# PEND OREILLE WALLEYE MONITORING 2014


## ABSTRACT

Non-native fish colonization has been recognized as a threat to native fish communities across the west and specifically in the Pend Oreille drainage. Walleye, a non-native fish in the Pend Oreille basin, were first documented in this system during a fishery survey of the Pend Oreille River (POR) in 2005. Monitoring was important for fisheries managers to understand Walleye abundance and distribution in Lake Pend Oreille (LPO) and the POR and how this introduced piscivore may impact native fish and kokanee in this system. In 2014, we completed a survey of Walleye abundance and distribution in LPO and the POR following standardized Fall Walleye Index Netting protocols. We completed 48 net nights among all sampled areas resulting in a total capture of 105 Walleye and a catch rate of 2.2 ± 0.5 Walleye per net. Walleye captures were well distributed. Eight age classes were present in the collected samples. Survey results suggested walleye were present in low, but increasing abundance. Pend Oreille basin Walleye continue to demonstrate characteristics such as fast growth, good condition, and early maturation consistent with an expanding population. However, results suggested dynamic rates have moderated since the last survey. We also found Yellow Perch grew to 200 mm within approximately three years. Multiple Yellow Perch age classes were present, but 87% of the fish collected were from one year class. Results suggested Yellow Perch were not stunted, but exhibited cyclic recruitment that may impact fishing conditions from year to year. Continued monitoring of long term trends in Walleye abundance and distribution in the Pend Oreille basin is recommended as a means of understanding future impacts to other Pend Oreille basin fishes. We also recommend continued monitoring of Yellow Perch in association with future FWIN surveys to help confirm the mechanisms at work that influence the presence of quality fish in the fishery.



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## INTRODUCTION

Non-native fish colonization has been recognized as a threat to native fish communities across the west and specifically in the Pend Oreille drainage (PBTAT 1998). Walleye *Sander* *vitreus* have been known to negatively impact salmonid fish assemblages where these populations overlap (Baldwin et al. 2003). Lake Trout in Lake Pend Oreille (LPO) are heavily studied and currently being suppressed in an effort to enhance Kokanee *Oncorhynchus nerka* and associated native fish assemblages. Walleye are also present in LPO, but little is known about their abundance, distribution, and associated impacts on the fish community.

Walleye are a non-native to the Pend Oreille basin and were first documented in the system during a fishery survey of the Pend Oreille River (POR) in 2005 (Schoby et al. 2007). Subsequently, Walleye were also documented in LPO near the Pack River between 2007 and 2010 (IDFG, unpublished data). Walleye were illegally established in the upstream waters of the lower Clark Fork River within the Noxon Reservoir reach in the early 1990's and continue to persist (Horn et al. 2009). This upstream population is believed to be the source of primary introduction into LPO and the POR.

In addition, to documenting the presence of Walleye in 2007, LPO Lake Trout netting efforts have provided a crude measure of relative Walleye abundance. Walleye were collected at one sample site near the Pack River in a repeated spring net set between 2007 and 2010 (IDFG, unpublished data). Most Walleye caught at this site were mature adults. However, in 2010 juvenile production was first document by the capture of multiple younger age classes in the POR (Maiolie et al. 2011). POR samples suggested Walleye abundance was likely expanding in both abundance and distribution. However the available information did not provide a basin wide status of Walleye. In 2011, a comprehensive fall Walleye index survey was completed to better describe the current condition of the population.

Continued monitoring of Walleye abundance and distribution in LPO and the POR is essential for fisheries managers to understand how this new introduced piscivorous species may impact the existing fish community of the Pend Oreille system. Our objective was to continue a Walleye monitoring program that provided an understanding of current abundance, distribution, and potential impacts of Walleye in LPO and the POR. Standardized comparisons allowed for monitoring of change in abundance, distribution, and potential impact over time.

Yellow Perch are also an important component of the Pend Oreille basin fishery. Anglers typically target Yellow Perch during the winter months as an ice fishery or less commonly during spring and early summer months in open water. In recent, years Yellow Perch anglers have commented that fish size and abundance has declined. Anglers have speculated, abundance of Yellow Perch is linked to increasing Walleye abundance and or small size fish may reflect a stunted growth pattern. We included a more specific evaluation of Yellow Perch growth and recruitment in association with our 2014 survey efforts to help inform fisheries managers and the angling public.

