequency between 30–120 Hz DC. Depending on water conductivity, pulse frequency and percent of range was adjusted slightly. In addition, to prevent unnecessary fish injury, the behavior of fish was noted within the electrical field and the power was adjusted accordingly to promote galvanotaxis.

Time, personnel, and direction of travel (downstream) associated with sampling were also standardized. The goal of each electrofishing boat was to electrofish each site for 600 seconds. However, sampling time was variable due to occasional environmental factors and in–river hazards. Nonetheless, total time spent electrofishing was always recorded. The number of crew on an individual boat was also regulated to maintain a constant effort between times and boats. Each crew consisted of one boat operator and two dip netters stationed at the front of the boat.

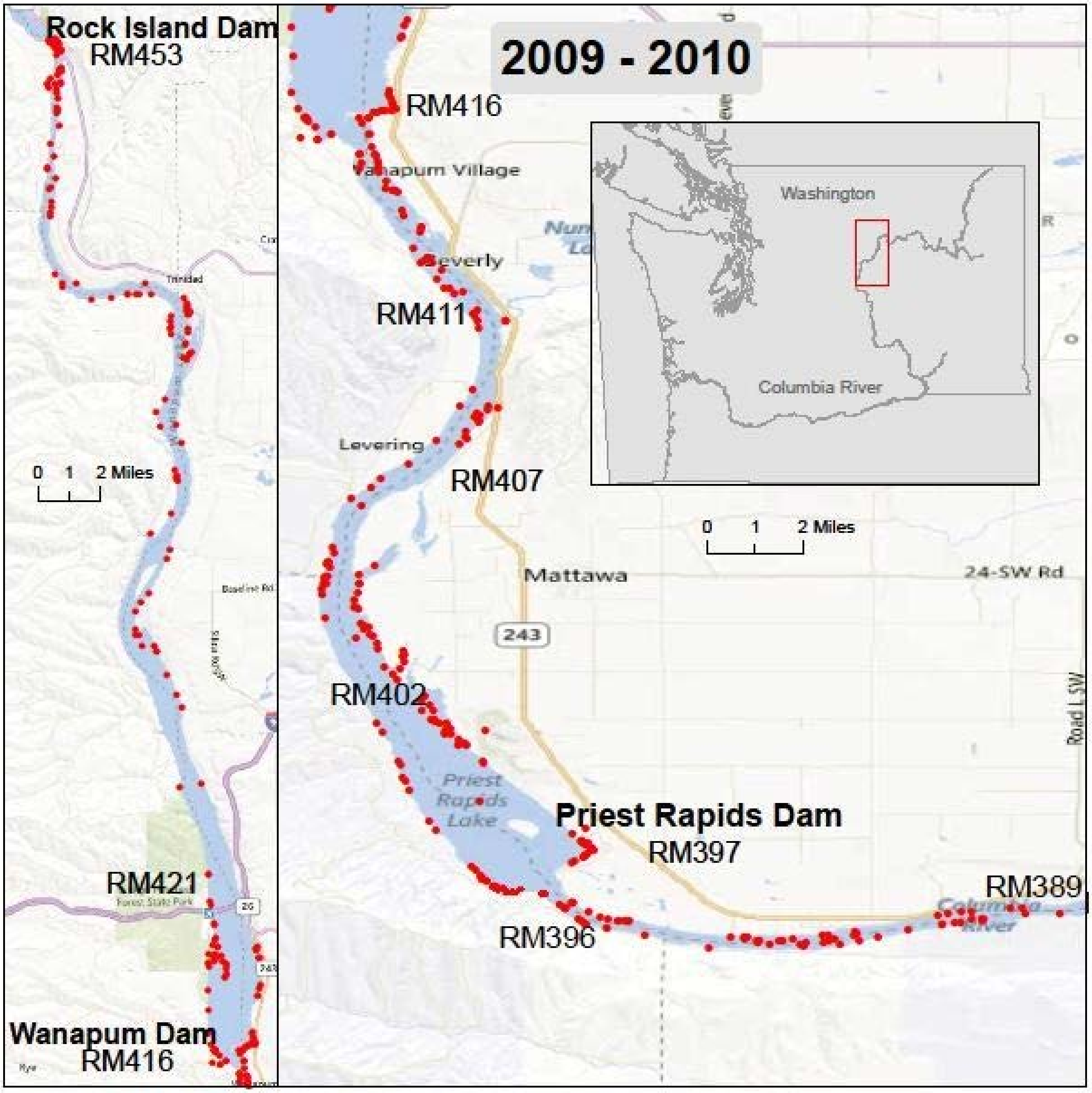

Figure 4 **Sites sampled in 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.**

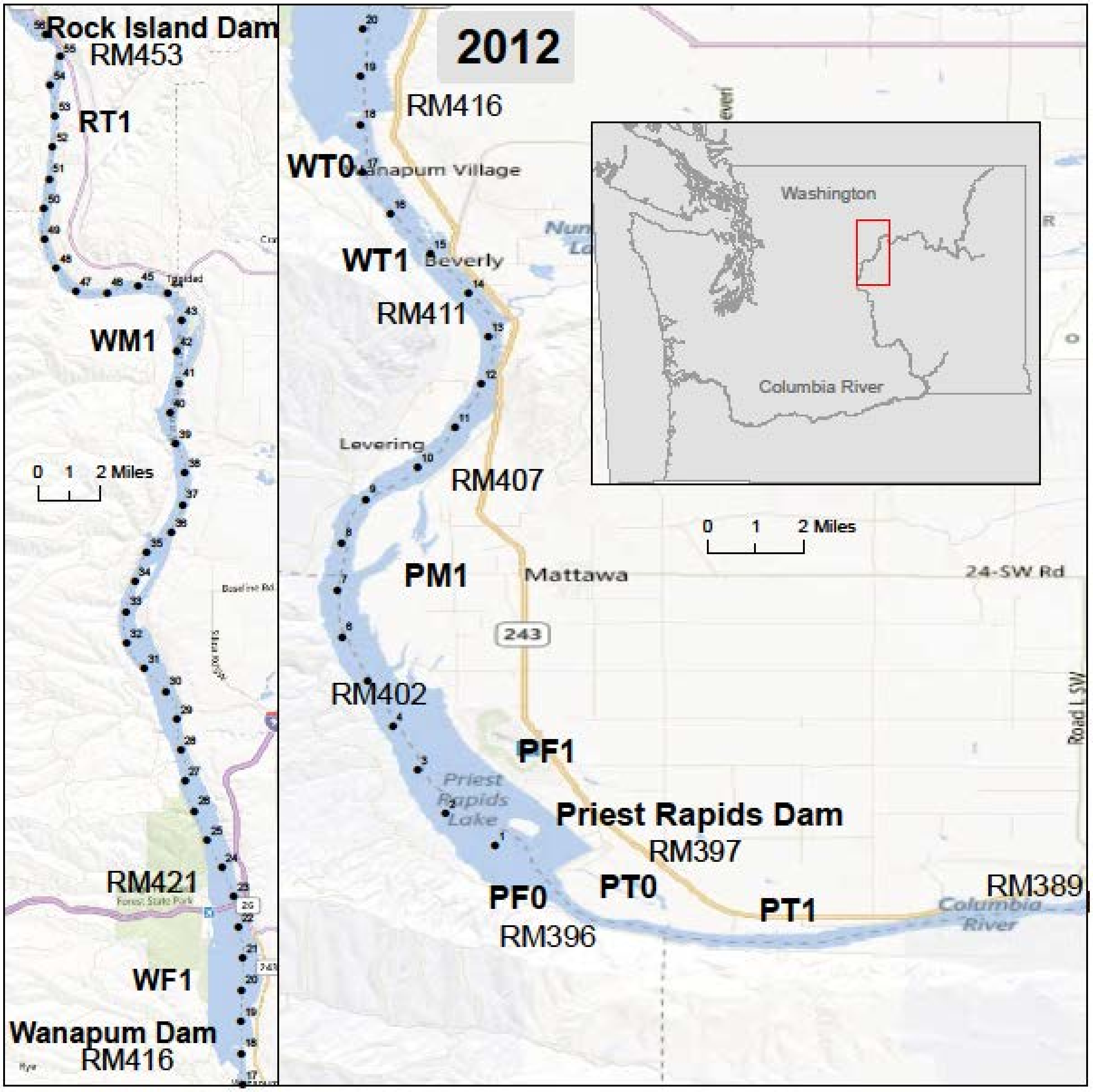

Figure 5 Map showing points assigned at each river mile in the middle of the river from Priest Rapids Dam to Rock Island Dam in the Priest Rapids Project, mid-Columbia River, USA.

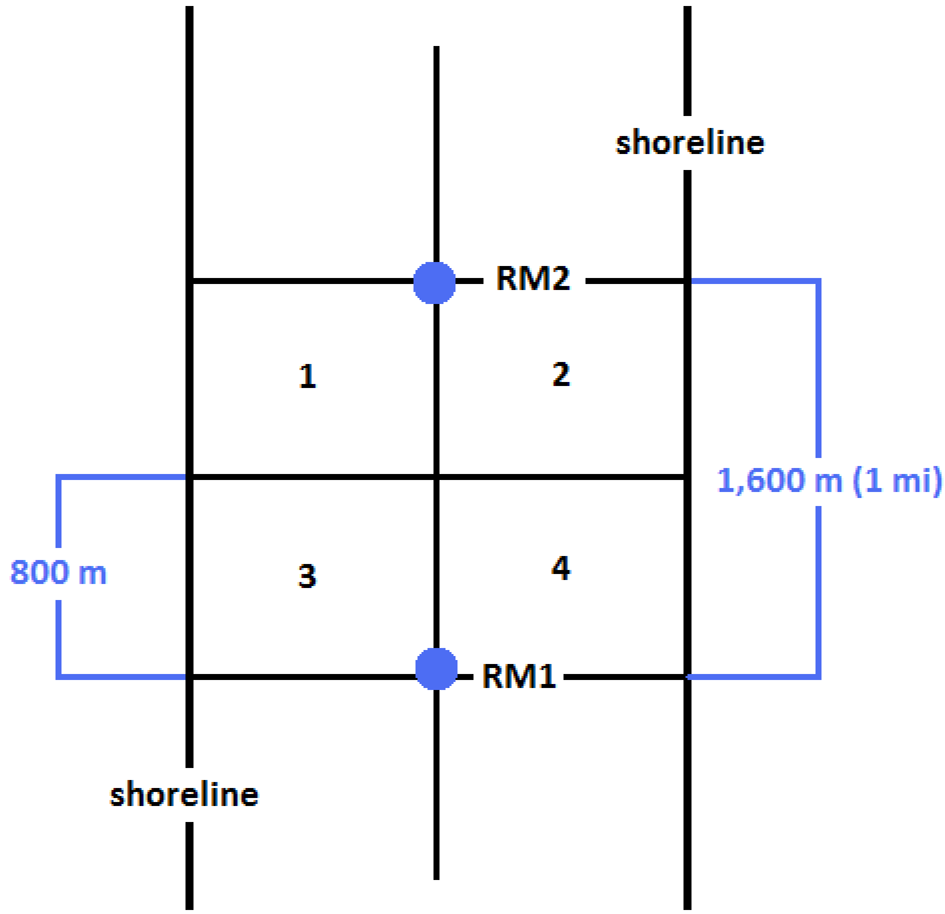

Figure 6 **Graphic depicting how sample sites were created in the Priest Rapids Project, mid-Columbia River, USA in 2012 and 2017. RM = river mile.**

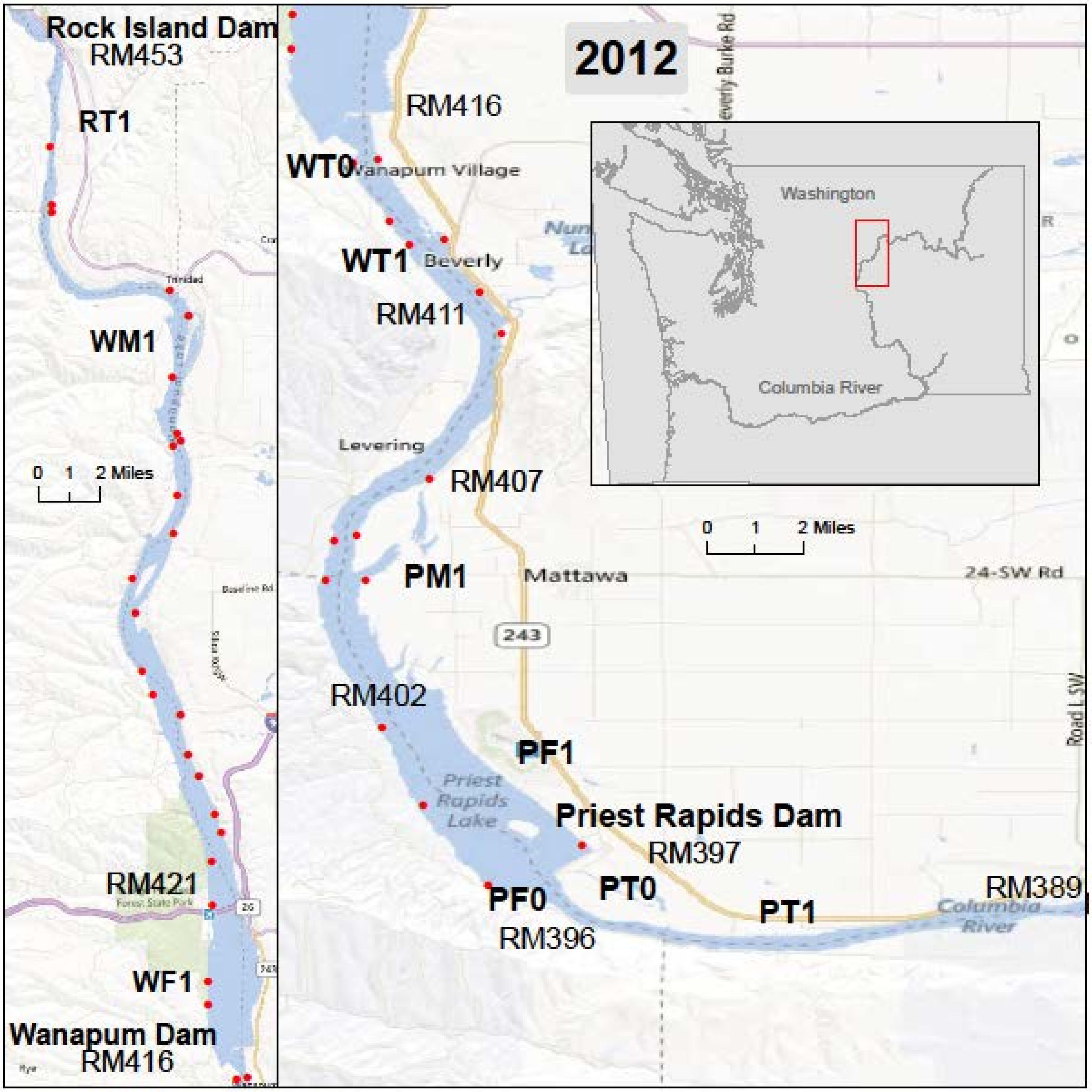

Figure 7 Sites sampled in 2012 in the Priest Rapids Project, mid-Columbia River, USA.

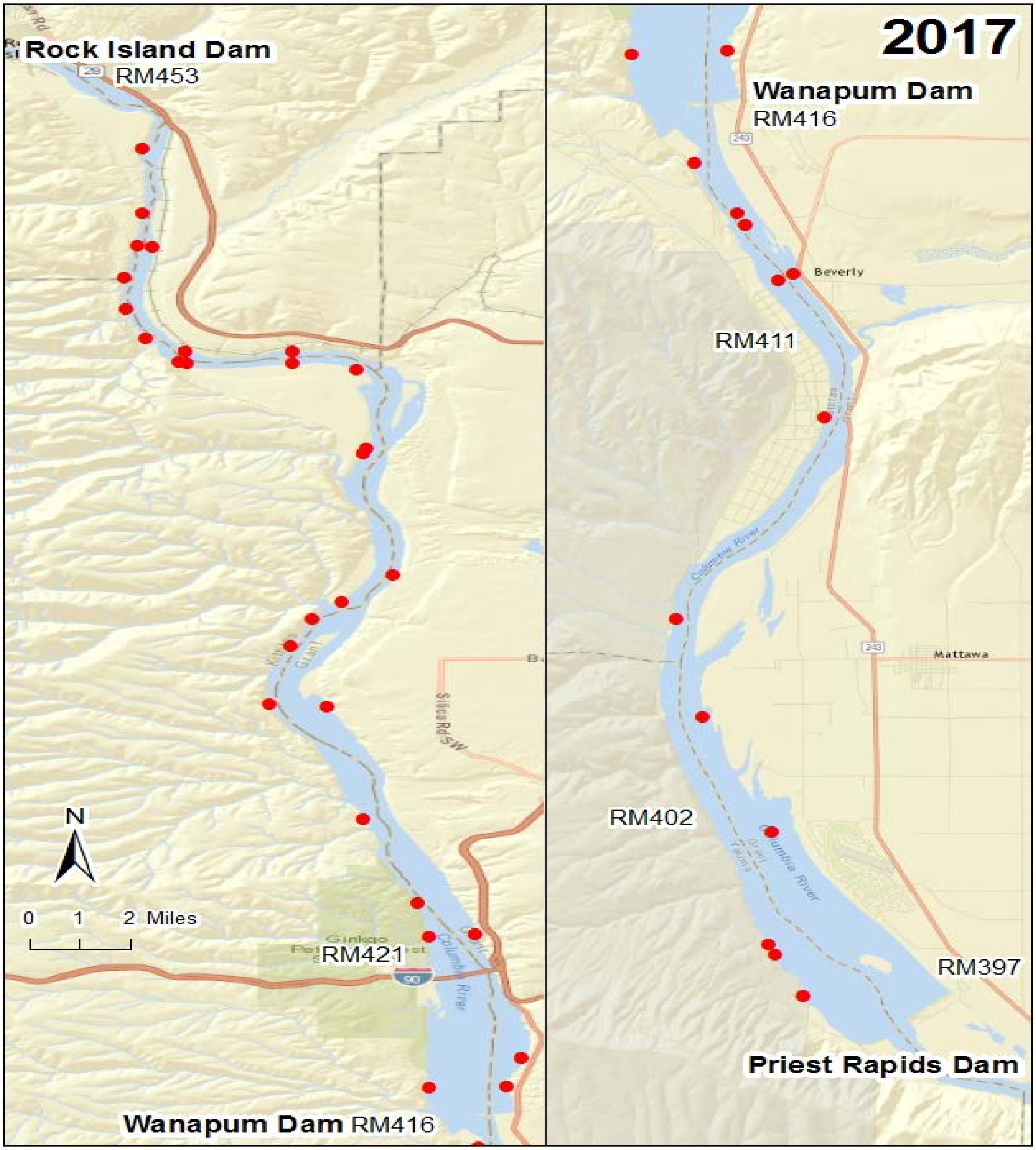

Figure 8 **Sites sampled in 2017 in the Priest Rapids Project, mid-Columbia River, USA.**

Boat electrofishing began at least thirty minutes after official sunset. However, boats were launched earlier each night in order to enter all site coordinates and test electrofishing units before transiting to designated sites. After arrival at a designated site, boat crews recorded the following information: water temperature, specific conductance, time when sampling began, coordinates in UTM, initials of crew, assigned coordinates, date, and site designation. Upon completion of site data collections, the boat operator verified the crew's readiness, started the onboard generator, oriented the boat downstream, and began electrofishing. Two crew members located at the bow of the boat used 8' long dip nets to capture stunned fish that were immediately placed into one of the two onboard livewells equipped with a pump that continually added fresh water into the tank. Netters were also responsible to make the boat operator aware of approaching hazards while electrofishing at which point maneuvers could be initiated to prevent injury to staff or damage to equipment. After 600 seconds of electrofishing, the boat operator pressed the man overboard button on the GPS to identify the end of the actual electrofishing site. This information was recorded on the data sheet along with the power settings used to electrofish. Following site data collection, the boat crew secured all items and traveled to the next selected sample site where the methods were repeated. After the completion of two–600 second electrofishing sites, the boat operator moored the electrofishing boat on shore where LLRT staff recorded the biological information from the captured fish. In the event transit time between sites was extended as a result of distance or environmental conditions, crews collected the pertinent data from the captured fish immediately after the completion of the first site.

3.4 Fish Data Collection

Captured fish were identified to species or taxa and all fish were measured to total length (mm), weighed to the nearest gram, and examined for anomalies (i.e. diseases, tumors, fin damage, bird scars). Black Bullhead *Ameiurus melas* and Yellow Bullhead *A. natalis* are not abundant in Washington state, though they are found in the sampling area (Wydoski and Whitney 2003) and Black Bullhead and Brown Bullhead *A. nebulosus* readily hybridize (Trautman 1981; Cingolani, Jr. et al. 2007); therefore, all Bullhead captured were recorded simply as Bullhead spp. Longnose Dace *Rhinichthys cataractae* and Speckled Dace *R. osculus* are known to hybridize (Sigler and Miller 1963); therefore, in instances where dace could not be identified to species, they were recorded as Dace spp. Sculpin *Cottus* spp. were not differentiated due to variation in morphological characteristics within species and the overlap of meristic characteristics among species (Wydoski and Whitney 2003). Meristic characteristics of Suckers *Catostomus* spp. overlap somewhat (Wydoski and Whitney 2003), Largescale Suckers *C. macrocheilus* and Bridgelip Suckers *C. columbianus* sometimes breed (Scott and Crossman 1973), and small individuals (generally less than 70 mm) are difficult to distinguish; therefore when fish could not be identified conclusively, they were recorded as Sucker spp. Because distributions and growth characteristics of Lake Whitefish *Coregonus clupeaformis* and Mountain Whitefish *Prosopium williamsoni* overlap, and the distinguishing characteristic between the two species is difficult to determine in the field [single flap (Mountain Whitefish) vs. double flap (Lake Whitefish) between anterior and posterior nostrils (Wydoski and Whitney 2003)], all individuals were recorded as Whitefish spp. Due to the propensity of hybridization among Chiselmouth *Acrocheilus alutaceus*, Northern Pikeminnow *Ptychocheilus oregonensis*, Peamouth *Mylocheilus caurinus*, and Redside Shiner *Richardsonius balteatus* (Scott and Crossman 1973), unidentifiable individuals were recorded simply as cyprinid spp.

3.5 Index of Biotic Integrity

The IBI is designed to assess biotic integrity directly through 12 attributes of fish communities in streams (Fausch et al. 1984). These attributes, called community metrics, fall into several categories, including species richness and composition, trophic composition, fish abundance, and condition (Fausch et al. 1984). Each metric received a score of 1, 3, or 5 depending on the criteria in Appendix 3, Table 3–1. The scores for all twelve metrics were then totaled and that number was used to evaluate the fish community and compare data from 1999 (Pfeifer et al. 2001), 2009–2010 (LLRT), 2012 (LLRT), and 2017 (LLRT) surveys. Karr (1981) assigned total scores to classes according to the following scale: excellent (57–60); excellent–good (53–56); good (48–52); good–fair (45–47); fair (39–44); fair–poor (36–38); poor (28–35); poor–very poor (24–27); and very poor (≤23). The specific metrics calculated were those used by Hughes and Gammon (1987) (Appendix 3, Table 3–1) for the Willamette River, Oregon, which were modified from Karr et al. (1986). The metrics from Hughes and Gammon (1987) were chosen due to the similarities between the Willamette and Columbia River systems (Reimers and Bond 1967; Wydoski and Whitney 2003). The relative tolerance to organic pollution, warm water, and sediment for each fish species sampled by Pfeifer et al. (2001) from the Project (Appendix 3, Table 3–2) was assigned to each species. This assignment was based on fish species observed in the Willamette River by Hughes and Gammon (1987), as well as Wydoski and Whitney (2003) for species that were not found in the Willamette River.

3.6 Species Composition by Number and Weight (Biomass)

Species composition by number and weight (biomass) was calculated for each fish species by:

$$\text{Spp. comp.} = (\Sigma \text{Spp}_{\text{wt or \#}} / \Sigma \text{T}_{\text{wt or \#}}) \times 100$$

Where: Spp. comp. is the species composition or biomass of an individual species,

$\text{Spp}_{\text{wt or \#}}$ = the sum of the weight or number of an individual species, and

$\text{T}_{\text{wt or \#}}$ = the sum of the weight or number of all the species collected.

3.7 Catch per Unit Effort

Catch per unit effort was calculated by:

$$\text{CPUE} = \text{N/T}$$

Where: CPUE = catch per unit effort,

N = the number of individuals of a particular species, and

T = time (hours).

3.8 Size Structure

3.8.1 Length Data

For species with over ten individuals captured, length frequency histograms were created using 10 mm bins. Minimum and maximum total lengths were determined for each species captured and mean total lengths were calculated by:

$$\bar{x} = \Sigma x_i / n$$

Where: $\bar{x}$ = the mean total length of a species

Σx_i = the sum of the total lengths of an individual species, and

n = the number of individuals of a particular species measured.

3.8.2 Length-Weight Relationships

For species with over ten individuals captured above the accepted minimum total lengths (Appendix 4, Table 4–1) length–weight data were logarithmically transformed to mathematically describe the relationship between length and weight (Murphy and Willis 1996). This is useful for researchers when weight data may not be available (linear regression equations are generated that allow the determination of unknown weights from known lengths).

3.9 Indices of Fish Condition

For species with over ten individuals captured, where those ten individuals were above the accepted minimum total lengths (Appendix 4, Table 4–1), and where accepted standard regression equations could be found, relative weights and condition factor were determined.

3.9.1 Relative Weight

Relative weights were determined by:

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

Where: W_r = the relative weight of an individual,

W = the weight of an individual, and

W_s = the length–specific standard weight predicted by a length–weight regression constructed to represent the species (Appendix 4, Table 4–1).

3.9.2 Fulton's Condition Factor

Condition factors were determined by:

$$K_{TL} = (W/L^3) \times 100{,}000$$

Where: K_{TL} = Fulton's condition factor based on total length (mm),

L = the length of an individual,

W = the weight of an individual, and

100,000 = a scaling constant (Murphy and Willis 1996).

4.0 Results

During 2009–2010, 521 sites were electrofished, which equated to 313,018 seconds or approximately 87 hours. In 2012, 40 sites were electrofished, which equated to 24,001 seconds or approximately 6.7 hours. In 2017, 40 sites were electrofished for a total of 24,002 seconds (6.7 hours).

4.1 Index of Biotic Integrity (IBI)

Index of biotic integrity scores were similar for all sampling years (Table 1). The IBI score was lower in 2009–2010 by two points as a result of the lower percent of individuals as insectivores (Table 1, shaded). This was due, however, to the higher percent of individuals as omnivores, particularly Suckers of all species. In 2009–2010 the sampling area included sections below Priest Rapids Dam that were not sampled in 1999, 2012, or 2017. Over 55% of the fish captured below the dam were Sucker spp. (>1,700).

4.1.1 Species Composition by Number

In 2009–2010, 22,288 fish were captured, representing 35 species/taxa and 11 families (Table 2). Of the fish captured, approximately 94% were of native origin and 6% were introduced. Species composition was dominated by Largescale Sucker (35%), Northern Pikeminnow (16%), and Redside Shiner (14%). Chiselmouth, Longnose Sucker *Catostomus catostomus*, Peamouth, Sand

Roller *Percopsis transmontana*, Sculpin spp., Smallmouth Bass *Micropterus dolomieu*, Sucker spp., and Whitefish spp. represented from 1–7% of the total catch, while all other species represented less than 1% (Table 2). During the 2012 supplemental sampling, 2,000 fish were captured, representing 20 species/taxa and 8 families (Table 3). Of the fish captured, approximately 96% were of native origin and 4% were introduced. Species composition was again dominated by Largescale Sucker (15%), Northern Pikeminnow (25%), and Redside Shiner (27%) in 2012 (Table 3). Chiselmouth, Peamouth, Sand Roller, sculpin spp., Smallmouth Bass, Sucker spp., and Yellow Perch *Perca flavescens* represented from 1–6% of the total catch, while all other species represented less than 1% (Table 3). During the 2017 sampling, 4,147 fish were captured, representing 18 species/taxa and 8 families (Table 4). Of the fish captured, approximately 96% were of native origin and 4% were introduced. Species composition was again dominated by Largescale Sucker (34%), Redside Shiner (15%), and Northern Pikeminnow (15%) in 2017 (Table 4). Bridgelip Sucker, Chiselmouth, Peamouth, Sand Roller, Sculpin spp., Smallmouth Bass, Threespine Stickleback, and Yellow Perch *Perca flavescens* represented from 1–6% of the total catch, while all other species represented less than 1% (Table 4).

Table 1 **Community metrics scores and total index of biotic integrity (IBI) scores calculated for data calculated for data collection by Pfeifer et al. (2001) and the Washington Department of Fish and Wildlife's Large Lakes Research Team (2009-2010, 2012, and 2017.) Fish were collected via boat electrofishing in the Priest Rapids Project, mid-Columbia, USA. Shaded values indicate differences in score among the four sampling periods.**

	Score and (Value)			
Survey Year	**1999**	**2009–2010**	**2012**	**2017**
	Species richness and composition			
Total number of native species	5 (20)	5 (21)	5 (15)	5 (12)
Number of cottid species	1 (1)	1 (1)	1 (1)	1(1)
Number of native cyprinid species	5 (7)	5 (7)	3 (5)	5(6)
Number of catostomid species	5 (3)	5 (4)	5 (4)	5(3)
Number of intolerant species	5 (9)	5 (9)	5 (5)	5(4)
% of individuals as common carp	5 (<1)	5 (<1)	5 (<1)	5 (<1)
Trophic composition				
% of individuals as omnivores	3 (35.8)	3 (44.7)	5 (20.6)	3 (35.8)
% of individuals as insectivores	5 (43.6)	3 (28.5)	5 (45.5)	5(40.3)
% of individuals as catchable salmonids[1]	1 (<1)	1 (<1)	1 (<1)	1(<1)
Fish abundance and condition				
Number of individuals	5 (9,554)	5 (22,288)	5 (2,000)	5(4,135)
% of individuals introduced (exotic)	3 (2.6)	3 (6.2)	3 (4.4)	3 (4.3)
% of individuals with anomalies[2]	5 (<1)	5 (<1)	5 (<1)	5(<1)
Total IBI Score	**48**	**46**	**48**	**48**
Class	**Good**	**Good–Fair**	**Good**	**Good**

[1]Salmonids (excluding Whitefish) > 200mm. [2]i.e. disease, tumors, fin damage. Species Composition by Number and Weight (Biomass)

Table 2 Number, species composition (%N) of fish[1], family, and origin (N=native, I=introduced) collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Number	%N	Family	Origin
American Shad	2	>0.01	Clupeidae	I
Black Crappie	6	0.03	Centrarchidae	I
Bluegill	40	0.18	Centrarchidae	I
Bridgelip Sucker	138	0.62	Catostomidae	N
Bull Trout	1	0.004	Salmonidae	N
Bullhead spp.	2	0.01	Ictaluridae	I
Burbot	1	0.004	Gadidae	N
Channel Catfish	1	0.004	Ictaluridae	I
Chinook Salmon	8	0.04	Salmonidae	N
Chiselmouth	1,284	5.76	Cyprinidae	N
Coho Salmon	3	0.01	Salmonidae	N
Common Carp	117	0.52	Cyprinidae	I
Dace spp.	1	0.004	Cyprinidae	N
Grass Carp[2]	1	0.004	Cyprinidae	I
Green Sunfish[3]	4	0.02	Centrarchidae	I
Largemouth Bass	55	0.25	Centrarchidae	I
Largescale Sucker	7,853	35.23	Catostomidae	N
Longnose Dace	13	0.06	Cyprinidae	N
Longnose Sucker	228	1.02	Catostomidae	N
Northern Pikeminnow	3,614	16.22	Cyprinidae	N
Peamouth	808	3.62	Cyprinidae	N
Pumpkinseed	38	0.17	Centrarchidae	I
Rainbow Trout/Steelhead	7	0.03	Salmonidae	N
Redside Shiner	3,024	13.57	Cyprinidae	N
Sand Roller	284	1.27	Percopsidae	N
Sculpin spp.	1,469	6.59	Cottidae	N
Smallmouth Bass	919	4.12	Centrarchidae	I

Species	Number	%N	Family	Origin
Sockeye Salmon	4	0.02	Salmonidae	N
Speckled Dace	7	0.03	Cyprinidae	N
Sucker spp.	1,577	7.08	Catostomidae	N
Tench	48	0.22	Cyprinidae	I
Threespine Stickleback	109	0.49	Gasterosteidae	N
Walleye	77	0.34	Percidae	I
Whitefish spp.	466	2.09	Salmonidae	N
Yellow Perch	79	0.35	Percidae	I
Total Number (N)	**22,288**			

[1]Scientific names of fish are listed within the text; in Appendix 3, Table 3–2; or below.
[2]*Ctenopharyngodon idella*
[3]*Lepomis cyanellus*

Table 3 Number and species composition (%N) of fish[1] collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Number	(%N)	Family	Origin
Bridgelip Sucker	3	0.15	Catostomidae	N
Chinook Salmon	1	0.05	Salmonidae	N
Chiselmouth	127	6.35	Cyprinidae	N
Common Carp	2	0.10	Cyprinidae	I
Largemouth Bass	16	0.8	Centrarchidae	I
Largescale Sucker	297	14.85	Catostomidae	N
Longnose Sucker	2	0.10	Catostomidae	N
Minnow spp.	16	0.80	Cyprinidae	N
Northern Pikeminnow	493	24.65	Cyprinidae	N
Peamouth	129	6.45	Cyprinidae	N
Rainbow Trout/Steelhead	1	0.05	Salmonidae	N
Redside Shiner	547	27.35	Cyprinidae	N
Sand Roller	87	4.35	Percopsidae	N
Sculpin spp.	78	3.90	Cottidae	N

Species	Number	(%N)	Family	Origin
Smallmouth Bass	40	2.00	Centrarchidae	I
Sucker spp.	108	5.40	Catostomidae	N
Threespine Stickleback	9	0.45	Gasterosteidae	N
Walleye	2	0.10	Percidae	I
Whitefish spp.	15	0.75	Salmonidae	N
Yellow Perch	27	1.35	Percidae	I
Total Number (N)	**2,000**			

[1]Scientific names of fish are listed within the text or in Appendix 3, Table 3–2.

Table 4 Number and species composition (%N) of fish[1] collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Number	%N	Family	Origin
Bluegill	4	0.10	Centrarchidae	I
Bridgelip Sucker	61	1.47	Catostomidae	N
Chinook Salmon	4	0.10	Salmonidae	N
Chiselmouth	255	6.15	Cyprinidae	N
Common Carp	4	0.10	Cyprinidae	I
Cyprinid spp.	7	0.17	Cyprinidae	--
Largemouth Bass	2	0.05	Centrarchidae	I
Largescale Sucker	1,409	33.98	Catostomidae	N
Longnose Sucker	4	0.10	Catostomidae	N
Northern Pikeminnow	618	14.9	Cyprinidae	N
Peamouth	558	13.46	Cyprinidae	N
Pumpkinseed	1	0.02	Centrarchidae	I
Rainbow Trout/Steelhead	8	0.19	Salmonidae	N
Redside Shiner	620	14.95	Cyprinidae	N
Sand Roller	181	4.36	Percopsidae	N
Sculpin spp.	147	3.54	Cottidae	N

Species	Number	%N	Family	Origin
Smallmouth Bass	70	1.69	Centrarchidae	I
Sucker spp.	30	0.72	Catostomidae	N
Tench	3	0.07	Cyprinidae	I
Threespine Stickleback	66	1.59	Gasterosteidae	N
Walleye	6	0.14	Percidae	I
Yellow Perch	89	2.15	Percidae	I
Total Number (N)	**4,147**			

[1]Scientific names of fish are listed within the text or in Appendix 3, Table 3–2.

Fish captured in 1999 represented 30 species/taxa and 9 families (Table 5). Of the 9,554 fish captured, 97% were native and 3% were introduced. In 2009–2010, far more Smallmouth Bass (919) and Walleye (77) were captured than in 1999 (161 and 14, respectively). The larger number of Smallmouth Bass and Walleye captured in 2009–2010 contributed to the higher percentage of introduced fish captured (6%) compared to 1999 (3%).

4.1.2 Biomass

During the 2009–2010 sampling seasons, biomass was dominated by Largescale Sucker (80%) (Table 6). All other species represented less than 5%. During 2012, biomass was dominated by Largescale Sucker (78%) and Northern Pikeminnow (12%). All other species represented less than 3% (Table 7). For the 2017 survey, Largescale Suckers also dominated the biomass (75%) followed by Northern Pikeminnow (8%), and Peamouth (5%) (Table 8).

Table 5 Number, species composition (%N) of fish[1], family, and origin (N=native, I=introduced) collected via boat electrofishing during 1999 in the Priest Rapids Project, mid-Columbia River, USA. Adapted from Pfiefer et al. (2001).

Species	Number	%N	Family	Origin
American Shad	2	0.02	Clupeidae	I
Black Crappie	1	0.01	Centrarchidae	I
Bluegill	2	0.02	Centrarchidae	I
Bridgelip Sucker	169	1.77	Catostomidae	N
Bull Trout	2	0.02	Salmonidae	N
Chinook Salmon	214	2.24	Salmonidae	N
Chiselmouth	507	5.31	Cyprinidae	N
Coho Salmon	13	0.14	Salmonidae	N

Species	Number	%N	Family	Origin
Common Carp	32	0.33	Cyprinidae	I
Cutthroat Trout	1	0.01	Salmonidae	N
Largemouth Bass	4	0.04	Centrarchidae	I
Largescale Sucker	3,198	33.47	Catostomidae	N
Leopard Dace	2	0.02	Cyprinidae	N
Longnose Dace	2	0.02	Cyprinidae	N
Longnose Sucker	17	0.18	Catostomidae	N
Mountain Whitefish	24	0.25	Salmonidae	N
Northern Pikeminnow	1,051	11.0	Cyprinidae	N
Peamouth	436	4.56	Cyprinidae	N
Pumpkinseed	16	0.17	Centrarchidae	I
Rainbow Trout/Steelhead	26	0.27	Salmonidae	N
Redside Shiner	2,230	23.34	Cyprinidae	N
Sand Roller	578	6.05	Percopsidae	N
Sculpin spp.	708	7.41	Cottidae	N
Smallmouth Bass	161	1.69	Centrarchidae	I
Sockeye Salmon	1	0.01	Salmonidae	N
Speckled Dace	2	0.02	Cyprinidae	N
Tench	2	0.02	Cyprinidae	I
Threespine Stickleback	126	1.32	Gasterosteidae	N
Walleye	14	0.15	Percidae	I
Yellow Perch	13	0.14	Percidae	I
Total Number (N)	**9,554**			

Table 6 Weight (g) and biomass (%N) of fish collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Weight (g)	Biomass (%N)
American Shad	1,116	0.02
Black Crappie	213	<0.01
Bluegill	1,243	0.02
Bridgelip Sucker	60,947	0.87
Bull Trout	2,671	0.04
Bullhead spp.	560	0.01
Burbot	854	0.01
Channel Catfish	2,735	0.04
Chinook Salmon	68	<0.01
Chiselmouth	81,171	1.16
Coho Salmon	31	<0.01
Common Carp	211,118	3.02
Grass Carp	3,682	0.05
Green Sunfish	349	<0.01
Largemouth Bass	9,615	0.14
Largescale Sucker	5,604,021	80.12
Longnose Dace	44	<0.01
Longnose Sucker	78,145	1.12
Northern Pikeminnow	306,740	4.39
Peamouth	51,315	0.73
Pumpkinseed	907	0.01
Rainbow Trout/Steelhead	1,921	0.03
Redside Shiner	33,249	0.48
Sand Roller	1,697	0.02
Sculpin spp.	34,932	0.50
Smallmouth Bass	195,280	2.79
Sockeye Salmon	873	0.01

Species	Weight (g)	Biomass (%N)
Speckled Dace	14	<0.01
Sucker spp.	2,620	0.04
Tench	71,316	1.02
Threespine Stickleback	150	<0.01
Walleye	92,269	1.32
Whitefish spp.	139,252	1.99
Yellow Perch	3,164	0.05
Total Number (N)	**6,994,282**	

Table 7 Weight (g) and biomass (%N) of fish collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Weight (g)	Biomass (%N)
Bridgelip Sucker	1,459	0.49
Chiselmouth	7,340	2.48
Common Carp	1,260	0.43
Largemouth Bass	635	0.21
Longnose Sucker	361	0.12
Largescale Sucker	230,155	77.69
Northern Pikeminnow	36,157	12.21
Peamouth	6,466	2.18
Redside Shiner	5,294	1.79
Sand Roller	446	0.15
Sculpin spp.	2,727	0.92
Sucker spp.	326	0.11
Smallmouth Bass	1,612	0.54
Threespine Stickleback	10	<0.01
Walleye	61	0.02
Whitefish	865	0.29
Yellow Perch	1,058	0.36
Total Weight (N)	**296,232**	

Table 8 Weight (g) and biomass (%N) of fish collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Weight (g)	Biomass (%N)
Bluegill	249	0.05
Bridgelip Sucker	5,251	1.06
Chiselmouth	10,912	2.20
Common Carp	10,425	2.11
Largemouth Bass	678	0.14
Longnose Sucker	895	0.18
Largescale Sucker	372,770	75.31
Northern Pikeminnow	40,945	8.27
Peamouth	26,934	5.44
Pumpkinseed	23	<0.01
Redside Shiner	7,122	1.44
Sand Roller	1,094	0.22
Sculpin spp.	4,094	0.83
Sucker spp.	133	0.03
Smallmouth Bass	8,809	1.78
Tench	1,855	0.37
Threespine Stickleback	63	0.01
Walleye	1,045	0.21
Yellow Perch	1,712	0.35
Total Weight (N)	**495,009**	

4.1.3 Catch per Unit Effort

In 2009–2010 catch per unit effort (number of fish captured per hour) was highest for Largescale Sucker (90 fish/hr.), followed by Northern Pikeminnow (42 fish/hr.), and Redside Shiner (35 fish/hr.) (Table 9). In 2012, catch per unit effort was highest for Redside Shiner (82 fish/hr.), Northern Pikeminnow (74 fish/hr.), and Largescale Sucker (45 fish/hr.) (Table 10). In 2017 catch rates were the highest for Largescale Sucker (211 fish/hr.), Redside Shiner (93 fish/hr.), and Northern Pikeminnow (93 fish/hr.) (Table 11).

Table 9 Catch per unit effort (CPUE; no fish/hr) for fish collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

Species	CPUE
American Shad	0.02
Black Crappie	0.07
Bluegill	0.46
Bridgelip Sucker	1.59
Bullhead spp.	0.02
Bull Trout	0.01
Burbot	0.01
Channel Catfish	0.01
Chinook Salmon	0.09
Chiselmouth	14.77
Coho Salmon	0.03
Common Carp	1.35
Dace spp.	0.01
Grass Carp.	0.01
Green Sunfish	0.05
Largemouth Bass	0.63
Largescale Sucker	90.32
Longnose Dace	0.15
Longnose Sucker	2.62
Northern Pikeminnow	41.56
Peamouth	9.29
Pumpkinseed	0.44
Rainbow Trout/Steelhead	0.08
Redside Shiner	34.78
Sand Roller	3.27
Smallmouth Bass	10.57
Speckled Dace	0.08

Species	CPUE
Sculpin spp.	16.89
Sockeye Salmon	0.05
Sucker spp.	18.14
Tench	0.55
Threespine Stickleback	1.25
Walleye	0.89
Whitefish spp.	5.36
Yellow Perch	0.91

Table 10 Catch per unit (CPUE; no of fish/hr) for fish collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA.

Species	CPUE
Bridgelip Sucker	0.45
Chinook Salmon	0.15
Chiselmouth	19.05
Common Carp	0.30
Cyprinid spp.	2.40
Largemouth Bass	2.40
Largescale Sucker	44.55
Longnose Sucker	0.30
Northern Pikeminnow	73.95
Peamouth	19.35
Rainbow Trout/Steelhead	0.15
Redside Shiner	82.05
Sand Roller	13.05
Sculpin spp.	11.70
Smallmouth Bass	6.00
Sucker spp.	16.20
Threespine Stickleback	1.35
Walleye	0.30

Species	CPUE
Whitefish spp.	2.25
Yellow Perch	4.05

Table 11 Catch per unit effort (CPUE; no of fish/hr) for fish collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

Species	CPUE
Bluegill	0.60
Bridgelip Sucker	9.15
Chiselmouth	38.23
Common Carp	0.60
Cyprinid spp.	1.05
Largemouth Bass	0.30
Largescale Sucker	211.24
Longnose Sucker	0.60
Northern Pikeminnow	92.65
Peamouth	83.66
Pumpkinseed	0.15
Redside Shiner	92.95
Sand Roller	27.14
Sculpin spp.	22.04
Smallmouth Bass	10.49
Tench	0.45
Sucker spp.	4.50
Threespine Stickleback	9.90
Walleye	0.90
Yellow Perch	13.34

4.2 Size Structure

4.2.1 Length Data

During 2009–2010, sampling was conducted throughout the spring and summer. Because multiple months were sampled, fish were encountered at various stages of ontogeny, which potentially accounts for the variation in sizes of fish captured (Table 12). Length frequency histograms are presented alphabetically by species in Appendix 5, Figures 5–1 through 5–18. The 2012 supplemental survey was completed in a three week period, which greatly reduced the variability in length of fish contacted (Table 13). Sampling in 2017 was conducted over a two week period (Table 14).

4.2.2 Length-Weight Relationship

During sampling within the Project in 2009–2010, 2012, and 2017, LLRT staff captured and measured thousands of fishes. With the abundance of data, length–weight regressions were constructed (Table 15, 16, and 17). Coefficients of determination were generally strong (r^2>0.85) for most species, suggesting relatively good relationships between length and weight. Coefficients of determination for Redside Shiner and Sand Roller were low in 2009–2010 (r^2=0.77 and r^2=0.78, respectively); low for SandRoller in 2012 (r^2=0.78); poor for Threespine Stickleback in 2009–2010 (r^2=0.25); low for Redside Shiner (r^2=0.73) in 2017. This is generally due to erroneous weights measured in the field rather than an indication of a poor length–weight relationship. The sensitive balances needed to accurately determine weights for fish weighing between 0 and 2 g are not practical to take in the field. Pfeifer et al. (2001) also reported a poor coefficient of determination for Threespine Stickleback (r^2=0.12).

Table 12 Minimum, mean, and maximum total length (MM) and two standard deviations [95% confidence interval (C.I.)] of fish collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Minimum TL	Mean TL	Maximum TL	95% C.I.[1]
Bluegill	26	103	185	83
Bridgelip Sucker	95	311	509	222
Chiselmouth	24	179	92	110
Common Carp	92	654	854	274
Largemouth Bass	74	151	491	206
Largescale Sucker	46	367	916	316
Longnose Sucker	73	278	551	239
Northern Pikeminnow	33	184	581	161
Peamouth	44	163	410	152
Pumpkinseed	55	97	150	43
Redside Shiner	32	102	228	51
Sand Roller	38	76	111	31
Sculpin spp.	20	114	228	64
Smallmouth Bass	21	214	515	178

Species	Minimum TL	Mean TL	Maximum TL	95% C.I.[1]
Sucker spp.	43	88	184	47
Tench	106	451	514	137
Threespine Stickleback	30	50	69	12
Walleye	165	439	786	359
Yellow Perch	61	133	300	83

[1]Species without a confidence interval value indicate that only one individual was captured.