## METHODS

We completed a survey of Walleye abundance and distribution in LPO and the POR following standardized Fall Walleye Index Netting (FWIN) protocols described in the FWIN Manual of Instructions (Morgan 2002). Sample locations were randomly selected, but were focused primarily within the northern portion of LPO (Clark Fork River delta to POR mouth) and the POR (Appendix A). These areas contained water depths consistent with FWIN protocol. Much of LPO was not compatible with the selected sampling protocol due to existing bathymetry. In addition to survey effort in the northern portion of the basin, we sampled a limited portion of the southernmost tip of LPO (Idelwild and Scenic Bays) to assist in describing distribution on a larger scale. Bathymetry also limited available sample locations in this zone. Selected sample zones were defined within the 25 m depth contour. We also excluded two areas from sampling due to concerns with overlapping Bull Trout *Salvelinus confluentus* distribution and associated potential bycatch. Excluded areas included the Pack River mouth and the lower most portion of the Pend Oreille River in Idaho from historic community of Thema downstream. The total area included in the survey was approximately 10,000 Ha. We set a total of 48 nets based on sample size recommendations described in FWIN protocol and prior knowledge of catch rate variability described in our 2011 FWIN survey of LPO.

We used monofilament experimental gill nets described in the FWIN protocol to sample fish. Nets were eight panel monofilament 1.8 m deep, 61.0 m long, with 7.6 m panels measuring 25 mm, 38 mm, 51 mm, 64 mm, 76 mm, 102 mm, 127 mm, and 152 mm stretched mesh. Net sets were equally divided between two depth strata including 2 – 5 m and 5 – 15 m depths. All nets were placed perpendicular to the shoreline. Netting was conducted at water temperatures between 10 °C and 15 °C. Net sets were approximately 24 hour in length. Catch per unit effort (CPUE) calculated as catch per net was used to describe relative abundance of Walleye. The arithmetic mean of CPUE was used to describe average relative abundance among all samples.

Upon removal from gill nets we measured (TL, mm) and weighed (g) all Walleye. All non-target species were measured with a sub-sample weighed. We collected otoliths from all Walleye and from a subsample of Yellow Perch from three sample locations on the POR for estimation of age.

We estimated age by examining otoliths under a dissecting microscope in whole view or by breaking centrally, browning, sanding, and viewing the cross section. Walleye growth patterns were evaluated using estimated fish ages to determine mean length at age at time of capture by sex. Growth patterns of Yellow Perch were also evaluated, but only by length at age at time of capture. We used growth of Yellow Perch to describe the potential of stunting in the population. Yellow Perch ages from subsampled fish were applied to the remaining sample by proportion using an age length key. Catch at age was reported as a descriptor of annual recruitment and mortality in both species.

Condition indices were generated from collected Walleye to describe the general health of the population. To estimate condition indices, we removed and weighed visceral fat. Visceral fat weights were used in calculating a visceral fat index. We calculated the visceral fat index as the ratio of visceral fat weight to total body weight and described this as a percentage. Gonads were also removed and weighed to estimate a gonadal somatic index (GSI) value for each fish. We calculated the GSI value as the ratio of gonad weight to body weight and described this as a percentage.

We estimated rates of sexual maturity in captured Walleye by examining all Walleye and ranking each individual as mature or immature (Duffy et al. 2000). Maturation rates are inversely related to growth rate and may reflect shifting population dynamics (Gangl and Pereira 2003, Schneider et al. 2007). We determined total length and age at 50% maturity using logistic regression (Quinn and Deriso 1999). We also calculated a female diversity index value based on the Shannon diversity index to describe the diversity of the age structure of mature females (Gangl and Pereira 2003). The female diversity index has been shown to be sensitive to changes in population structure (Gangl and Pereira 2003).

## RESULTS

FWIN sampling was conducted between October 1 and October 9, 2014. We completed 48 net nights among all sampled areas. A total of 105 Walleye were collected comprising 4.0% of the total catch. Walleye CPUE ranged from zero to 10 Walleye per net. Walleye were captured at 33 of 48 sample sites. Relative abundance measured as arithmetic mean CPUE for Walleye of all age classes was 2.2 fish/net (± 0.50, 80% CI). Although we did not capture Walleye in every net, we did capture Walleye in representative samples throughout LPO and the POR (Figure 1). Walleye catch was distributed across areas where netting occurred. As an example, 34% of Walleye captured were caught in the POR representing 31% of the nets set in the survey.