Table 13 Minimum, mean, and maximum total length (mm) and two standard deviations [95% confidence interval (C.I)] of fish collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Minimum TL	Mean TL	Maximum TL	95% C.I.[1]
Bridgelip Sucker	112	273	506	414
Chinook Salmon	178	178	178	
Chiselmouth	31	180	270	70
Common Carp	628	642	655	38
Largemouth Bass	58	138	193	69
Largescale Sucker	55	364	623	378
Longnose Sucker	250	272	294	62
Minnow spp.	28	36	44	10
Northern Pikeminnow	36	165	508	173
Peamouth	25	140	337	166
Rainbow Trout/Steelhead	200	200	200	
Redside Shiner	34	104	169	46
Sand Roller	41	74	102	22
Sculpin spp.	69	129	224	60
Smallmouth Bass	34	89	372	136
Sucker spp.	40	66	125	30
Threespine Stickleback	31	45	65	19
Walleye	112	148	184	102

Species	Minimum TL	Mean TL	Maximum TL	95% C.I.[1]
Whitefish spp.	111	173	293	105
Yellow Perch	99	141	245	70

Table 14 Minimum, mean, and maximum total length (mm) and two standard deviations [95% confidence interval (C.I)] of fish collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

Species	Minimum TL	Mean TL	Maximum TL	95% C.I.[1]
Bluegill	32	122	176	131
Bridgelip Sucker	67	189	322	107
Chiselmouth	20	163	284	74
Common Carp	520	630	730	177
Cyprinid spp.	32	37	46	9
Largemouth Bass	106	224	342	327
Largescale Sucker	66	254	639	214
Longnose Sucker	234	266	335	92
Northern Pikeminnow	39	165	534	152
Peamouth	35	172	351	96
Pumpkinseed[1]	101	101	101	
Redside Shiner	36	111	154	34
Sand Roller	35	80	193	29
Sculpin spp.	44	111	196	69
Smallmouth Bass	41	125	462	232
Sucker spp.	42	72	148	39
Tench	206	311	412	202
Threespine Stickleback	26	43	71	18
Walleye	141	251	355	159
Yellow Perch	71	99	279	76

[1]Species without a confidence interval value indicate that only one individual was captured.

Table 15 **Length-weight relationships, sample size (n), and coefficients of determination (r^2) for fish collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA. The equation format is $\log_{10}(W) = a + b \times \log_{10}$ (total length; TL), where is a the *y*-axis intercept and b is the slope of the equation and were estimated by linear regression of logarithmically transformed length-weight data (Murphy and Willis 1996). Thus, for a given length, a weight is found by taking the antilog of $\log_{10}(W)$.**

Species	Length–Weight Relationship	N	r^2
Bridgelip Sucker	$\log_{10}(W) = –5.0839 + 3.0401 \times \log_{10}(TL)$	60	0.98
Chiselmouth	$\log_{10}(W) = –4.968 + 2.965 \times \log_{10}(TL)$	1,259	0.96
Common Carp	$\log_{10}(W) = –4.351 + 2.816 \times \log_{10}(TL)$	60	0.97
Largemouth Bass	$\log_{10}(W) = –5.478 + 3.267 \times \log_{10}(TL)$	15	0.99
Largescale Sucker	$\log_{10}(W) = –4.914 + 2.961 \times \log_{10}(TL)$	6,307	0.98
Longnose Dace	$\log_{10}(W) = –3.587 + 2.240 \times \log_{10}(TL)$	11	0.89
Longnose Sucker	$\log_{10}(W) = –5.222 + 3.089 \times \log_{10}(TL)$	223	0.99
Northern Pikeminnow	$\log_{10}(W) = –5.374 + 3.110 \times \log_{10}(TL)$	3,187	0.98
Peamouth	$\log_{10}(W) = –5.230 + 3.056 \times \log_{10}(TL)$	794	0.97
Pumpkinseed	$\log_{10}(W) = –4.899 + 3.123 \times \log_{10}(TL)$	38	0.97
Redside Shiner	$\log_{10}(W) = –5.184 + 3.123 \times \log_{10}(TL)$	1,541	0.77
Sand Roller	$\log_{10}(W) = –4.481 + 2.781 \times \log_{10}(TL)$	257	0.78
Smallmouth Bass	$\log_{10}(W) = –5.246 + 3.155 \times \log_{10}(TL)$	662	0.99
Tench	$\log_{10}(W) = –5.187 + 3.139 \times \log_{10}(TL)$	48	0.98
Threespine Stickleback	$\log_{10}(W) = –3.984 + 2.425 \times \log_{10}(TL)$	86	0.25
Walleye	$\log_{10}(W) = –5.531 + 3.192 \times \log_{10}(TL)$	76	0.99
Yellow Perch	$\log_{10}(W) = –5.280 + 3.178 \times \log_{10}(TL)$	61	0.95

Table 16 Length-weight relationships, sample sizes (N), and coefficients of determination (r^2) for fish collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA. The equation is $\log_{10}$ (W) = a + b x $\log_{10}$ (total length; TL), where a is the *y*-axis intercept and b is the slope of the equation and were estimated by linear regression of logarithmically transformed length-weight data (Murphy and Willis 1996). Thus, for a given length, a weight is found by taking the antilog of $\log_{10}$ (W).

Species	Length–Weight Relationship	N	r^2
Chiselmouth	$\log_{10}$ (W) = –5.245 + 3.083 × $\log_{10}$ (TL)	126	0.97
Largescale Sucker	$\log_{10}$ (W) = –4.758 + 2.898 × $\log_{10}$ (TL)	208	0.97
Northern Pikeminnow	$\log_{10}$ (W) = –5.382 + 3.118 × $\log_{10}$ (TL)	386	0.99
Peamouth	$\log_{10}$ (W) = –4.885 + 2.906 × $\log_{10}$ (TL)	127	0.98
Redside Shiner	$\log_{10}$ (W) = –5.591 + 3.240 × $\log_{10}$ (TL)	289	0.86
Sand Roller	$\log_{10}$ (W) = –3.841 + 2.419 × $\log_{10}$ (TL)	86	0.78
Yellow Perch	$\log_{10}$ (W) = –5.821 + 3.398 × $\log_{10}$ (TL)	26	0.98

Table 17 Length-weight relationships, sample sizes (n), and coefficients of determination (r^2) for fish collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA. The equation format is $\log_{10}$ (W) = a + b x $\log_{10}$ (total length; TL), where a is the *y*-axis intercept and b is the slope of the equation and were estimated by linear regression of logarithmically transformed length-weight data (Murphy and Willis 1996). Thus, for a given length, a weight is found by taking the antilog of $\log_{10}$ (W).

Species	Length–Weight Relationship	N	r^2
Bridgelip Sucker	$\log_{10}$ (W) = –5.0839 + 3.0401 × $\log_{10}$ (TL)	60	0.99
Chiselmouth	$\log_{10}$ (W) = –5.9381 + 3.9392 × $\log_{10}$ (TL)	253	0.96
Largescale Sucker	$\log_{10}$ (W) = –4.9686 + 2.9795 × $\log_{10}$ (TL)	1,394	0.97
Northern Pikeminnow	$\log_{10}$ (W) = –5.4630 + 3.1503 × $\log_{10}$ (TL)	531	0.96
Peamouth	$\log_{10}$ (W) = –4.8790 + 2.8920 × $\log_{10}$ (TL)	520	0.90
Redside Shiner	$\log_{10}$ (W) = –5.4602 + 3.1712 × $\log_{10}$ (TL)	488	0.73
Sand Roller	$\log_{10}$ (W) = –5.3846 + 3.2199 × $\log_{10}$ (TL)	171	0.81
Smallmouth Bass	$\log_{10}$ (W) = –4.9128 + 3.0026 × $\log_{10}$ (TL)	45	0.98
Yellow Perch	$\log_{10}$ (W) = –5.0258 + 3.0147 × $\log_{10}$ (TL)	88	0.95

4.3 Indices of Condition

All fish were above 80% of the “average” relative weight and in a generally healthy condition Table 18, 19, and 20). Yellow Perch relative weight was lower in 2012 than individuals sampled in 2009–2010. In 2017 Yellow Perch relative weight was higher than both years.

Table 18 **Mean (x̄) calculated weights (*W*), standard weights (*Ws*), and relative weights (*Wr*) (%), condition factor (K) and 95% confidence intervals (C.I.) for fish collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA. Parameters for standard weights are presented in Appendix 4, Table 4-1.**

	W		W_s		W_r (%)		K	
Species and (Sample Size)	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**
Bluegill (24)	49.5	14.2	49.7	14.8	102.3	9.2	2.0	0.2
Bridgelip Sucker (109)	338.1	48.6	264.8	37.0	125.6	2.9	1.1	0.02
Common Carp (60)	3,516.1	255.0	3547.9	256.3	99.9	2.6	1.4	0.04
Largemouth Bass (15)	592.5	426.7	545.6	391.4	105.1	6.5	1.5	0.1
Largescale Sucker (6,307)	876.0	14.4	828.6	13.2	105.8	0.3	1.0	0.003
Northern Pikeminnow (3,187)	95.6	6.2	100.3	6.1	92.6	0.5	0.8	0.004
Pumpkinseed (38)	23.9	5.5	21.4	5.0	113.7	4.2	2.2	0.1
Redside Shiner (1,541)	16.7	0.4	17.4	0.4	97.9	1.0	0.9	0.01
Smallmouth Bass (662)	286.4	24.3	304.5	26.2	95.3	0.7	1.3	0.01
Walleye (76)	1,214.1	268.6	1,356.5	308.2	90.0	2.1	0.9	0.03
Yellow Perch (61)	49.6	14.9	50.1	14.8	99.9	3.9	1.3	0.05

Table 19 Mean ($\bar{x}$) calculated weights (*W*), standard weights (*Ws*), and relative weights (*Wr*) (%), condition factor (K) and 95% confidence intervals (C.I.) for fish collected via boat electrofishing during 2012 in the Priest Rapids Project, mid-Columbia River, USA. Parameters for standard weights are presented in Appendix 4, Table 4-1.

	W		***W_s***		***W_r* (%)**		**K**	
Species and (Sample Size)	**$\bar{x}$**	**95% C.I.**	**$\bar{x}$**	**95% C.I.**	**$\bar{x}$**	**95% C.I.**	**$\bar{x}$**	**95% C.I.**
Largescale Sucker (208)	1,100.6	69.6	1,083.5	68.8	103.0	2.0	0.9	0.02
Northern Pikeminnow (386)	90.9	17.4	95.4	17.9	94.1	1.3	0.8	0.01
Redside Shiner (289)	14.9	0.7	16.6	0.8	90.4	1.5	0.8	0.01
Yellow Perch (26)	40.3	16.7	45.8	16.8	84.8	3.4	1.1	0.06

Table 20 **Mean (x̄) calculated weights (*W*), standard weights (*Ws*), and relative weights (*Wr*) (%), condition factor (K) and 95% confidence intervals (C.I.) for fish collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA. Parameters for standard weights are presented in Appendix 4, Table 4-1.**

	W		***W_s***		***W_r* (%)**		**K**	
Species and (Sample Size)	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**	**x̄**	**95% C.I.**
Bridgelip Sucker (60)	87.5	17.0	87.8	17.4	100.3	1.9	1.0	0.02
Chiselmouth (253)	43.1	4.0	42.6	3.7	100.7	1.4	0.9	0.01
Largescale Sucker (1,394)	267.4	22.0	261.3	20.8	102.5	2.4	1.0	0.02
Northern Pikeminnow (531)	76.5	13.4	74.4	12.5	104.0	4.8	0.8	0.03
Peamouth (520)	51.7	4.0	50.3	3.6	102.9	3.7	0.8	0.03
Redside Shiner (488)	13.5	0.4	13.0	0.3	101.3	1.4	0.8	0.01
Sand Roller (171)	6.3	0.5	5.9	0.3	103.3	3.1	1.1	0.03
Smallmouth Bass (45)	194.8	102.4	184.9	93.6	103.7	6.9	1.3	0.09
Yellow Perch (88)	19.4	11.0	15.7	7.6	104.6	4.5	1.1	0.05

5.0 Discussion

Comparing resident fish assemblage among the 2009–2010, 2012, and 2017 sampling periods to the baseline resident fish survey in 1999 (Pfeifer et. al. 2001) indicates little change with respect to IBI results. Minor differences in the community metrics scores among the three sample periods was observed for the number of insectivores captured during the 2009–2010 sampling period. This was a result of the higher percent of omnivores, specifically, Sucker spp. In 2009–2010 the sampling area included sections below Priest Rapids Dam, which were not sampled in 1999, 2012, or 2017. Over 55% of the fish captured in 2009–2010 below Priest Rapids Dam were Suckers (>1,700). During the 2012 sampling period, the IBI score was identical to the initial resident fish survey in 1999 and 2017.

In 2009–2010, approximately 94% of the fish captured were of native origin and 6% were introduced, compared to 97% native and 3% introduced in 1999; and 96% native and 4% introduced in 2012 and 2017. In 2009–2010, species composition of Smallmouth Bass (4%) and Walleye (0.3%) was higher than in 1999, 2012, and 2017. Species composition of Smallmouth Bass (2%) and Walleye (0.1%) was the same in 1999 (Pfeifer et al. 2001), 2012, and 2017 roughly half that of 2009–2010. The difference between the 2009–2010 sampling period and the 1999, 2012, and 2017 surveys can be attributed to potential bias in sampling in 2009–2010. During the 2009–2010 sampling period, the primary objective was to target predatory fish and it is likely that the predator–specific nature of the survey contributed to the higher percentage of introduced fish captured, since species composition of introduced fish other than Smallmouth Bass and Walleye did not change noticeably (Table 2–Table 4).

Decreased numbers of Redside Shiners and increased numbers of Northern Pikeminnow captured in 2009–2010 compared to the 1999 survey were also likely a result of the predator–specific nature of the 2009–2010 surveys, rather than an indication that Redside Shiner abundance decreased or Northern Pikeminnow abundance increased over the ten–year span between surveys. In 1999, far more salmon/steelhead were captured (254) compared to 2009–2010 (22), 2012 (2). In 2017 four Chinook salmon and six Rainbow Trout/Steelhead were noted or netted and immediately released. Those salmonids were not counted in the species composition. Although salmon/steelhead are present within the Project, not many were captured as a result of sampling limitations of ESA–listed fish, which potentially under–estimated salmon/steelhead relative abundance. Had similar restrictions been exercised, salmon/steelhead may have sampled in appreciable numbers in 2009–2010, 2012, and 2017. Sand Roller abundance appeared to decrease from 1999 (6.1%) to 2009–2010 (1.3%); however, sample sizes were too small to perform statistical analysis.

The species composition during both the 2009–2010, 2012, and 2017 sampling periods consisted mostly of Largescale Suckers, Northern Pikeminnow, and Redside Shiners. Over 75% of the biomass of fish sampled during each of the 2009–2010, 2012, and 2017 sampling periods consisted of Largescale Suckers. Largescale Sucker conditions and weights were also above average, indicating an adequate amount of forage and a relatively low stress environment (Anderson and Neumann 1996). However, Redside Shiners and Northern Pikeminnow were generally lighter for a given weight relative to regional standards. For example, in 2009 Northern Pikeminnow mean weight for a given length was only 95.6 g compared to the standard weight of 100.3 g; and the mean weight of Redside Shiners was 16.7 g compared to the standard weight of 17.4 g at the same length. The condition factors of both Redside Shiners and Pikeminnow were also below 1.0 indicating a lack of girth. High stress environments associated with predation, competition, and forage availability can affect fish health or condition (Anderson and Neumann 1996). However, without investigating forage availability, factors contributing to a decrease in condition and relative weights within the Project can only be speculated. Because sampling in 2012 and 2017 was abbreviated compared to that in 1999 and 2009–2010, fewer fish were captured and "rare" species such as dace were not captured. However, the numbers did not indicate any major changes in species assemblage.

Survey results among years show that boat electrofishing serves as an adequate sampling method due to relative sampling efficiency and cost-effectiveness; however, continuing future resident fish surveys during October is preferable, to early August through mid–September as recommended in the NRFMP. Supplemental sampling in 2012 had to be postponed until October due to high water temperatures within the Project due to permitting limitations of the Endangered Species Act (ESA) which did not allow electrofishing in water exceeding 64 degrees Fahrenheit (Appendix 1). Since 1999, large resident fish surveys have been conducted by the LLRT throughout the Columbia Basin. The best results in previous years have been achieved when fish surveys are conducted in October due primarily to young of year fish having recruited and mortality rates, although still high, had stabilized.

In order to monitor fish assemblage integrity within the Project, this long term resident fish monitoring plan as outlined in the NRFMP should continue. Large–scale change is addressed within the NRFMP and will continue to be based on adaptive management, allowing for the adjustment of goals and objectives by the PRFF through a collaborative process, based on new information and ongoing monitoring results (Grant PUD 2009) to (1) identify what level of change in species assemblage as reflected in IBI results constitutes large–scale change and (2) whether sampling 40 sites every 5 years is an adequate sample size. Nevertheless, no notable changes were observed when comparing the resident fish assemblages to the baseline resident fish survey in 1999 and the three sampling periods, 2009–2010, 2012 and 2017.

6.0 Ten-Year Biological Objective Review

As part of the Project's 401 WQC (Conditions 6.2(5)(c) and 6.2(5)(d)), Grant PUD is required to develop Biological Objectives Status Reports (Status Reports) at Year 5 (submitted March 27, 2013) and Year 10 (this current report) for native resident fish which:

- Summarizes the results of the monitoring and evaluation program and evaluates the need for modification of the program.
- Describes the degree to which each Biological Objective has been achieved, and if not, the prospects for achieving those objectives in the next reporting periods.
- Reviews management options (both operational and structural) taken to meet those Biological Objectives.
- Recommends any new or modified implementation, monitoring, and/or evaluation measure that are needed to meet any of the Biological Objectives, to the extent reasonable and feasible. Such recommendation shall contain a schedule for timely implementation.

The Biological Objectives identified in Appendix C of the 401 WQC for native resident fish includes:

- Overall: Maintain resident species diversity.
- Harvest: Maintain harvest opportunities.

Provided below is an assessment for each native resident fish Biological Objective analyzed as part of this Year 10 Status Report.

6.1 Biological Objective #1 – Maintain Native Resident Species Diversity

6.1.1 Monitoring and Evaluation Program

A detailed summary of the 2009–2010, 2012, and 2017 resident fish sampling and IBI analysis are provided above in Section 5 – Results. In general, all four resident fish community surveys (1999–baseline, 2009–2010, 2012, and 2017) yielded very similar results in species composition and IBI scoring. For the 1999 and 2009–2010 surveys, a total of 15 and 16 different native resident fish species were sampled by electrofishing, respectively. The total number of native resident fish species sampled represents 50.0% and 45.7% of all fish species observed during the 1999 (n=30) and 2009–2010 (n=35) surveys, respectively. Both surveys received the highest IBI categorical rank (5–best) for overall native species representation (resident + non–resident) in the overall fish community. The total IBI scores for the 1999 and 2009–2010 datasets were 48 (Good) and 46 (Good–Fair), respectively. The 2012 and 2017 sampling results demonstrated strong similarity to the 1999 and 2009–2010 survey results. Of the total 20-21 different resident fish species sampled by electrofishing, 13 (62-65%) were native species. These surveys also received the highest IBI categorical rank for native species representation and a total score of 48 (Good).

Both electrofishing and IBI analysis were effective methods for assessing native resident fish species diversity within the Project. Implementation of these methods should continue to be utilized for future monitoring of resident fish in the project.

6.1.2 Achievement of Biological Objective

Based on fish species composition data and IBI analysis (Section 5), this Biological Objective is being achieved because the native resident fish community within the Project has not changed significantly from baseline conditions to present. Large changes in relative abundance of certain native resident fish species (e.g., Chiselmouth, Peamouth Chub, Northern Pikeminnow, and Suckers) were observed between the baseline and 2009–2010 surveys. However, it is unclear whether these large changes are related to differences in sampling designs, sampling dates, or other variables between both surveys.

6.1.3 Management Options

Because the 2009 – 2017 survey results did not find any large-scale changes in fish species relative abundance or structure, compared to earlier (Pfiefer et. al., 2001), WDFW did not evaluate operational or structural changes to Project dams effects to native resident fish communities in this report. Operational or structural changes within the Project will be reviewed by the PRFF.

6.1.4 Program Modifications

WDFW recommends the resident fish sampling timeframe identified in the NRFMP continue to occur during October of that sampling year. It has been WDFW’s experience that resident fishes are captured at higher rates with electrofishing during the fall when near–shore water temperatures are cooler and inhabited by a greater diversity of resident fish species. Additionally, WDFW's ESA sampling permit from NOAA Fisheries stipulates electrofishing within the Columbia River must cease when water temperatures exceed 64°F. During the 2012 supplemental sampling, WDFW field staff had to suspend electrofishing within the Project until October because water temperatures exceeded this threshold in September. Water temperatures in the Columbia River can easily exceed 64°F in August/September, but typically range between 59–61°C in October. For these reasons, continuing to sample during the October timeframe ensures uninterrupted electrofishing and the best resident fish data are collected from the Project.

Since the 2012 and 2017 surveys were both conducted in October and a total of 40 sites were sampled each year, WDFW recommends that future surveys follow this format and comparisons are only made to these surveys. This survey consistency will allow for comparisons that are more meaningful.

One of the objectives of the electrofishing survey is to detect large–scale changes in resident fish species diversity. What constitutes a large–scale change is not clearly defined in the NRFMP. Further, it is unknown what level of change can statistically be detected by the identified level of sampling effort. Consulting with a statistician could determine if current sampling levels are adequate and what percent change in resident fish species diversity can statistically be detected. Data from the 1999, 2009–2010, 2012, and 2017 surveys could be used for analysis if determined by the PRFF.

6.2 Biological Objective #2 – Maintain Harvest Opportunities

6.2.1 Monitoring and Evaluation Program

Angler harvest opportunities for resident fish within the Project were inferred from electrofishing survey data and institutional knowledge of WDFW fishery managers. Based on this information, anglers are believed to primarily target and harvest introduced Smallmouth Bass, Walleye, and covered–species such as Chinook and Sockeye salmon (not considered resident fish). White sturgeon and trout (all species) are also targeted by anglers per current WDFW fishing regulations (http://wdfw.wa.gov). Other resident fish species available to angler harvest include Northern Pikeminnow, Peamouth Chub, Suckers, and Whitefish. Harvest of these species is believed to be very low to non–existent because of their poor table fare, tendency to not strike conventional fishing tackle, poor angler knowledge of how to catch these species, low angler preference for those species, or some combination of all. All other resident fish species (mostly native) inhabiting the Project are closed to fishing as outlined in the current WDFW fishing regulations.

6.2.2 Achievement of Biological Objective

Based on resident fish data collected during electrofishing surveys and institutional knowledge of WDFW fishery managers, this Biological Objective has been achieved. Harvest opportunities for popular resident fish species like Smallmouth Bass and Walleye have been maintained from baseline conditions to present. Additionally, fishing seasons and harvest regulations for resident fish have changed little since 1999 and therefore not affected anglers' ability to harvest resident fish.

6.2.3 Management Options

Because the 2009 – 2017 survey results did not find any large-scale changes in fish species relative abundance or structure, compared to earlier (Pfiefer et. al., 2001), WDFW did not evaluate operational or structural changes to Project dams effects related to the harvest of native resident fish communities in this report. Operational or structural changes within the Project will be reviewed by the PRFF.

6.2.4 Program Modifications

At this time WDFW has no recommendations to modify the existing program to better achieve this Biological Objective.

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Appendix A
National Marine Fisheries Service (NMFS)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way NE
Seattle, Washington 98115

May 10, 2013 F/NWR3

Mr. Michael Tonseth
Research Team Leader
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, WA 98501-1091

Re: Permit 16979

Dear Mr. Tonseth:

Enclosed is Scientific Research Permit 16979 issued to the Washington Department of Fish and Wildlife (WDFW) under the authority of Section 10(a)(1)(A) of the Endangered Species Act. The permit authorizes the WDFW to annually take listed salmonids while conducting the research: Upper Columbia River Region Research and Stock Assessment Activities Affecting Upper Columbia River Spring Chinook and Steelhead.

The National Marine Fisheries Service (NMFS) requires that the individuals acting under the authority of Permit 16979 review the permit before engaging in the permitted activities. Please sign and date the last page then fax a copy of it (or mail a photocopy) to our office to the attention of Robert Clapp. Our fax number is (503) 230-5441. Please note that you are not authorized to conduct activities under Permit 16979 until our office receives a signed copy of the signature page.

We direct your attention to Sections A and B, which describe the yearly take limits and the permit conditions. Permit 16979 authorizes take at the levels, by the means, in the areas, and for the purposes stated in the permit application. The permit is also subject to annual authorization based on your reported annual take and compliance with the permit conditions. Annual reports are due by January 31 each year. Permit 16979 expires on December 31, 2017.

If you have any questions concerning the permit, please contact Robert Clapp at (503) 231-2314.

Sincerely,

for William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: File copy - [16979], F/EN6 - NMFS Enforcement (Raneses), F/NWC1 - Northwest Fisheries Science Center (Ferguson) and abiotic factors with respect to recovering listed species, (c) understand the potential effects of proposed land use practices, (d) determine appropriate regulatory and habitat protection measures in the areas where land use actions are planned, (e) project the impacts of potential hydraulic projects, and (f) evaluate the effectiveness of local forest practices and instream habitat improvement projects in terms of their ability to protect and enhance listed salmonid populations. The researchers would capture fish via a wide variety of means (snorkeling, dip netting, seining, using electrofishing equipment, traps and weirs, and barbless hook-and-line sampling). The captured fish would be variously tissue sampled, measured, tagged, allowed to recover, and released.

A. Take Descriptions and/or Levels

This permit is for activities to be conducted over an approximately five-year period. Annual take levels (listed below) are subject to NMFS' annual authorization process (see Section B - Conditions).

Authorized Take by ESU, Life Stage, Origin, and Activity for Permit 16979 (C=Capture, H=Handle, T=Tag, M=Mark, TS=Tissue Sample, R=Release).

ESU/ Species	Life Stage	Origin	Take Activity	Requested Take	Unintended Mortality	Research Location	Research Period
UCR Spr. Chinook	Adult	Natural	C/H/T/M/TS/R	279	2	The Columbia River and tributaries upstream from the Yakima R. confluence	January - December
UCR Spr. Chinook	Adult	Hatchery: Intact Adipose	C/H/T/M/TS/R	344	3	As Above.	As Above.
UCR Spr. Chinook	Juvenile	Natural	C/H/T/M/TS/R	10,000	200	As Above.	As Above.
UCR Spr. Chinook	Juvenile	Hatchery: Intact Adipose	C/H/T/M/TS/R	1,000	20	As Above.	As Above.
UCR Steelhead	Adult	Natural	C/H/T/M/TS/R	148	2	As Above.	As Above.
UCR Steelhead	Adult	Hatchery: Intact Adipose	C/H/T/M/TS/R	182	2	As Above.	As Above.
UCR Steelhead	Juvenile	Natural	C/H/T/M/TS/R	10,000	200	As Above.	As Above.
UCR Steelhead	Juvenile	Hatchery: Intact Adipose	C/H/T/M/TS/R	1,000	20	As Above.	As Above.

National Marine Fisheries Service (NMFS)
Endangered Species Act (ESA) Section 10(a)(1)(A) Research Permit
(16 U.S.C. §§ 1531-1543) (50 CFR Parts 222-226)

Permit Number:	16979
Permit Type:	Scientific Research
Expiration Date:	December 31, 2017
Reporting Period:	January 1 through December 31
Annual Report Due:	January 31

Permit Holder:	Michael Tonseth
	Research Team Leader
	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North
	Olympia, WA 98501-1091
Phone:	(509) 663-9678
Email:	Michael.Tonseth@dfw.wa.gov
Primary Contact:	Valerie Tribble
	Permit Liaison
	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North
	Olympia, WA 98502
Phone:	(360) 902-2329
Email:	valerie.tribble@dfw.wa.gov

Principal Investigator: Michael Tonseth

Co-investigator(s): Jeremy Cram, Charles Frady, Lynda Hoffman, Michael Hughes, Constance Iten, Robert Jateff, Travis Maitland, Ryan Mann, Todd Miller, Chris Moran, Andrew Murdoch, Charles Snow, Benjamin Truscott

Authorization:

The WDFW is hereby authorized to conduct research activities that will take salmonid species listed under the ESA. The taking is subject to the provisions of section 10(a)(1)(A) of the ESA (16 U.S.C. §§ 1531-1543), NMFS regulations governing permits to take listed species, and the conditions set forth in this permit. The species are:

Upper Columbia River Chinook Salmon (*Oncorhynchus tshawytscha)*
Upper Columbia River Steelhead (*O. mykiss*)

Abstract:

The WDFW is hereby authorized to annually take listed salmonids while conducting research designed to help managers (a) understand the distribution and proportion of hatchery and natural origin steelhead and Chinook in UCR tributaries, (b) understand the influences of other biotic

10. The permit holder must obtain approval from NMFS before changing sampling locations or research protocols.

11. The permit holder must notify NMFS as soon as possible but no later than two days after any authorized level of take is exceeded or if such an event is likely. The permit holder must submit a written report detailing why the authorized take level was exceeded or is likely to be exceeded.

12. The permit holder is responsible for any biological samples collected from listed species as long as they are used for research purposes. The permit holder may not transfer biological samples to anyone not listed in the application without prior written approval from NMFS.

13. The person(s) actually doing the research must carry a copy of this permit while conducting the authorized activities.

14. The permit holder must allow any NMFS employee or representative to accompany field personnel while they conduct the research activities.

15. The permit holder must allow any NMFS employee or representative to inspect any records or facilities related to the permit activities.

16. The permit holder may not transfer or assign this permit to any other person as defined in Section 3(12) of the ESA. This permit ceases to be in effect if transferred or assigned to any other person without NMFS' authorization.

17. NMFS may amend the provisions of this permit after giving the permit holder reasonable notice of the amendment.

18. The permit holder must obtain all other Federal, state, and local permits/authorizations needed for the research activities.

19. On or before January 31st of every year, the permit holder must submit to NMFS a post-season report in the prescribed form describing the research activities, the number of listed fish taken and the location, the type of take, the number of fish intentionally killed and unintentionally killed, the take dates, and a brief summary of the research results. The report must be submitted electronically on our permit website, and the forms can be found at https://apps.nmfs.noaa.gov/. Falsifying annual reports or permit records is a violation of this permit.

20. If the permit holder violates any permit condition they will be subject to any and all penalties provided by the ESA. NMFS may revoke this permit if the authorized activities are not conducted in compliance with the permit and the requirements of the ESA or if NMFS determines that its ESA section 10(d) findings are no longer valid.

21. Within a week of August 15th, every year, the WDFW primary contact will call or email the NMFS permit point-of-contact person to ensure that the take numbers are remaining within expected levels.

B. Conditions Common to All Research Permits Issued by NMFS' Northwest Region

Not all of these conditions may apply to the specific actions authorized by this permit. Nonetheless, failure to adhere to any condition that does apply may cause NMFS to revoke the permit.

1. The permit holder must ensure that listed species are taken only at the levels, by the means, in the areas and for the purposes stated in the permit application, and according to the conditions in this permit.

2. The permit holder must not intentionally kill or cause to be killed any listed species unless the permit specifically allows intentional lethal take.

3. The permit holder must handle listed fish with extreme care and keep them in cold water to the maximum extent possible during sampling and processing procedures. When fish are transferred or held, a healthy environment must be provided; e.g., the holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix of species, the permit holder must process listed fish first to minimize handling stress.

4. Each researcher must stop capturing and handling listed fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, listed fish may only be identified and counted. Additionally, electrofishing is not permitted if water temperatures exceed 64 degrees Fahrenheit.

5. If the permit holder anesthetizes listed fish to avoid injuring or killing them during handling, the fish must be allowed to recover before being released. Fish that are only counted must remain in water and not be anesthetized.

6. The permit holder must use a sterilized needle for each individual injection when passive integrated transponder tags (PIT-tags) are inserted into listed fish.

7. If the permit holder unintentionally captures any listed adult fish while sampling for juveniles, the adult fish must be released without further handling and such take must be reported.

8. The permit holder must exercise care during spawning ground surveys to avoid disturbing listed adult salmonids when they are spawning. Researchers must avoid walking in salmon streams whenever possible, especially where listed salmonids are likely to spawn. Visual observation must be used instead of intrusive sampling methods, especially when just determining fish presence.

9. The permit holder using backpack electrofishing equipment must comply with NMFS' Backpack Electrofishing Guidelines (June 2000) available at http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

22. Listed fish mortalities and tissue samples will be processed or archived within the WDFW Genetics Lab in Olympia or by staff/facilities approved by NMFS. Scale samples will be be sent to the WDFW Scale Lab in Olympia for analysis, or to staff/facilities approved by NMFS.

C. Penalties and Permit Sanctions

1. Any person who violates any provision of this permit is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the ESA and 15 CFR part 904 [Civil Procedures].

2. All permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

for William W. Stelle, Jr.
Regional Administrator

May 10, 2013
Date

Michael Tonseth
Research Team Leader
Washington Department of Fish and Wildlife

MAY 15, 2013
Date

Appendix B
Bull Trout Agreement between WDFW and USFWS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE. 11th Avenue
Portland, Oregon 97232-4181

IN REPLY REFER TO:

HATCHERIES
SEP - 4 1998
PROGRAM

AUG 28 1998

Ross Fuller
Washington Department of Fish and Wildlife
600 North Capitol Way
Olympia, Washington 98501

Dear Mr. Fuller:

We have completed our review of the Washington Department of Fish and Wildlife's proposed fish management and monitoring activities, which you submitted to the Fish and Wildlife Service by letter dated June 9, 1998, that may involve "take" of the threatened Columbia River population segment of the bull trout (*Salvelinus confluentus*). Based on that review, we believe that any such take associated with implementation of your program falls within the scope of activities addressed under the approved Endangered Species Act section 6 Cooperative Agreement between the Service and the Department, and is authorized via that Agreement.

We appreciate your assistance and cooperation in this matter. Please contact Bob Hallock of the Service's Upper Columbia River Basin Fish and Wildlife Office, 11103 East Montgomery Drive, Suite 2, Spokane, Washington (telephone 509/891-6839) if you have any questions or if there are any changes in your program that may affect the bull trout.

Sincerely,

Vicki M. Finn

Chief, Endangered Species

Appendix C
Parameters Used in the Index of Biotic Integrity Assessment

Table 3–1 Community metrics used in assessment of the Priest Rapids Project fish community (adopted from Hughes and Gammon 1987 and Grant PUD 2009).

	Scoring Criteria		
	1 (worst)	**3**	**5 (best)**
Species richness and composition			
Total number of native species	0–4	5–9	10+
Number of cottid species	0–1	2	3+
Number of native cyprinid species	0–2	3–5	6+
Number of catostomid species	0	1	2
Number of intolerant species	0	1–2	3+
% of individuals as common carp	10+	1–9	0–1
Trophic composition			
% of individuals as omnivores	50+	25–49	0–24
% of individuals as insectivores	0–19	20–39	40+
% of individuals as catchable salmonids[1]	0–1	1–9	10+
Fish abundance and condition			
Number of individuals	0–49	50–99	100+
% of individuals introduced (exotic)	10+	2–9	0–1
% of individuals with anomalies[2]	6+	2–5	0–1

[1]Salmonids (excluding Whitefish) > 200mm.

[2]i.e. disease, tumors, fin damage.

Table 3–2 Tolerance, trophic group, and geographic origin of fish present in the Priest Rapids Project[1] [adopted from Grant PUD (2009) from Pfeifer et al. (2001)].

Family, Species	**Relative tolerance of organic pollution, warm water, and sediment**	**Trophic group of adults**	**Origin**
Acipenseridae			
White Sturgeon *Acipenser transmontanus*	Intermediate	Piscivore	Native
Catostomidae			
Bridgelip Sucker *Catostomus columbianus*	Tolerant	Omnivore	Native
Largescale Sucker *Catostomus macrocheilus*	Tolerant	Omnivore	Native
Longnose Sucker *Catostomus catostomus*	Tolerant	Omnivore	Native
Centrarchidae			
Black Crappie *Pomoxis nigromaculatus*	Tolerant	Omnivore	Introduced
Bluegill *Lepomis macrochirus*	Tolerant	Insectivore	Introduced
Largemouth Bass *Micropterus salmoides*	Tolerant	Piscivore	Introduced
Pumpkinseed *Lepomis gibbosus*	Tolerant	Insectivore	Introduced
Smallmouth Bass *Micropterus dolomieu*	Intolerant	Piscivore	Introduced
White Crappie *Pomoxis annularis*	Tolerant	Insectivore	Introduced
Clupeidae			
American Shad *Alosa sapidissima*	Tolerant	Insectivore	Introduced

Family, Species	**Relative tolerance of organic pollution, warm water, and sediment**	**Trophic group of adults**	**Origin**
Cottidae			
Prickly Sculpin *Cottus asper*	Intermediate	Insectivore	Native
Torrent Sculpin *Cottus rhotheus*	Intolerant	Insectivore	Native
Cyprinidae			
Chiselmouth *Acrocheilus alutaceus*	Intermediate	Herbivore	Native
Common Carp *Cyprinus carpio*	Tolerant	Omnivore	Introduced
Leopard Dace *Rhinichthys falcatus*	Intermediate	Insectivore	Native
Longnose Dace *Rhinichthys cataractae*	Intermediate	Insectivore	Native
Northern Pikeminnow *Ptychocheilus oregonensis*	Tolerant	Piscivore	Native
Peamouth *Mylocheilus caurinus*	Intermediate	Insectivore	Native
Redside Shiner *Richardsonius balteatus*	Intermediate	Insectivore	Native
Speckled Dace *Rhinichthys osculus*	Intermediate	Insectivore	Native
Tench *Tinca tinca*	Tolerant	Omnivore	Introduced
Gadidae			
Burbot *Lota lota*	Intolerant	Piscivore	Native
Gasterosteidae			
Threespine Stickleback *Gasterosteus aculeatus*	Intermediate	Insectivore	Native
Ictaluridae			
Black Bullhead *Ameiurus melas*	Tolerant	Insectivore	Introduced

Family, Species	**Relative tolerance of organic pollution, warm water, and sediment**	**Trophic group of adults**	**Origin**
Channel Catfish *Ictalurus punctatus*	Tolerant	Insectivore	Introduced
Percidae			
Walleye *Sander vitreus*	Intermediate	Piscivore	Introduced
Yellow Perch *Perca flavescens*	Intermediate	Insectivore	Introduced
Percopsidae			
Sand Roller *Percopsis transmontana*	Intermediate	Insectivore	Native
Petromyzontidae			
Pacific Lamprey *Entosphenus tridentatus*	Intolerant	Parasite	Native
Salmonidae			
Brown Trout *Salmo trutta*	Intolerant	Omnivore	Introduced
Bull Trout *Salvelinus confluentus*	Intolerant	Piscivore	Native
Chinook Salmon *Oncorhynchus tshawytscha*	Intolerant	Piscivore	Native
Coho Salmon *Oncorhynchus kisutch*	Intolerant	Piscivore	Native
Cutthroat Trout *Oncorhynchus clarkii*	Intolerant	Insectivore	Native
Lake Whitefish *Coregonus clupeaformis*	Intolerant	Insectivore	Native
Mountain Whitefish *Prosopium williamsoni*	Intolerant	Insectivore	Native
Rainbow Trout/Steelhead *Oncorhynchus mykiss*	Intolerant	Insectivore	Native
Sockeye Salmon *Oncorhynchus nerka*	Intolerant	Insectivore	Native

[1]For fish captured in the Priest Rapids Project not listed within this table, community metrics of similar species were used as follows (species captured by LLRT = species captured by Pfeifer et al. 2000): 1. bullhead spp. = other Ictalurids; 2. dace spp. = other species of the genus *Rhinichthys*; 3. grass carp = common carp; 4. green sunfish = bluegill; 5. sculpin = torrent sculpin; 6. Sucker spp. = other species of the genus *Catostomus*; 7. Whitefish spp. = other Whitefish; and 8. minnow spp. = Peamouth (since unidentified minnows in the field are generally believed to be Peamouth/Northern Pikeminnow hybrids.)

Appendix D
Parameters Used to Calculate Indices of Conditions

Table 4–1 Intercept (a) and slope (b) parameters for standard weight (W_s) equations for various fish species and minimum total lengths or length ranges (mm) recommended for application. The standard equation format is: $\log_{10}(W_s) = a + b \times \log_{10}(\text{total length})$.

Species	a	b	Minimum Total Length or Length Range (mm)	Source
Bluegill	–5.374	3.316	80	Hillman (1982)
Bridgelip Sucker	–4.921	2.940	130–460	Bennett et al. (1983); Richter (2007)
Common Carp	–4.639	2.920	200	Bister et al. (2000)
Largemouth Bass	–5.316	3.191	150	Wege and Anderson (1978)
Largescale Sucker	–4.959	2.970	170–640	Bennett et al. (1983); Richter (2007)
Northern Pikeminnow	–5.268	3.080	100	Bennett et al. (1983); Pfeifer et al. 2001
Pumpkinseed	–5.179	3.237	50	Liao et al. (1995)
Redside Shiner	–5.854	3.390	100	Bennett et al. (1983); Pfeifer et al. 2001
Smallmouth Bass	–5.329	3.200	150	Kolander et al. (1993)
Walleye	–5.453	3.180	150	Murphy et al. (1990)
Yellow Perch	–5.386	3.230	100	Willis et al. (1991)

Appendix E
Length Frequency Histograms for Fish with Over Ten Individuals Captured

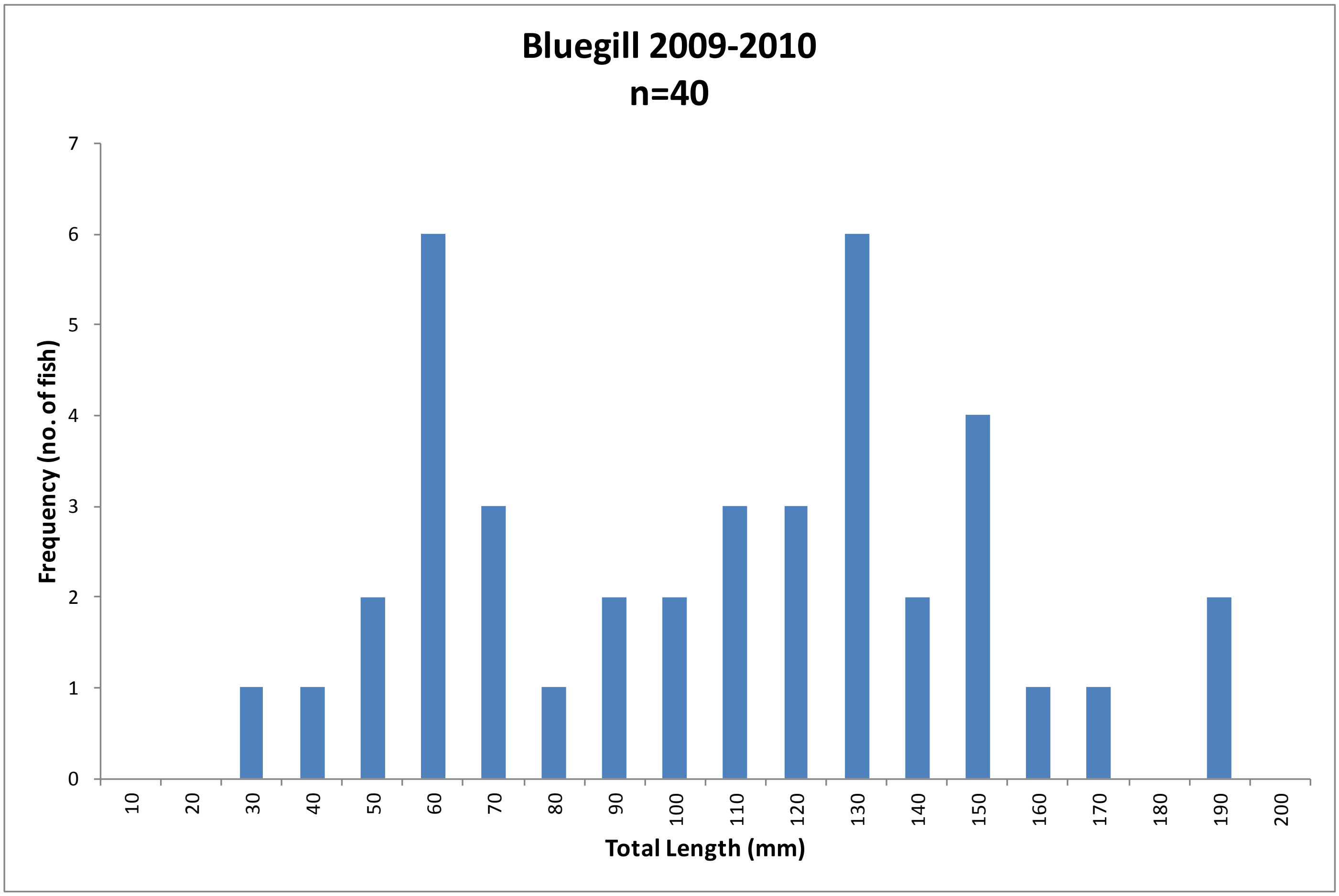


Figure 5-1 Length frequency distribution of Bluegill collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

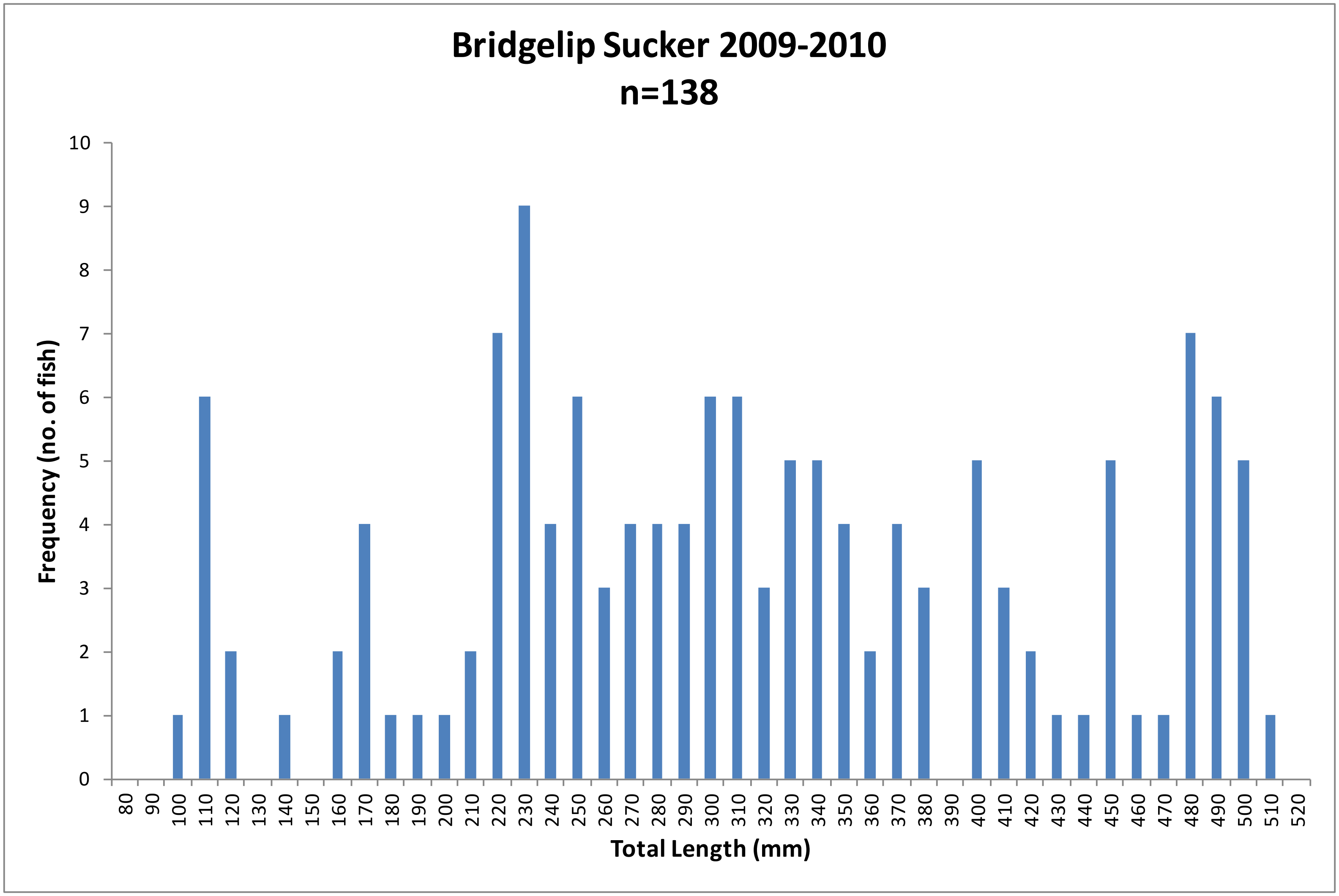


Figure 5-2 **Length frequency distribution of Bridgelip Sucker collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.**