We collected 22 other species in the by-catch associated with Walleye netting which included: Black Bullhead *Ictalurus melas* (0.3%), Black Crappie *Pomoxis nigromaculatus* (1.3%), Bluegill *Lepomis macrochirus* (>0.1%), Brown Bullhead *Ameiurus nebulosus* (1.1%), Brown Trout *Salmo trutta* (0.5%), Bull Trout (0.1%), Kokanee (0.5%), Largemouth Bass *Micropterus salmoides* (0.2%), Longnose Sucker *Catostomus catostomus* (1.1%), Largescale Sucker *Catostomus macrocheilus* (2.4%), Lake Whitefish *Coregonus clupeaformis* (17.8%), Mountain Whitefish *Prosopium williamsoni* (0.6%), Northern Pike *Esox lucius* (0.3%), Northern Pikeminnow *Ptychocheilus oregonensis* (9.6%), Peamouth *Mylocheilus caurinus* (15.5%), Pumpkinseed *Lepomis gibbosus* (1.4%), Rainbow Trout *Oncorhynchus mykiss* (0.2%), Smallmouth Bass *Micropterus dolomieui* (5.3%), Tench *Tinca tinca* (4.4%), Westslope Cutthroat Trout *Oncorhynchus lewisi* (0.4%), Westslope Cutthroat x Rainbow Trout Hybrids (> 0.1%), and Yellow Perch *Perca flavescens* (32.9 %) (Table 1). Mean length and weight of collected species was listed in Table 1.

Total length of sampled Walleye ranged from 137 mm to 805 mm (Figure 2). PSD of the sampled population was 54.8 (45.2 – 64.4, 95% CI). Walleye of stock size (at least 249 mm) and greater made up 99% of the sampled population. Forty two percent of the sampled Walleye were of preferred length (at least 509 mm) or greater (Figure 2).

Walleye collected in sampling efforts had a mean GSI value of 1.6 and 1.9 (± 0.3, 0.3; 80% CI) for males and females, respectively. Mean visceral fat indices were 3.1 and 4.8 (± 0.5, 0.5; 80% CI) for male and female Walleye, respectively.

Eight age classes were present in the collected samples representing fish of age classes zero, one, two, three, four, five, seven, and eleven (Figure 3). The majority of Walleye sampled were assigned to either the two or five year age classes. Age classes zero, seven, and eleven were represented by only one or two fish among all net samples.

Growth rates of sampled Walleye varied by sex. Female growth described by length at age was greater than comparable male growth when viewed across all age classes, with separation between sexes increasing with age (Figure 4). Mean length for age-2 fish at capture did not yet demonstrate strong divergence with mean lengths of 358 mm and 359 mm for males and females, respectively.

Female (56%) Walleye were more dominant in our catch than males (43%) (Figure 5). Fifty one percent of both male and female Walleye were mature. Length at 50% maturity for female Walleye was estimated at 505 mm. Length at 50% maturity for male Walleye was estimated at 375 mm. Thirty six percent of age two male Walleye collected were mature. Although we estimated maturation rates, it is likely our estimates were impacted by sample size and limited representation of several age classes. Eighty three percent of the mature female Walleye observed in our sample were assigned to one year class (age 5). Female diversity was low indexed at 0.27.

Yellow Perch in the Pend Oreille basin demonstrated good growth. Subsampled fish reached 200 mm in approximately 3 years (Figure 6). Six age classes were present in our sample. However, recruitment appeared sporadic with age one Yellow Perch making up 87% of all age classes present in our sample (Figure 7).

## DISCUSSION

Catch rates observed in our survey of Walleye in the Pend Oreille basin (CPUE, 2.2 ± 0.5) suggest abundance has increased since our last survey (CPUE, 1.4 ± 0.7; Fredericks et al. 2013). However overlapping confidence bounds limit the significance of the observed increases. Observed recruitment in each year since 2011 indicates that abundance is increasing through the addition of subsequent year classes. Only sporadic year classes were present in the 2011 survey. Although Walleye abundance appears to be increasing, catch rates continue to represent a low density population. In comparison, average CPUE from FWIN surveys in southern Idaho reservoirs with established populations were considerably higher than the Pend Oreille basin ranging from 19 to 34 Walleye per net (Ryan et al. 2009, IDFG unpublished data). A similar scale of catch rates was identified in Washington Walleye populations using the FWIN survey protocol with a mean catch rate reported from across multiple waters of 19 Walleye per net (WDFW 2005).