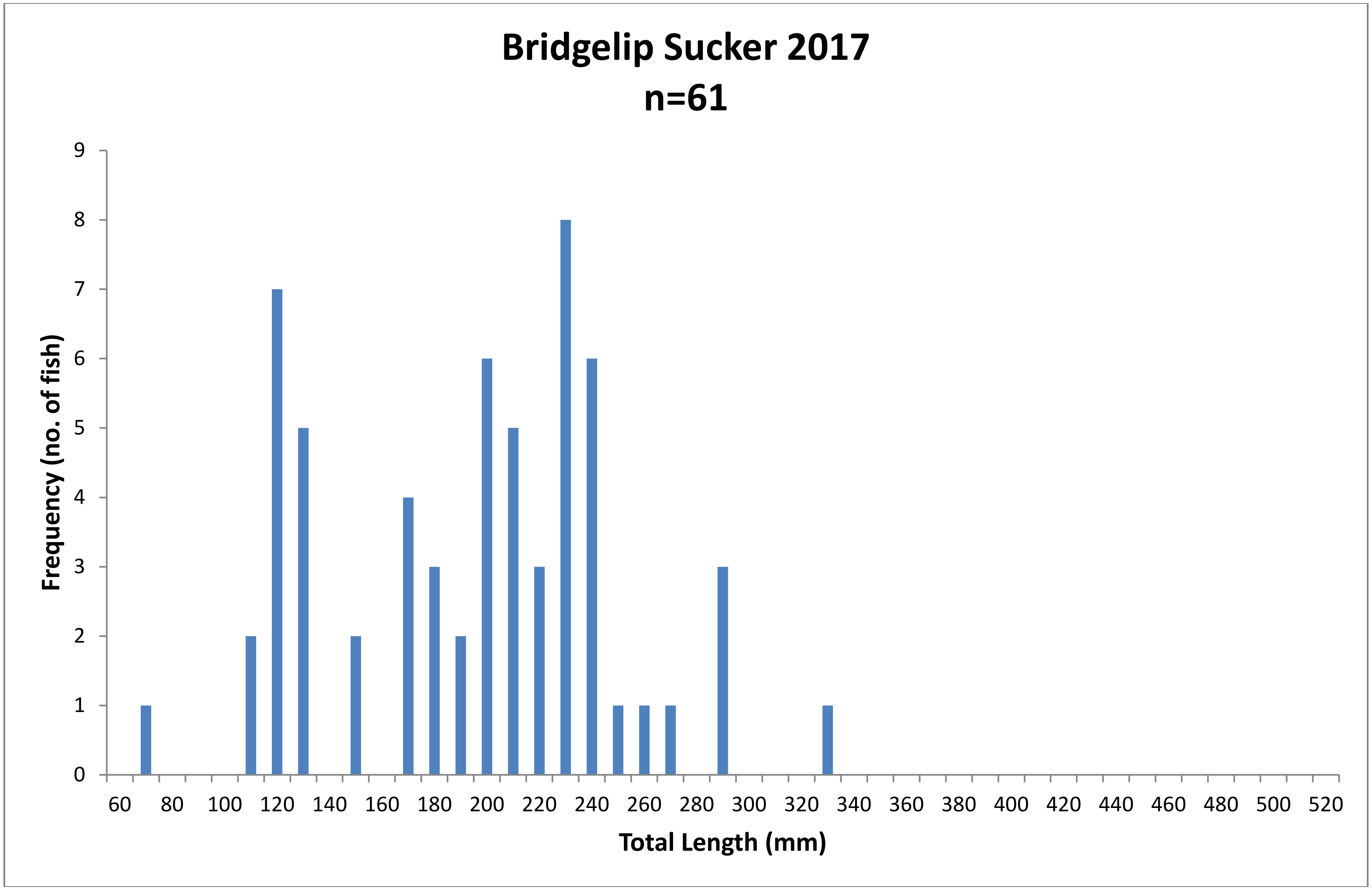


Figure 5-3 **Length frequency distribution of Bridgelip Sucker collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.**

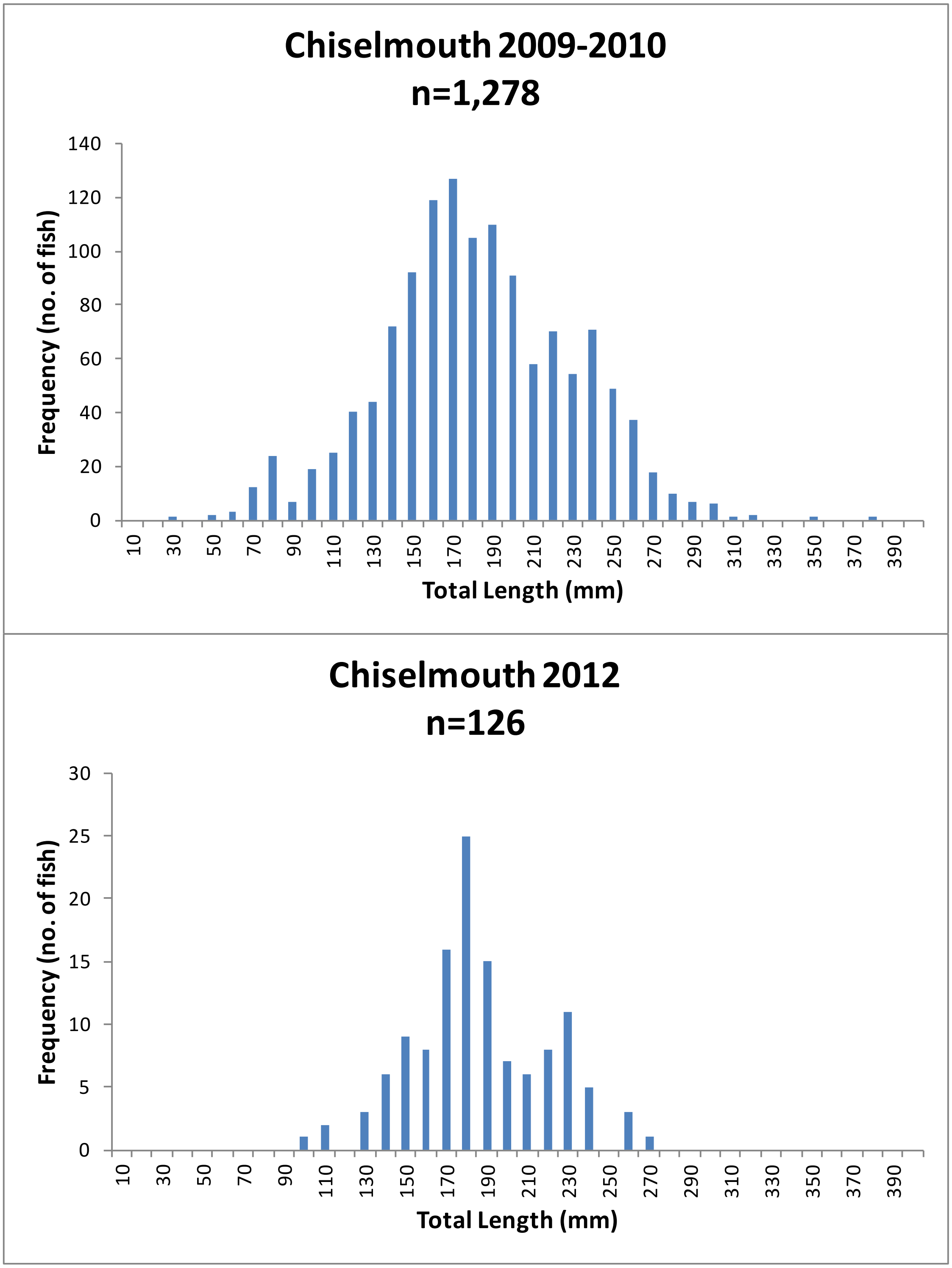


Figure 5-4 Length frequency distribution of Chiselmouth collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

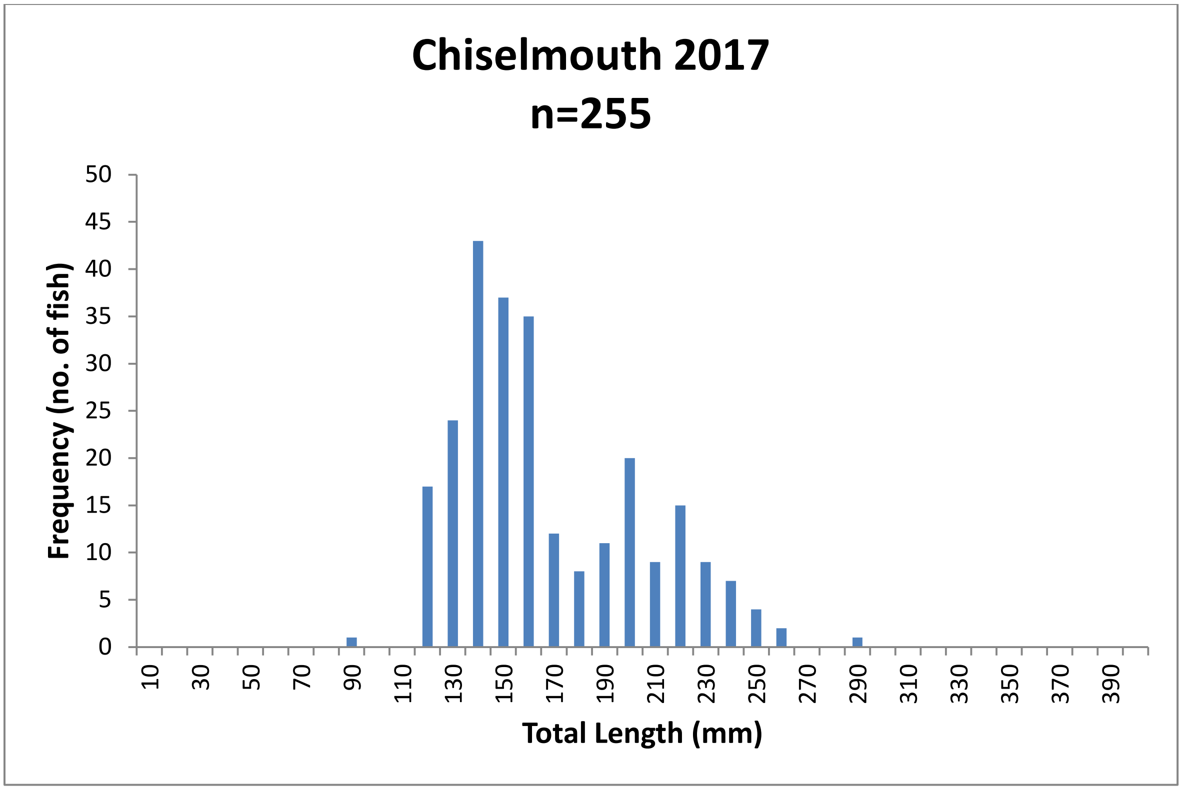


Figure 5-5 Length frequency distribution of Chiselmouth collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

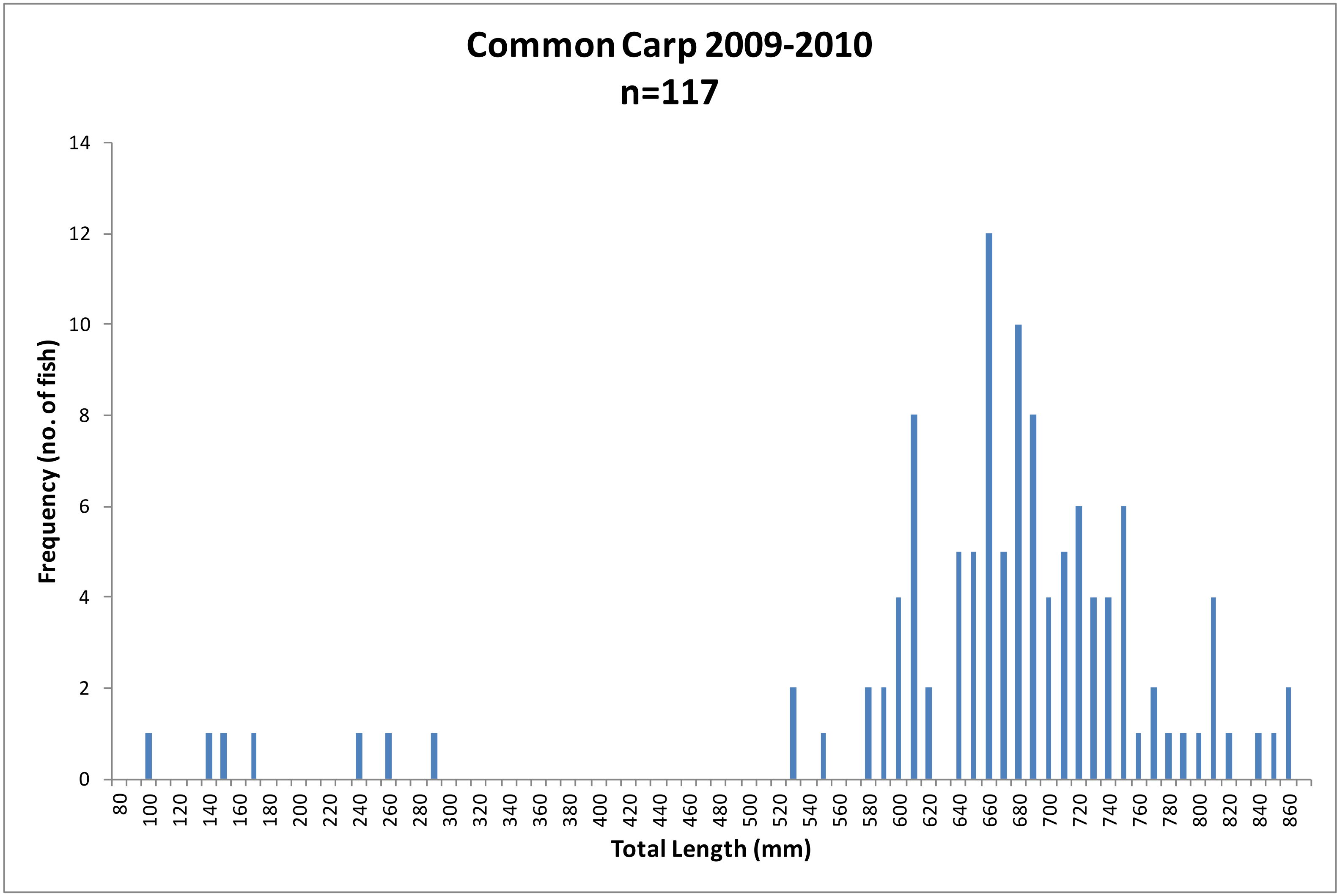


Figure 5-6 **Length frequency distribution of common carp collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.**

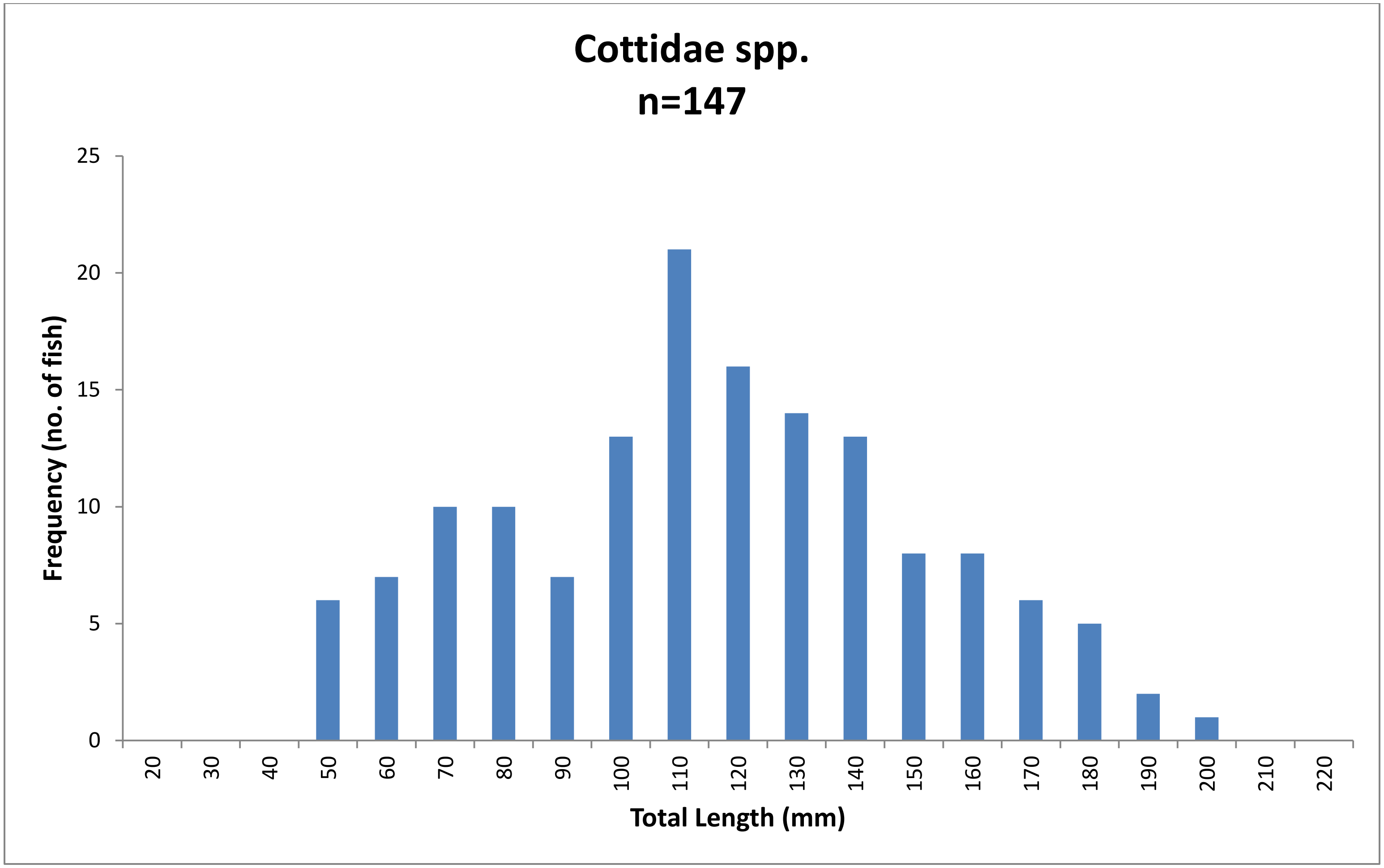


Figure 5-7 Length frequency distribution of Cottidae species collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

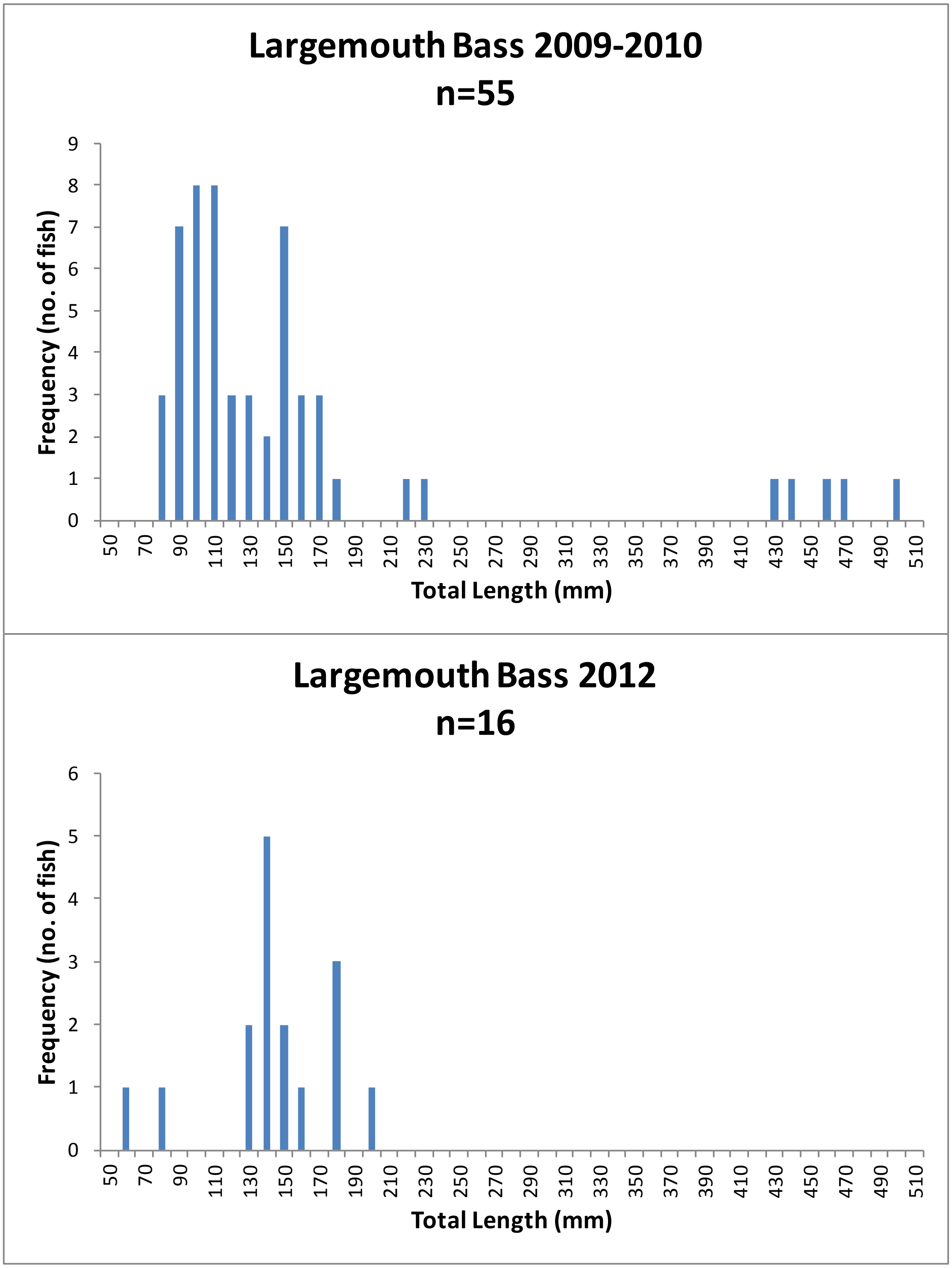


Figure 5-8 Length frequency distribution of largemouth Bass collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

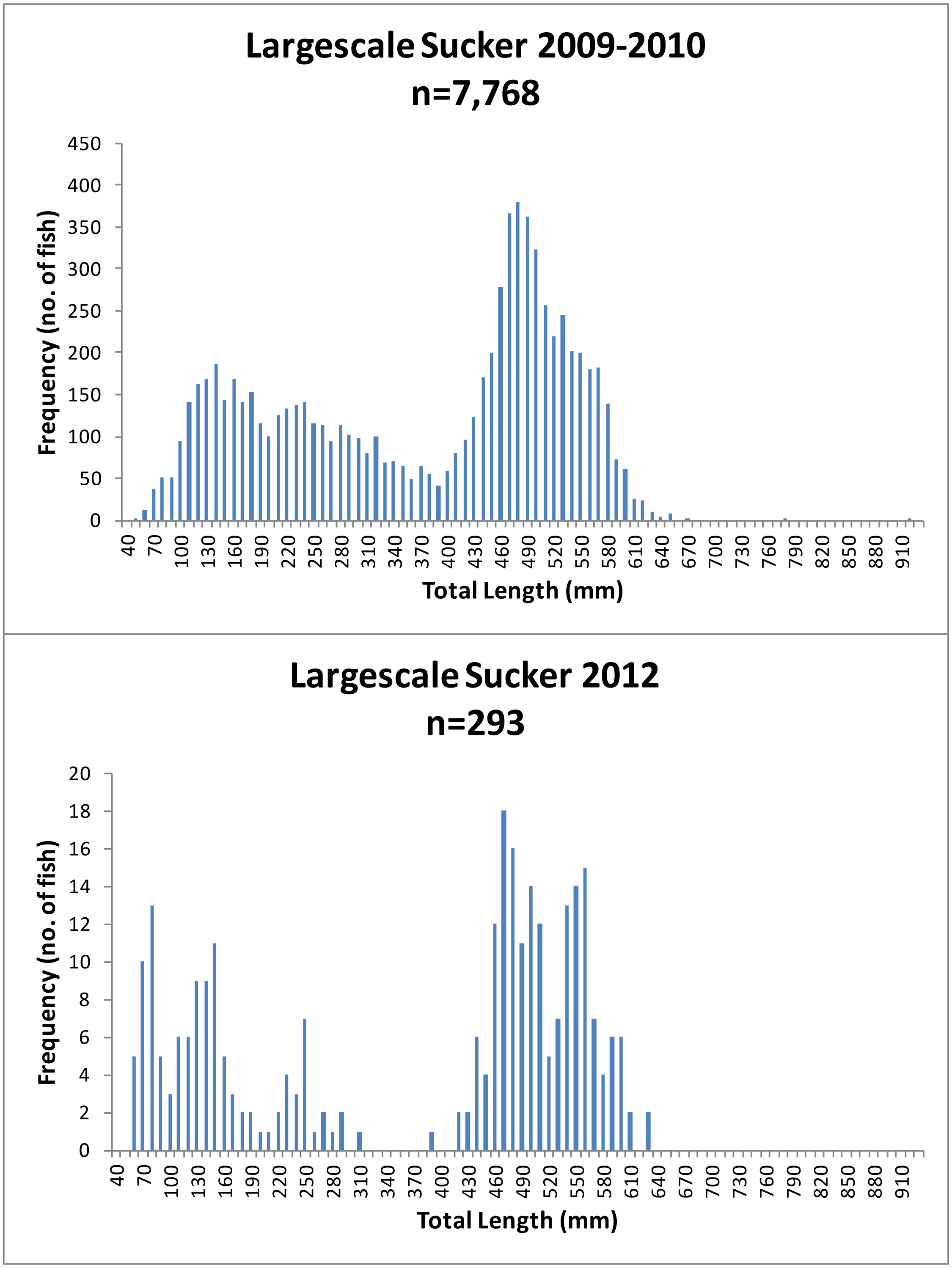


Figure 5-9 Length frequency distribution of Largescale Sucker collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

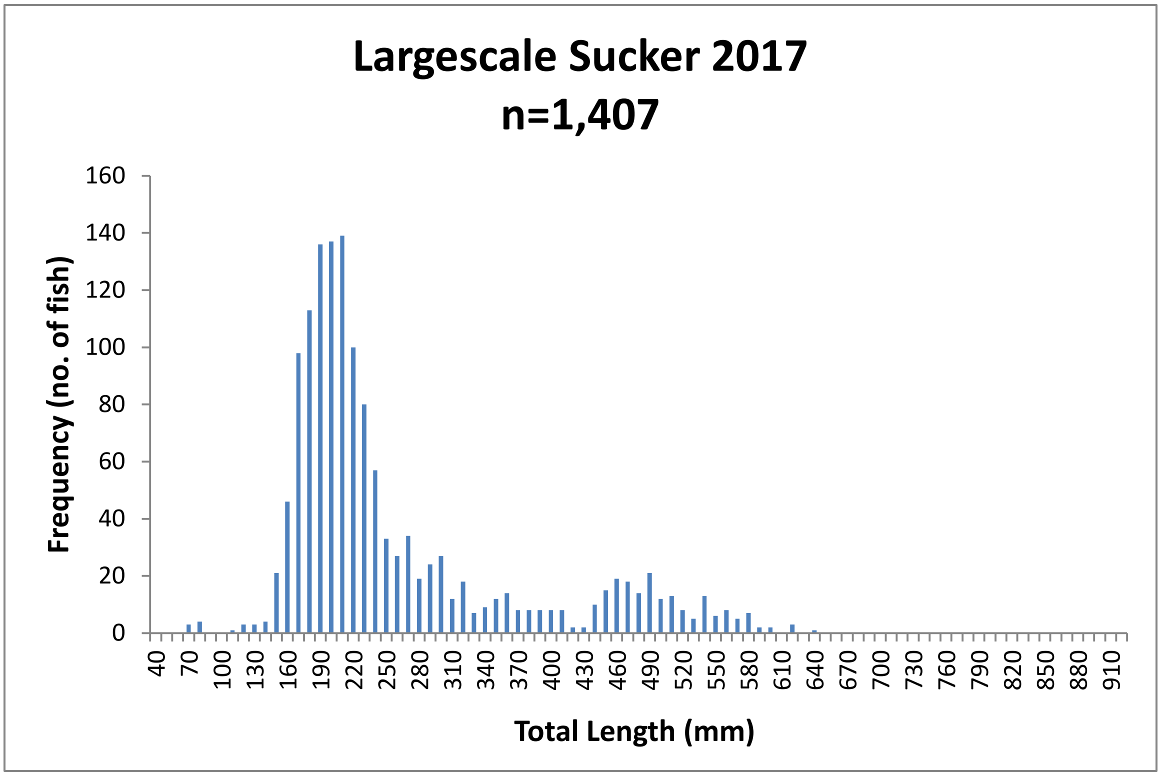


Figure 5-10 Length frequency distribution of Largescale Sucker collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

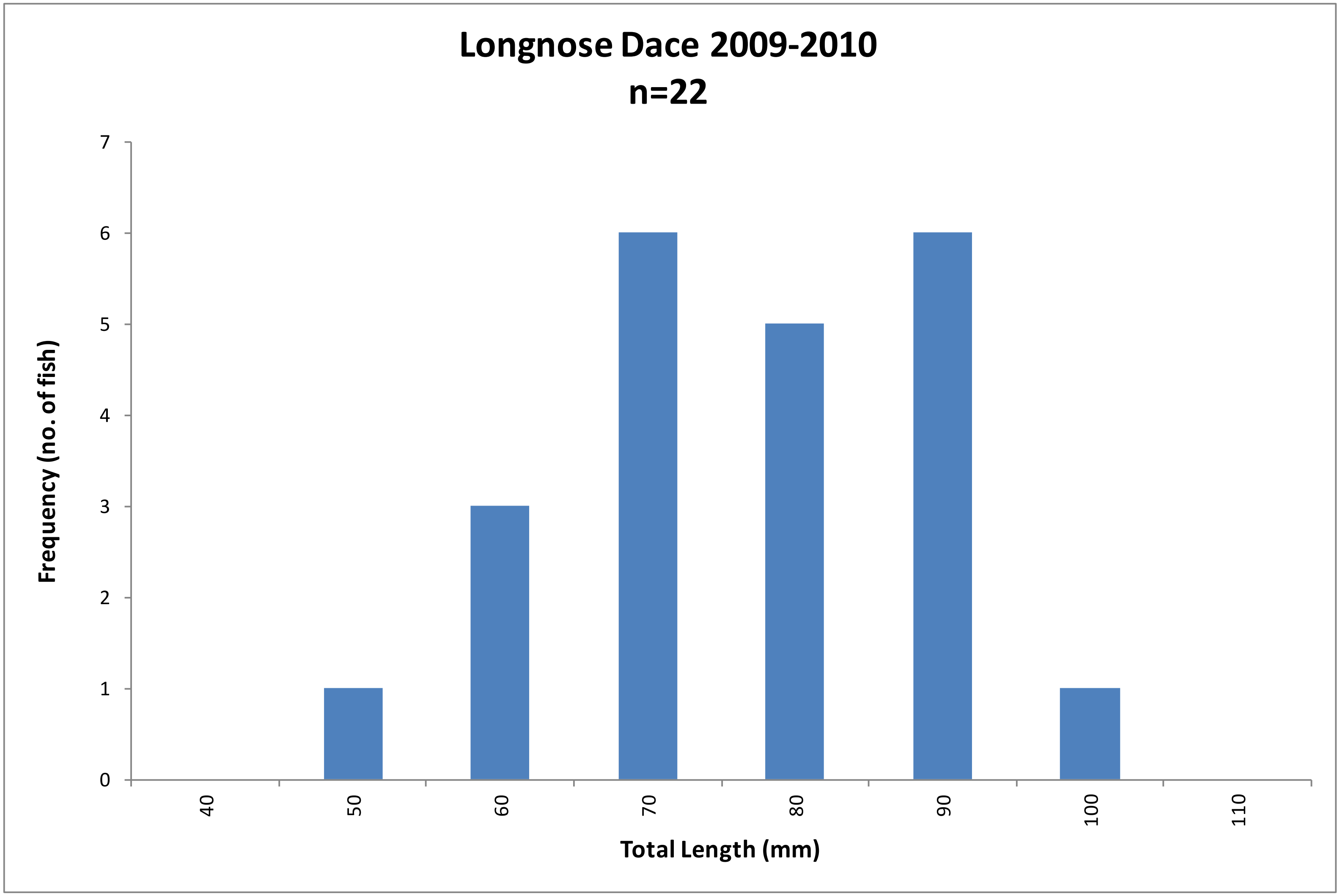


Figure 5-11 Length frequency distribution of Longnose Dace collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

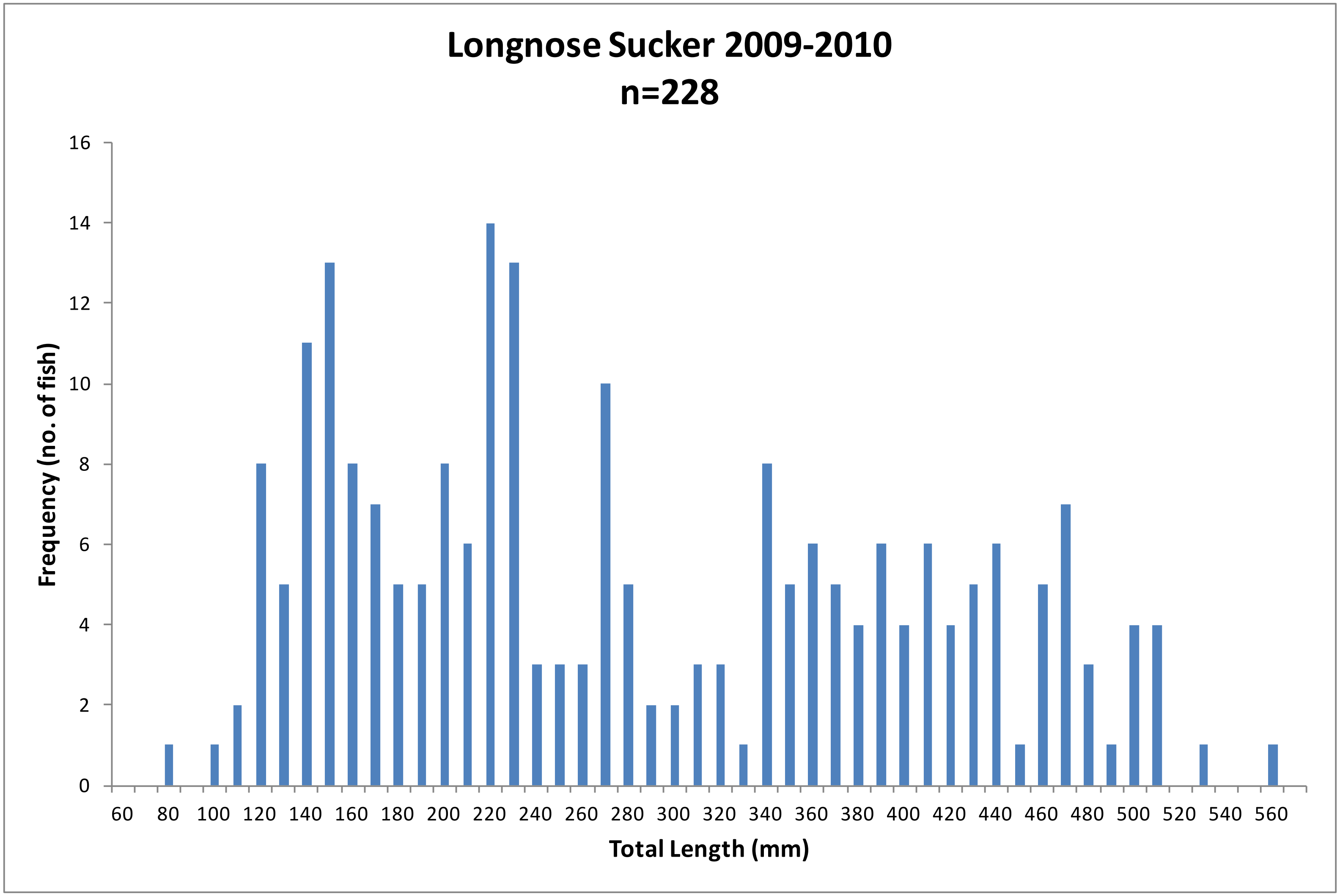


Figure 5-12 Length frequency distribution of Longnose Sucker collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

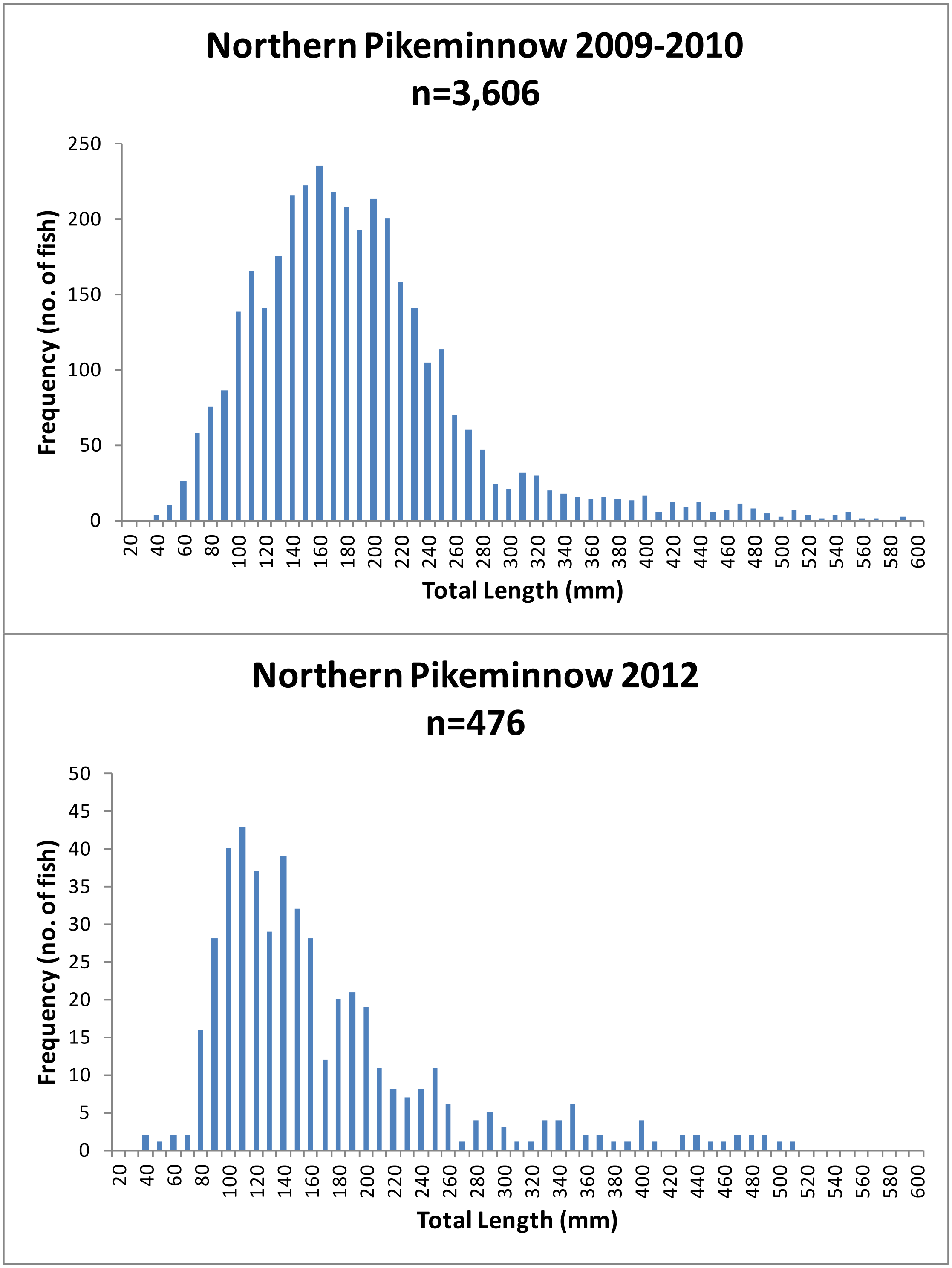


Figure 5-13 Length frequency distribution of Northern Pikeminoow collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

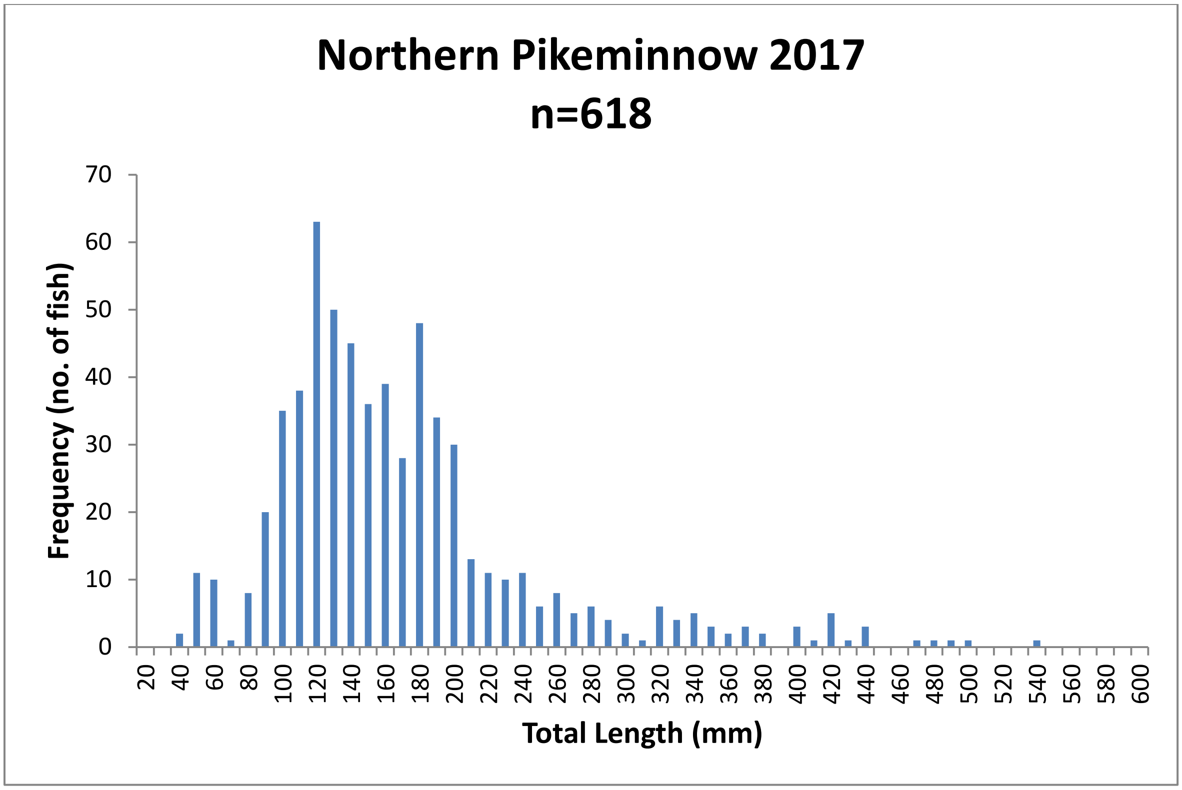


Figure 5-14 **Length frequency distribution of Northern Pikeminnow collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.**

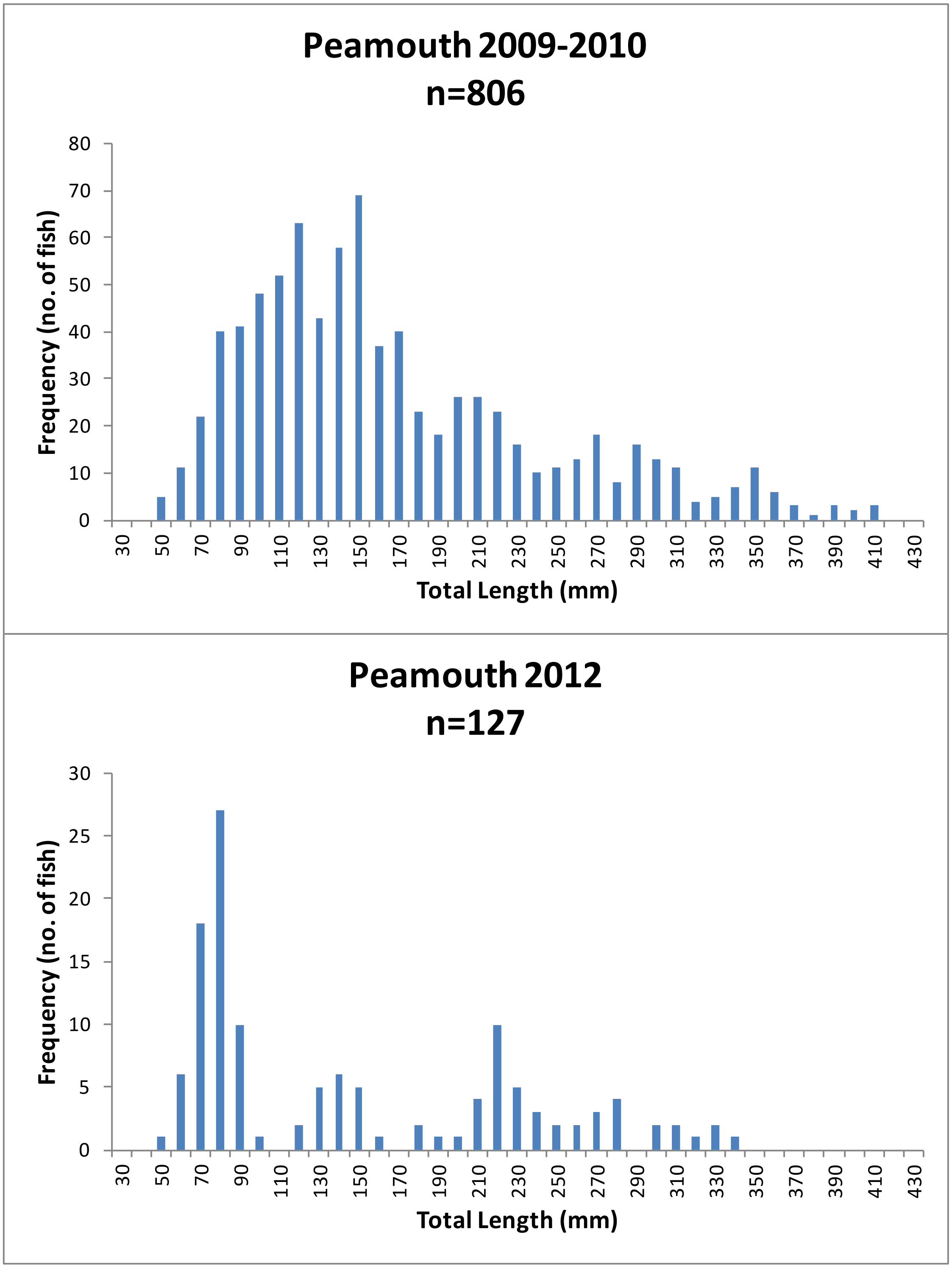


Figure 5-15 Length frequency distribution of Peamouth collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

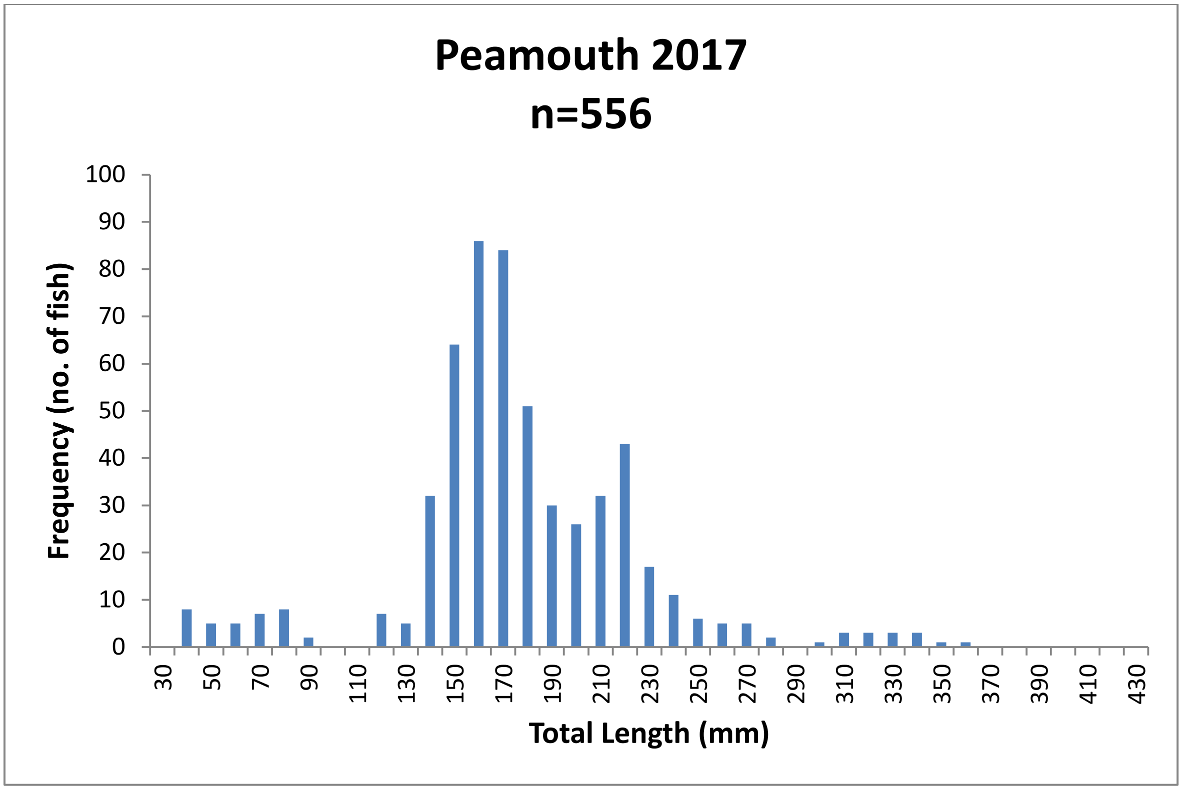


Figure 5-16 Length frequency distribution of Peamouth collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

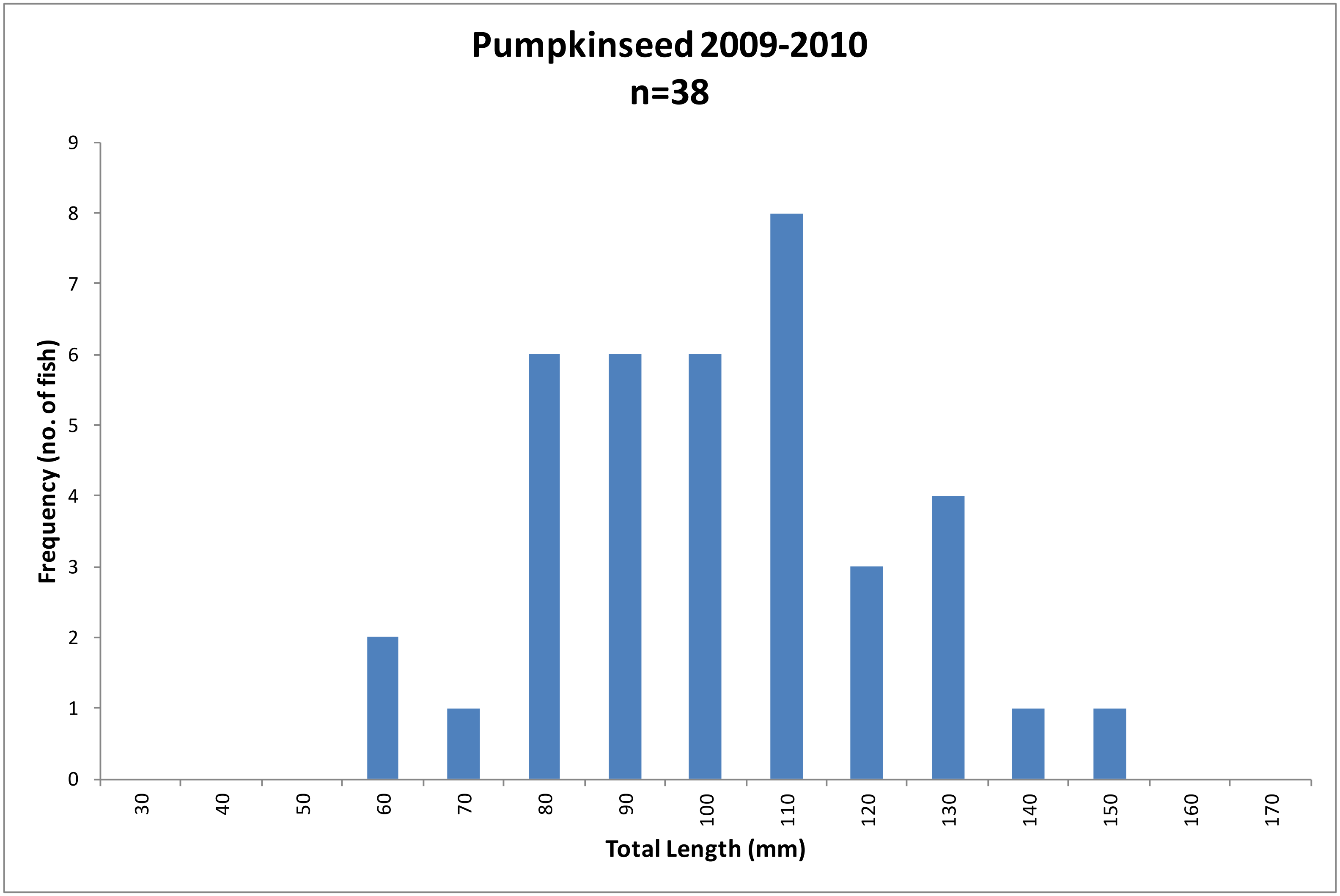


Figure 5-17 Length frequency distribution of Pumpkinseed collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

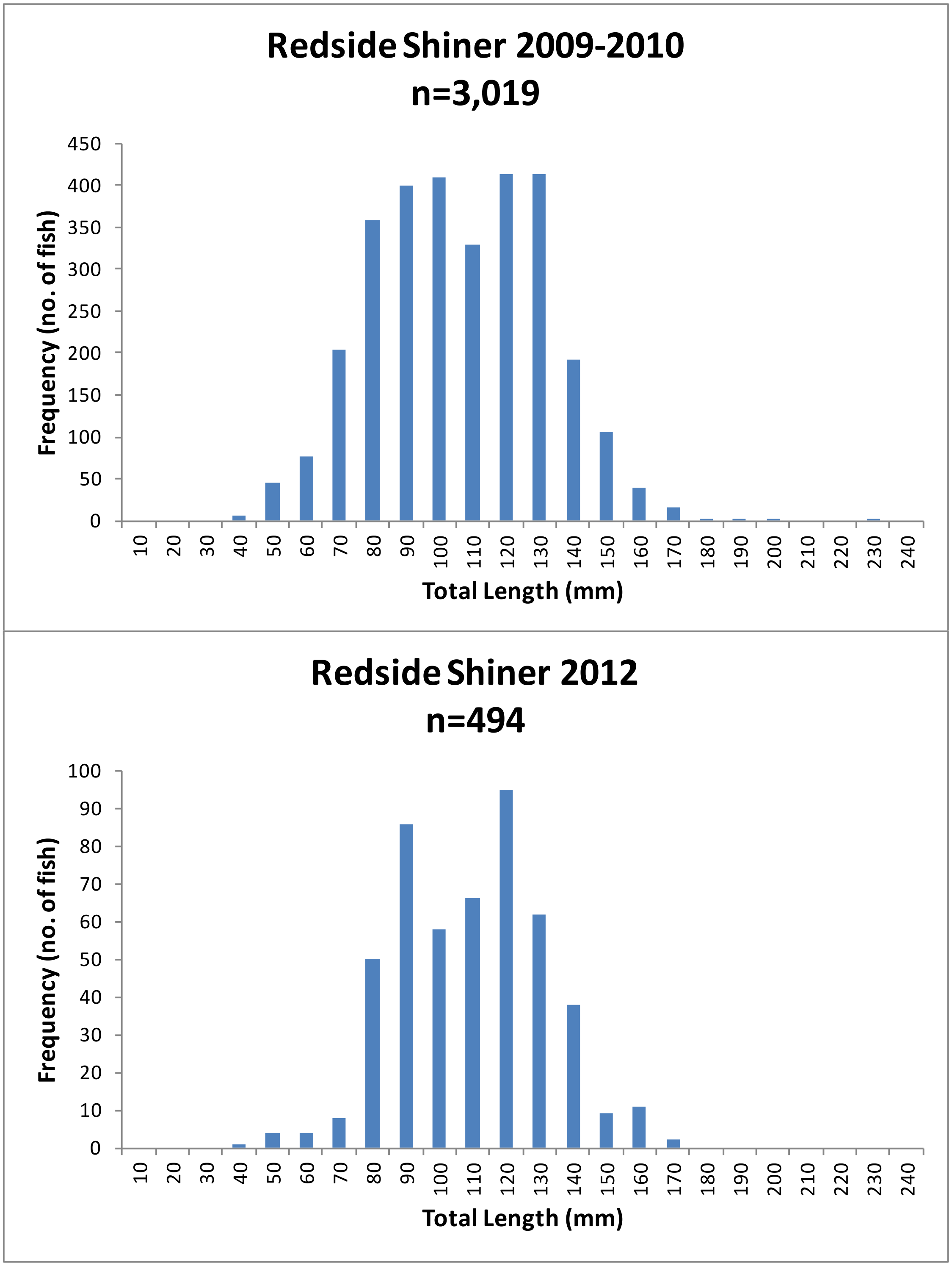


Figure 5-18 Length frequency distribution of Redside Shiner collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

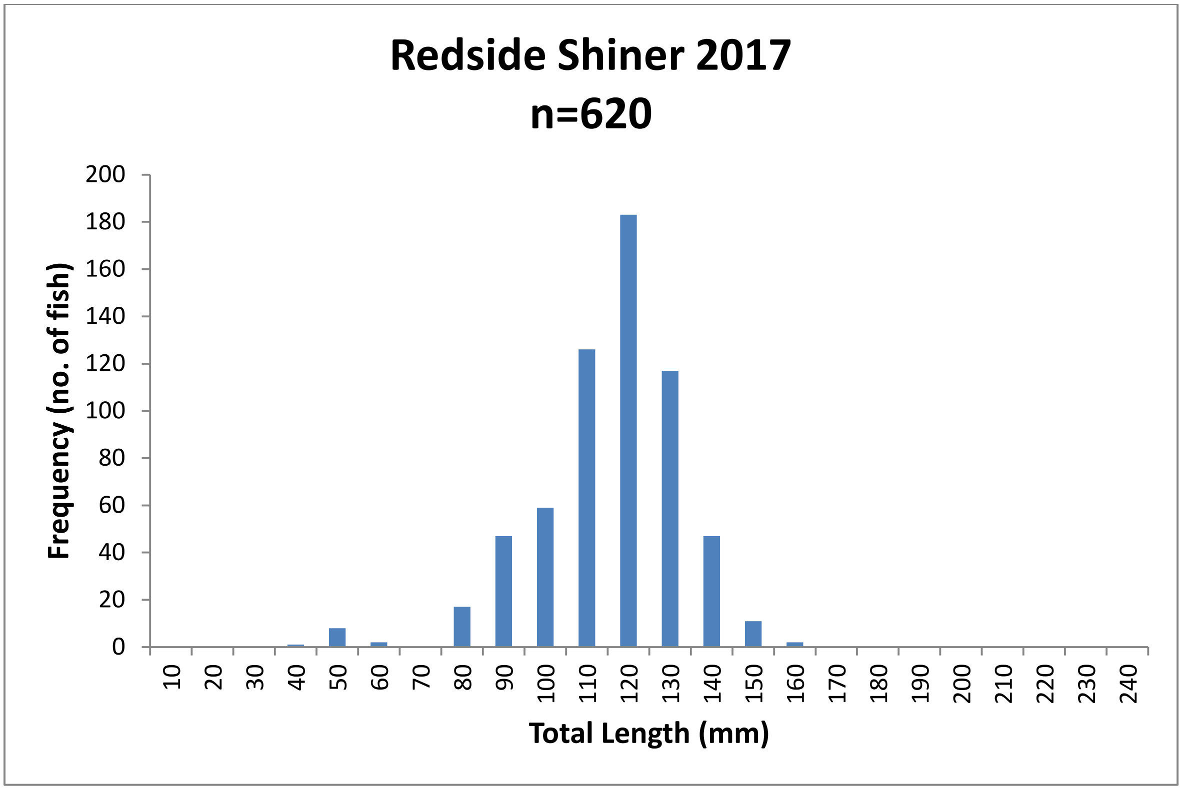


Figure 5-19 Length frequency distribution of Redside Shiner collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

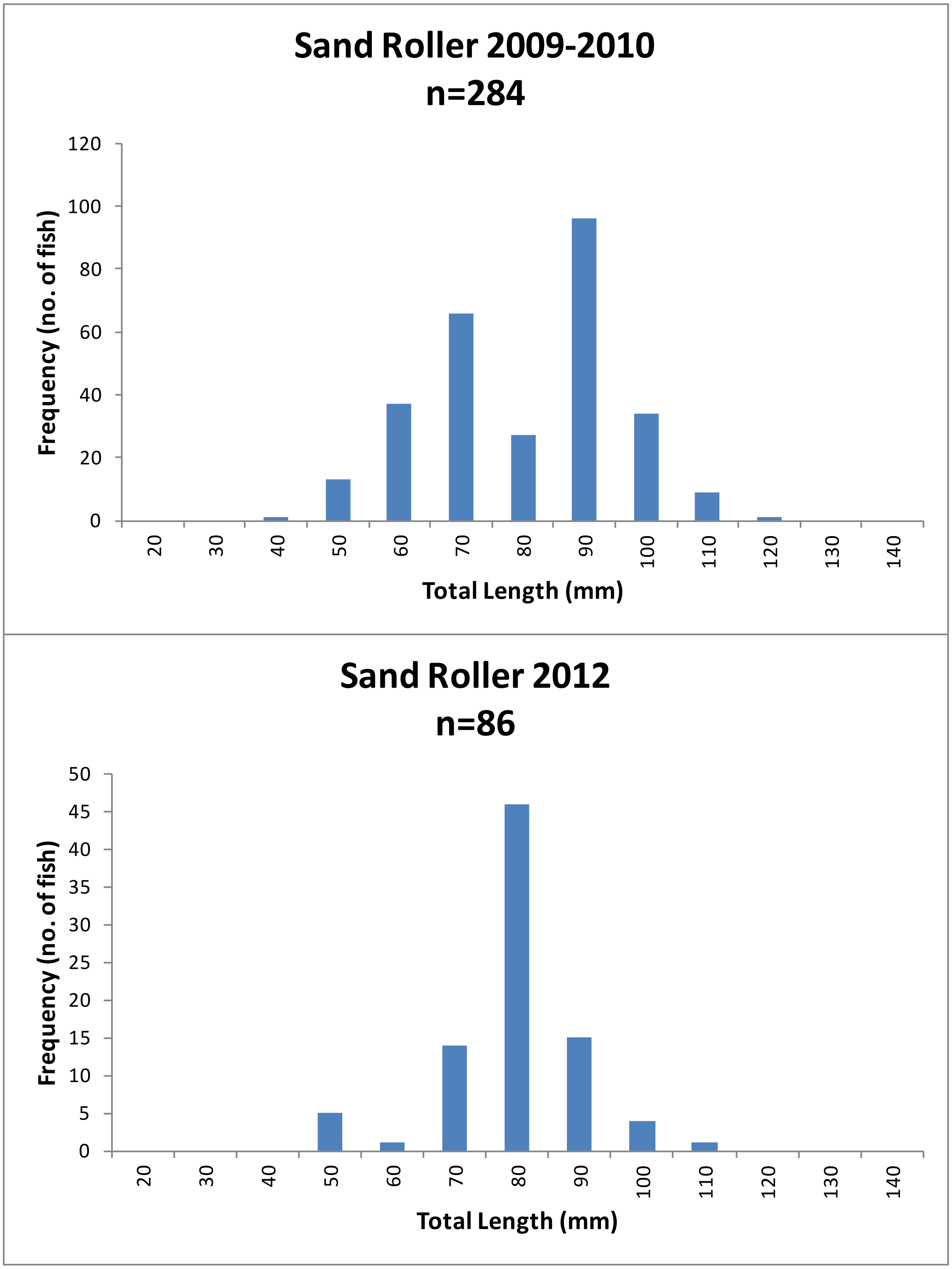


Figure 5-20 Length frequency distribution of Sand Roller collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

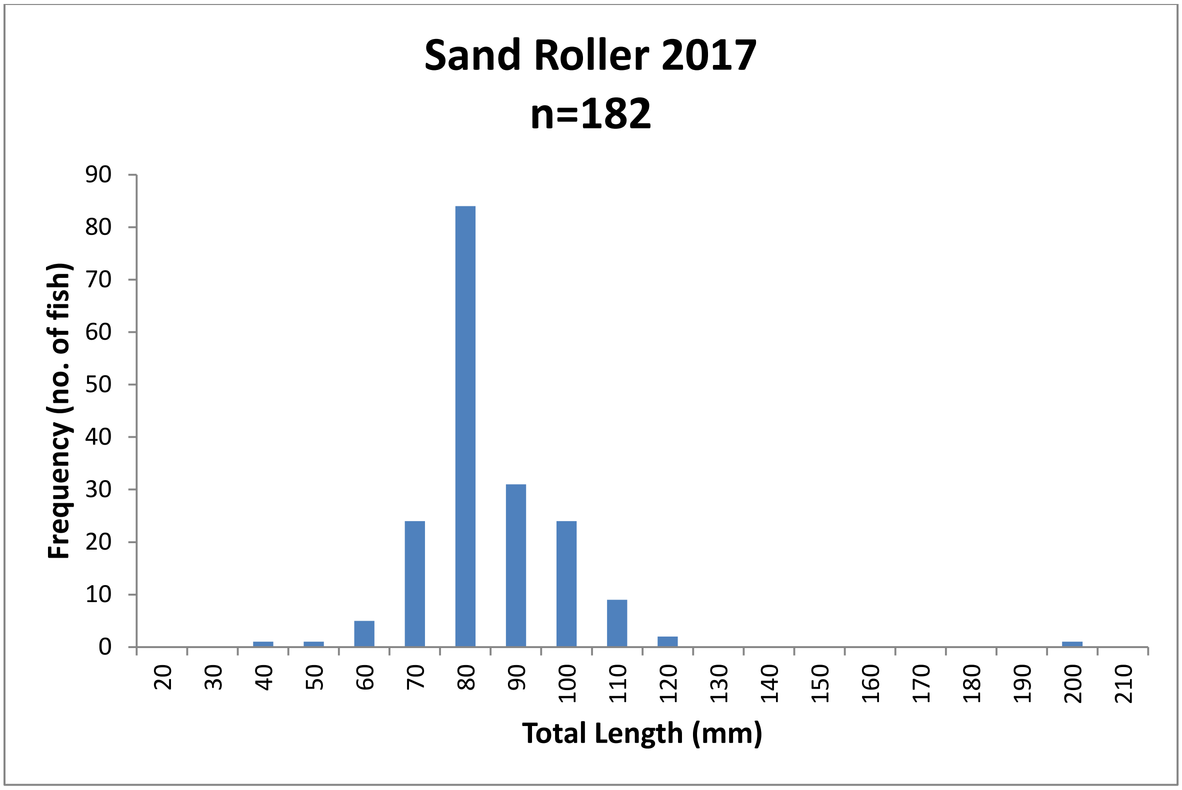
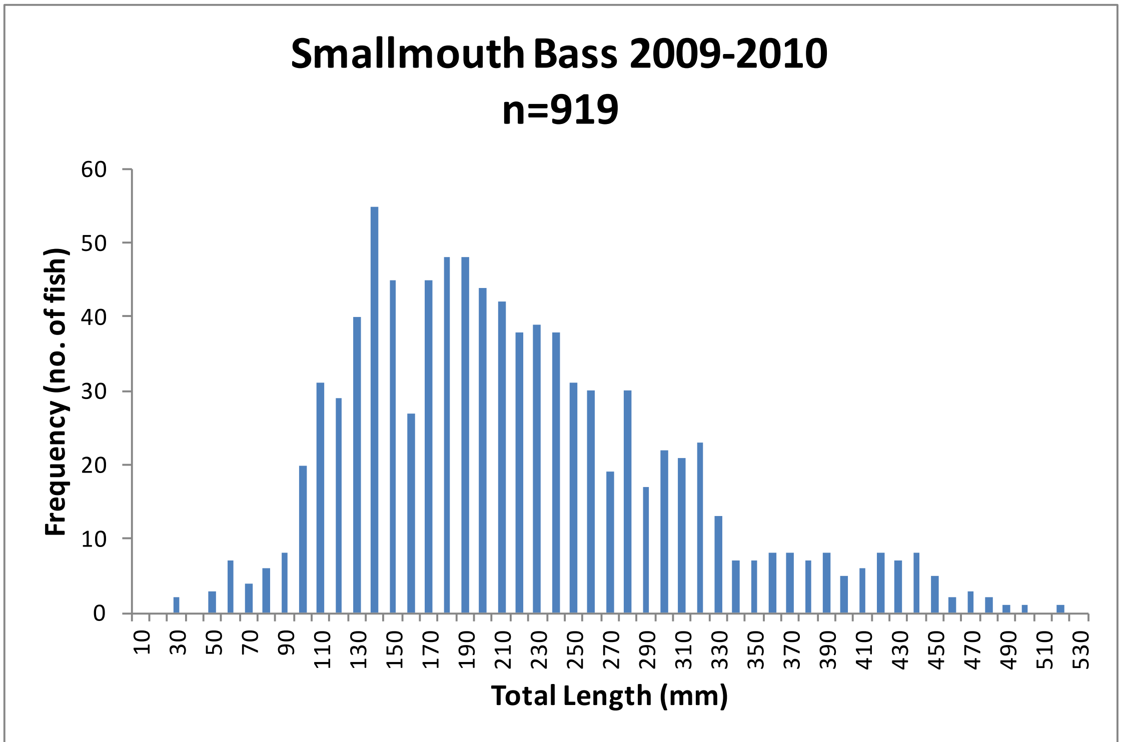


Figure 5-21 Length frequency distribution of Sand Roller collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.



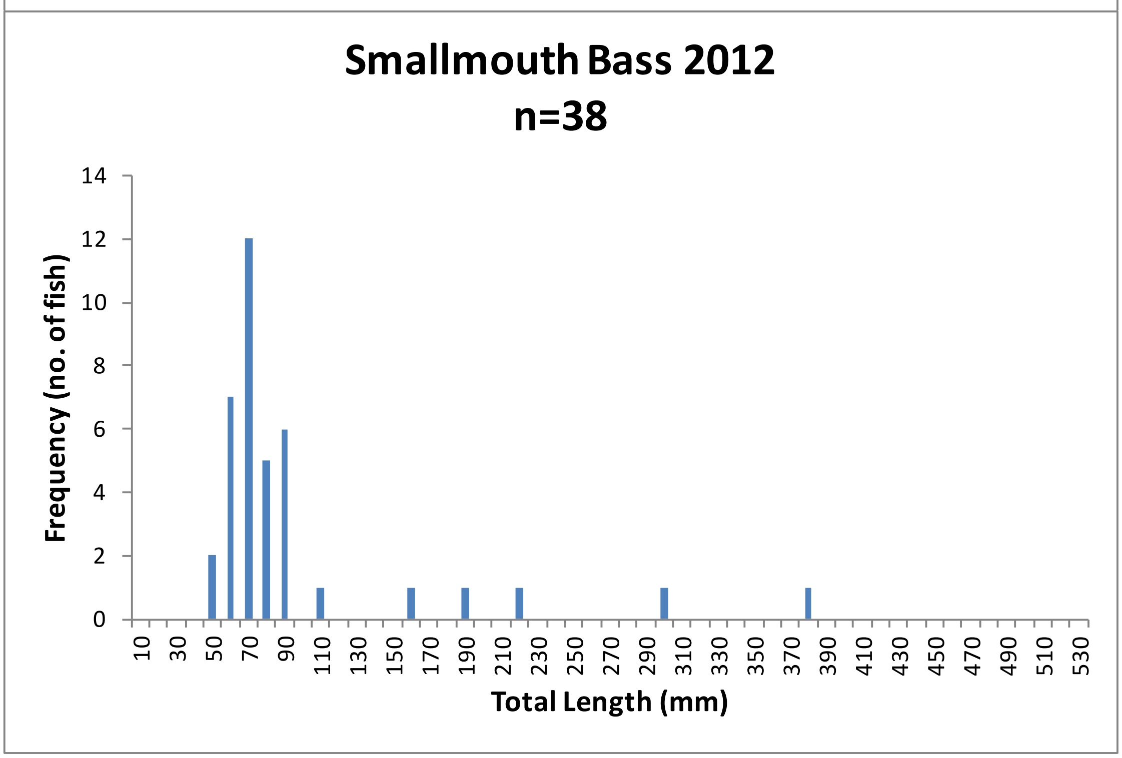


Figure 5-22 **Length frequency distribution of Smallmouth Bass collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.**

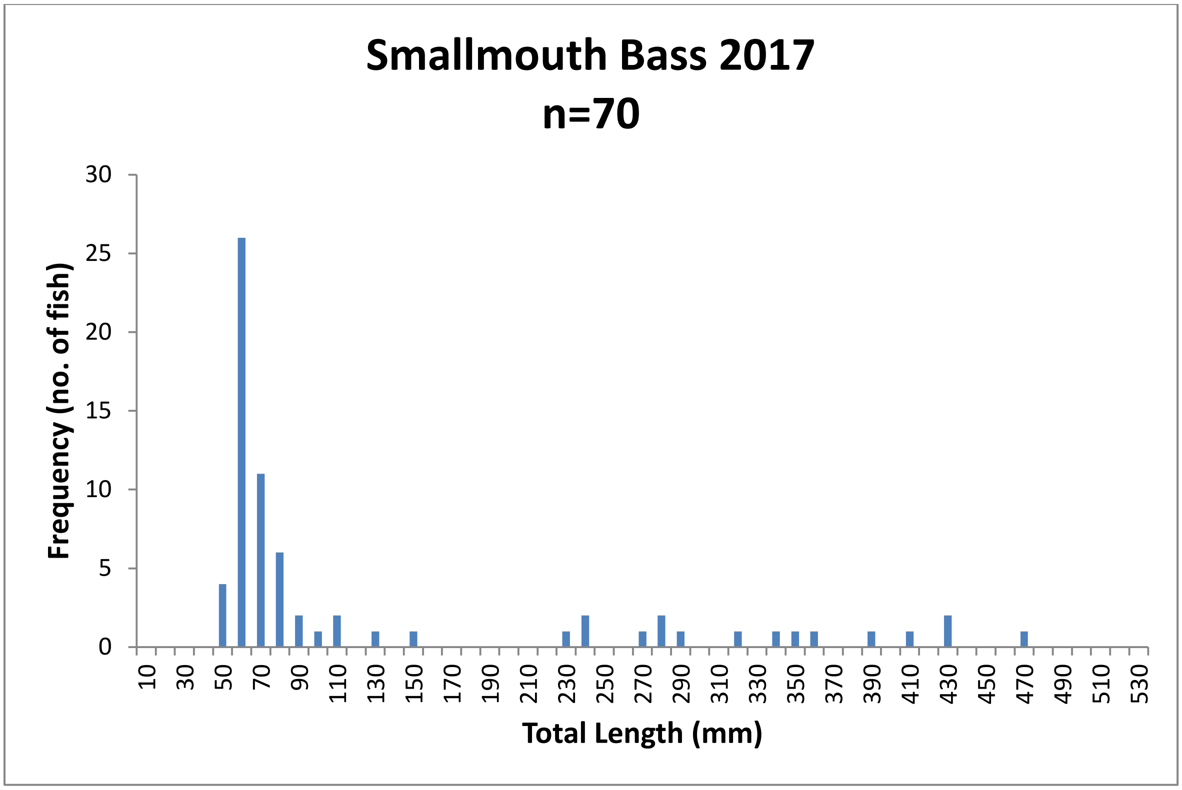


Figure 5-23 Length frequency distribution of Smallmouth Bass collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

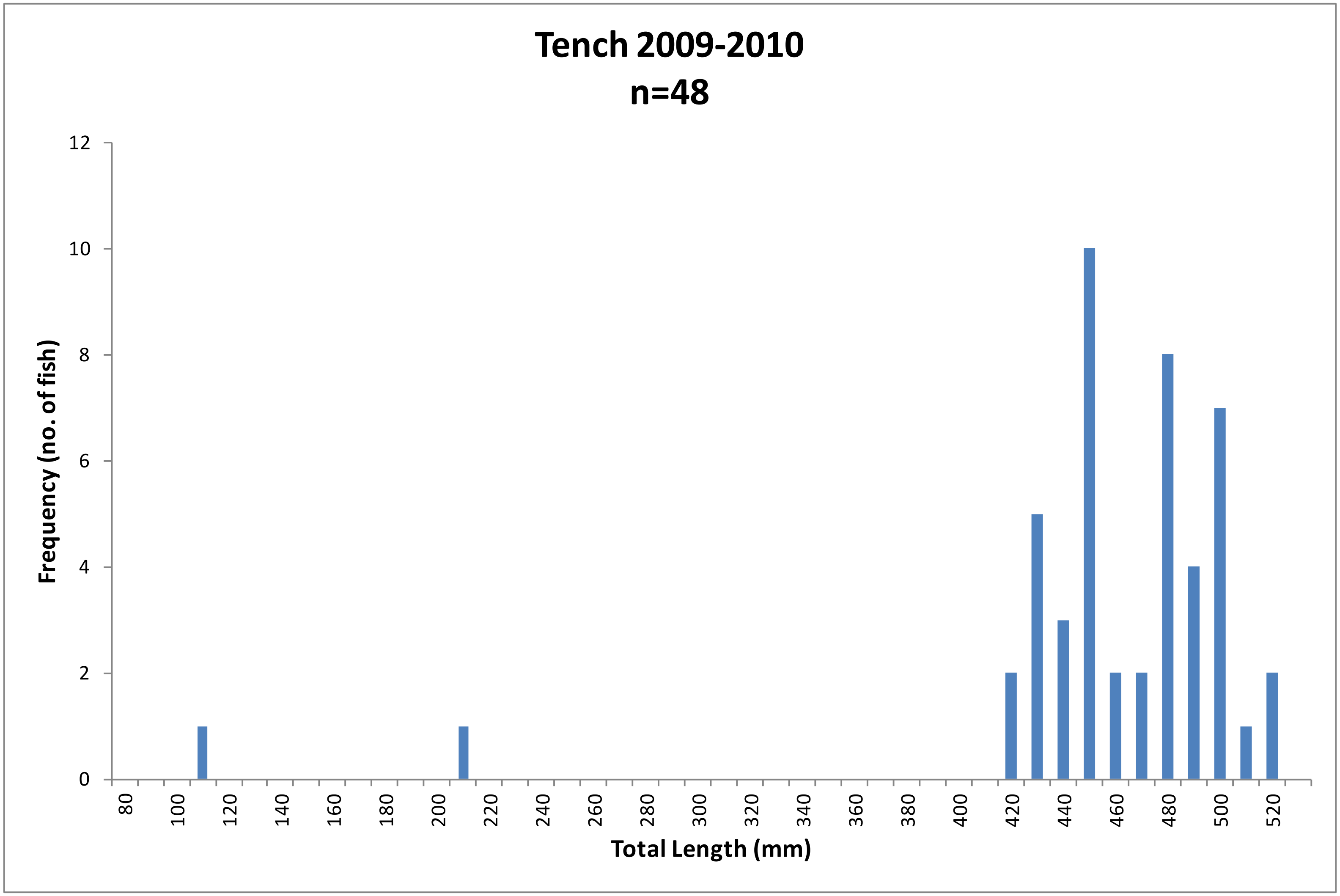


Figure 5-24 Length frequency distribution of Tench collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.

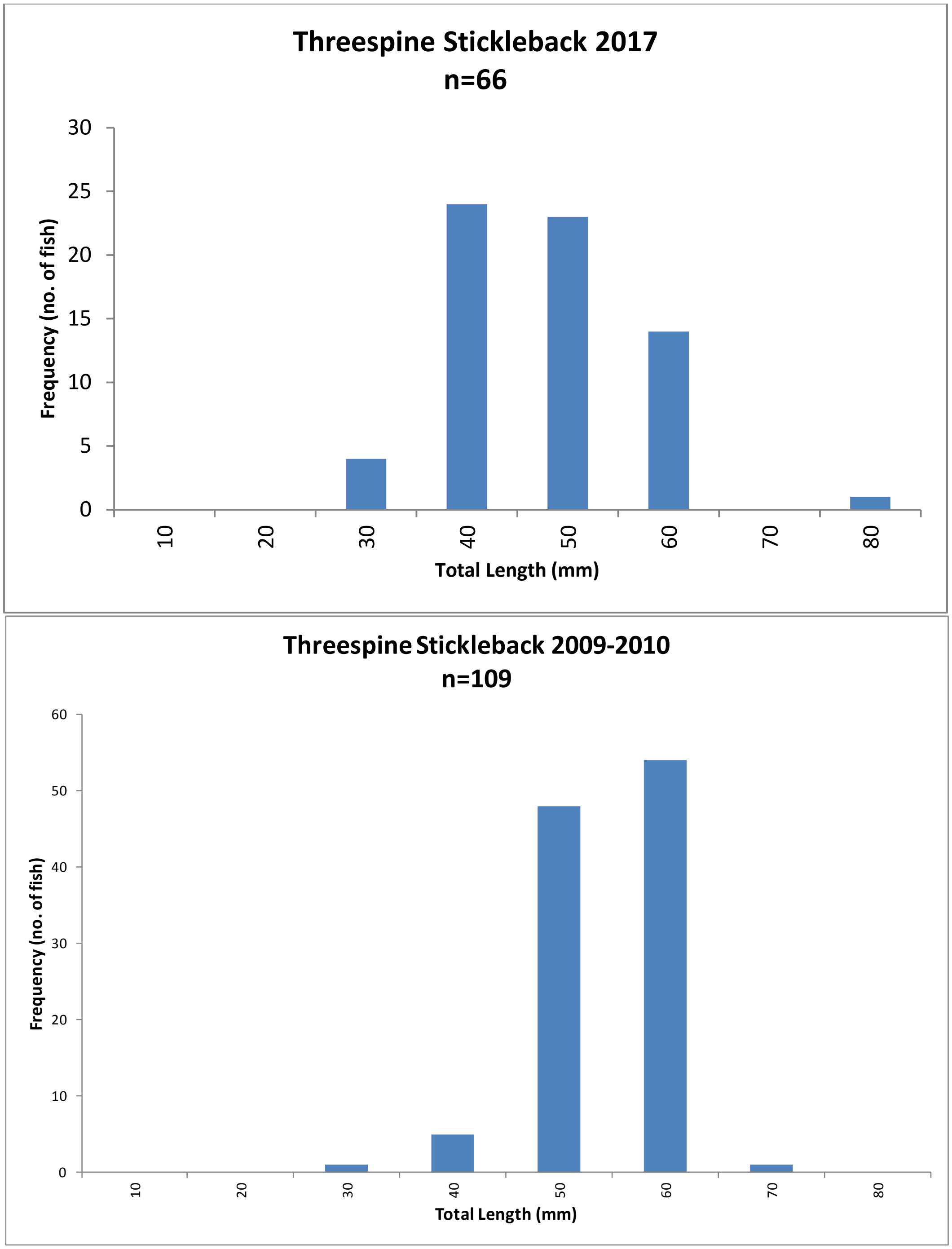


Figure 5-25 Length frequency distribution of Threespine Stickleback collected via boat electrofishing during 2009-2010 and 2017 surveys in the Priest Rapids Project, mid-Columbia River, USA.

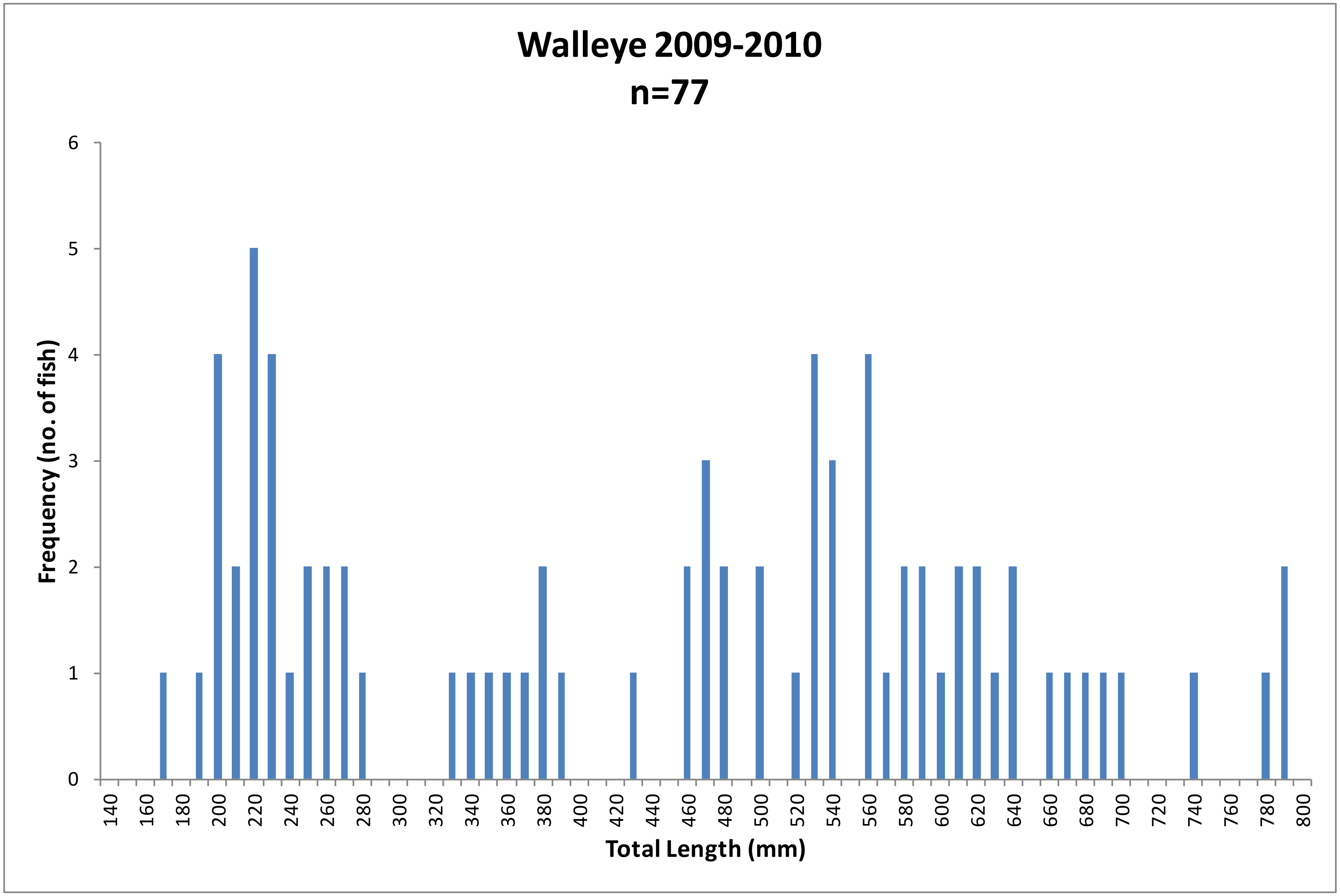


Figure 5-26 **Length frequency distribution of Walleye collected via boat electrofishing during 2009-2010 in the Priest Rapids Project, mid-Columbia River, USA.**

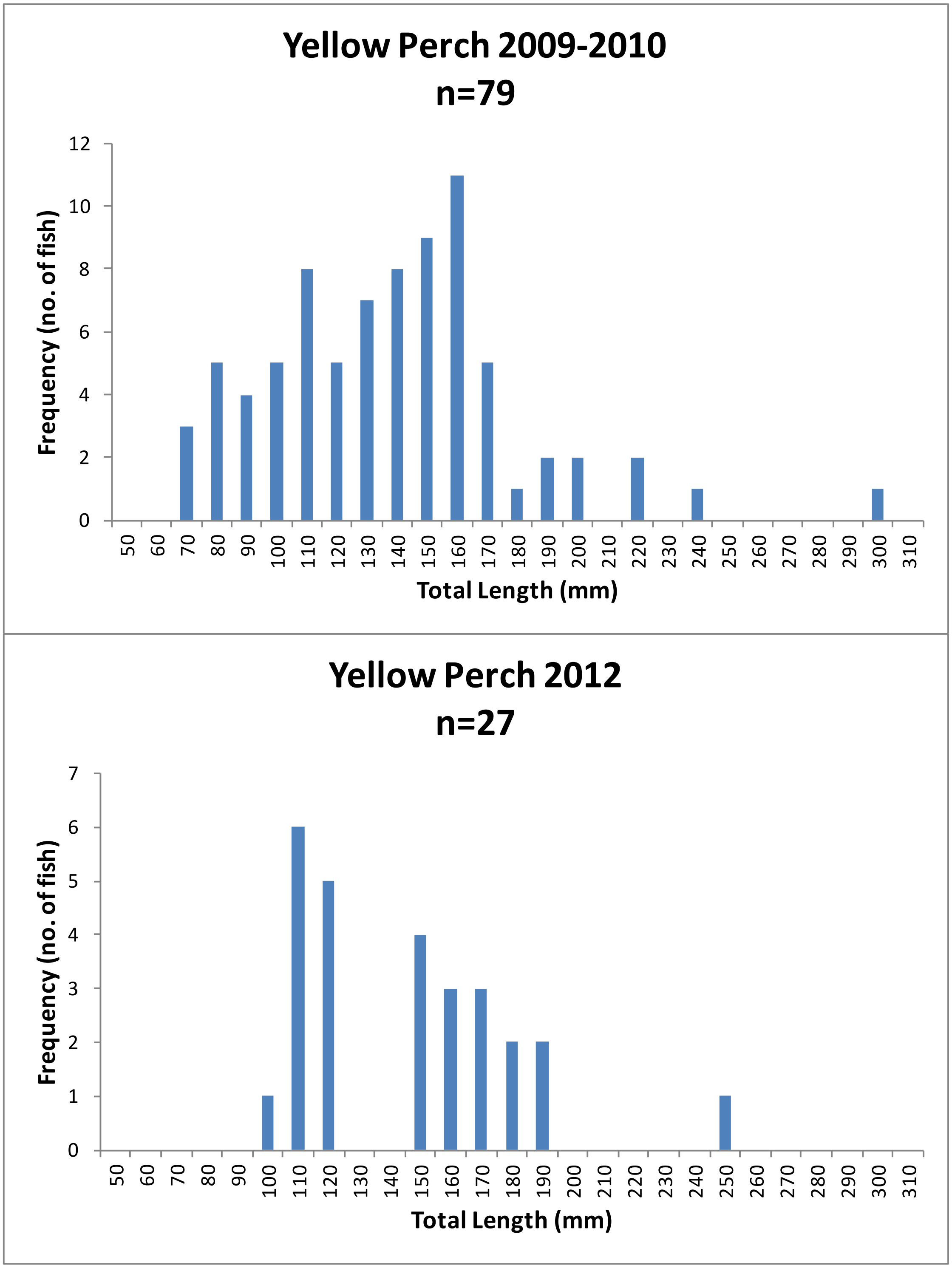


Figure 5-27 Length frequency distribution of Yellow Perch collected via boat electrofishing during 2009-2010 and 2012 in the Priest Rapids Project, mid-Columbia River, USA.

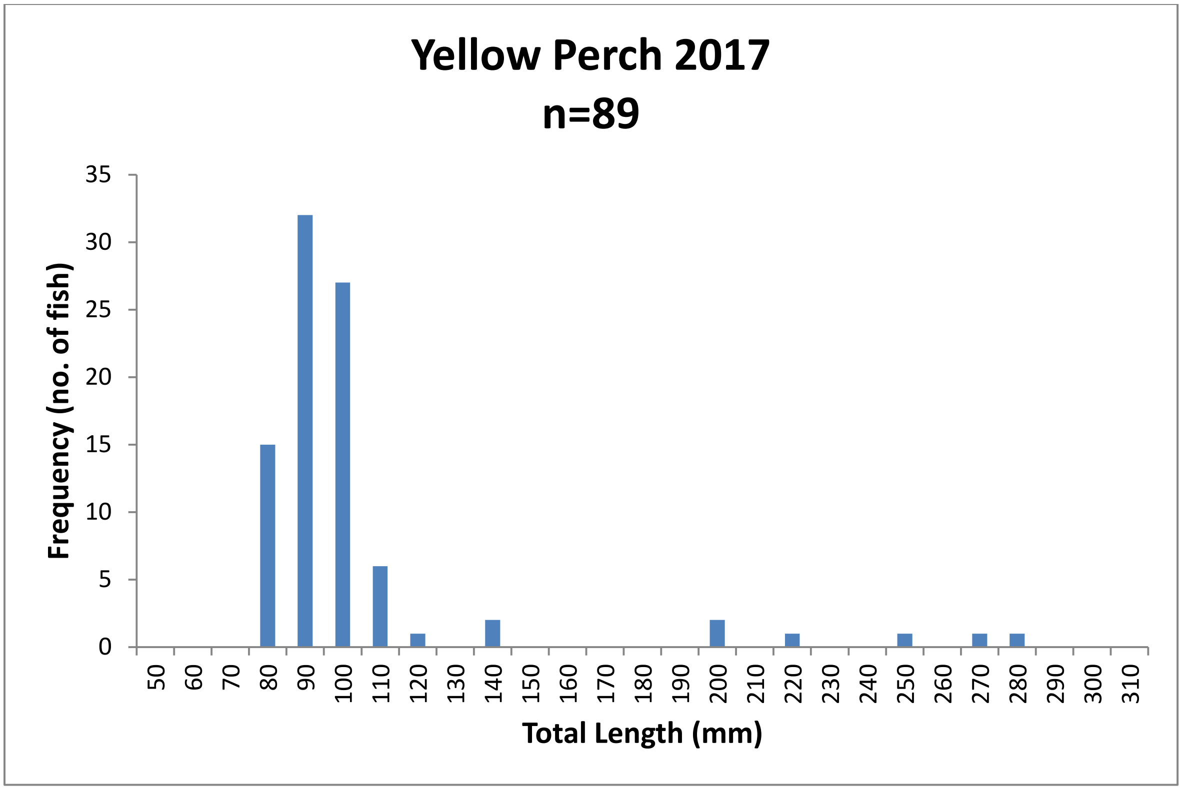


Figure 5-28 Length frequency distribution of Yellow Perch collected via boat electrofishing during 2017 in the Priest Rapids Project, mid-Columbia River, USA.

Appendix F
Washington Department of Ecology's Approval Letter for the 2017 Native Resident Fish Management Plan Ten Year Biological Objective Statue Report

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1250 W Alder St • Union Gap, WA 98903-0009 • (509) 575-2490

March 9, 2018

Mr. Tom Dresser
Fish, Wildlife and Water Quality Manager
Grant County PUD
PO Box 878
Ephrata, WA 98823

RE: Request for Ecology Review and Comment –*2017 Native Resident Fish Management Plan Priest Rapids Project Survey and 10 Year Biological Objectives Status Report*
Priest Rapids Hydroelectric Project No. 2114

Dear Mr. Dresser:

The Department of Ecology (Ecology) has reviewed the *2017 Native Resident Fish Management Plan Priest Rapids Project Survey and 10 Year Biological Objectives Status Report* e-mailed to Ecology on February 5, 2018. This report is a requirement of Section 6.2(5)(d) for the *Native Resident Fish* of the 401 certification.

If you have any questions for Ecology, please call me at (509) 575-2808, or e-mail me at breean.zimmerman@ecy.wa.gov.

Sincerely,

Breean Zimmerman

Breean Zimmerman
Hydropower Projects Manager
Water Quality Program

cc: Mike Clement, Senior Biologist, Grant County PUD