Reported catch rates are likely overestimating the true CPUE of the entire Pend Oreille basin. In our survey we sampled water depths up to 15 m consistent with FWIN protocol and within depths reasonably fished with the gear used in the survey (Morgan 2002). As such our survey did not cover the main LPO basin. Much of the main LPO basin is deep water (> 100 m) with steep near shore bathymetry. Although, Walleye are known to occupy at least portions of the near shore habitat in the main lake basin we suspect much of the basin is not occupied or has lower densities of Walleye. Had we surveyed that portion of the system our reported average CPUE would have likely been lower.

Our observations of consistency in recruited year classes provided evidence of increasing recruitment potential in the Walleye population. In 2011, we expected a two year old year class would largely be mature within the following two years, resulting in a significant increase in spawning potential. Consistent recruitment evidenced by the presence of Walleye in year classes zero through five in 2014 confirmed a threshold of production has been crossed. Despite this shift in production, the availability of mature female Walleye remains low. A female diversity index value closer to one would represent a fully functioning population (Gangl and Pereira 2003). As a generation of Pend Oreille Walleye is established it is likely recruitment potential will continue to increase. Although consistent in year class presence, year class strength appeared inconsistent. Inconsistent Walleye recruitment has been linked to multiple factors including adult Walleye abundance, spring water temperature, and abundance of other prey and predator fish species (Hansen et al. 1998).

Pend Oreille basin Walleye continued to demonstrate rapid growth and above average condition. Visceral fat indices of male and female Walleye represented healthy robust individuals with values ranging from 3.5 to 4.8. Values changed little from those reported in 2011 (3.5 to 4.5). In comparison, visceral fat indices from southern Idaho waters have been reported to range from 1.3 to 3.8 for male and female Walleye (Ryan et al. 2009). These measures of physical condition suggested forage was readily available. Reported by-catch reflected similar relative abundance of non-target species reported in 2011. Dominant species in the catch in 2011 and 2014 included Yellow Perch, Northern Pikeminnow, Peamouth, and Lake Whitefish.

Walleye populations may exhibit density dependent growth (Muth and Wolfert 1986, Sass et al 2004). Although, regional patterns of density dependent growth may be difficult to detect due other influential factors such as water temperature and productivity, shifts within waters may be evident especially within dramatic shifts in abundance. Pend Oreille Basin Walleye growth, comparatively evaluated as length at age 2, demonstrated rapid initial growth beyond that experienced in other regional waters of similar latitude. Fredericks et al. (2011), reported estimates of mean length at age two in this system at lengths greater than 400 mm for male and female Walleye. Comparatively, length at age two for other area waters have been observed to range from 276 mm to 350 mm (Ryan et al. 2009, Horn et al. 2009). However estimates of mean length at age two for Pend Oreille Basin Walleye declined by approximately 50 mm in our 2014 survey. Our observations combined with increased relative abundance suggest density dependent limitation in growth may be occurring as this newly established population expands. It seems unlikely accelerated growth, as observed in 2011, would continue given the relatively low productivity habitat provided within the Pend Oreille system.

Maturation of male Walleye has been generally described as initiating at a range of 2 to 9 years of age or beyond a threshold of 34cm (Kerr et al. 2004). Walleye in our survey conformed to this generalization. Maturation rates observed in 2014 represented increases in length and age at 50% maturity from 2011. Observed shifts in maturation rates were anticipated as a result of increased Walleye density and consistent with our observations of increasing relative abundance and decreasing growth rate.

Our 2014 FWIN survey will provide a means of monitoring long term trends in Walleye abundance and distribution in the Pend Oreille basin. Although it is unclear to what extent Walleye will expand within the system it is important to recognize the presence of Walleye and the potential impact they may have on other fish species. Management of other fishes such as Kokanee, Rainbow Trout, and Bull Trout all have potential to be impacted by the presence of a new predatory fish in the community.

Pend Oreille basin Yellow Perch demonstrated reasonable growth that did not provide evidence of stunting. The definition of stunted growth is subjective, but comparing growth in other waters provides some reference to the condition of our population. Gabelhouse (1984) defined quality length in Yellow Perch as fish between 200 mm and 250 mm in length. Diana and Salz (1990) suggested Lake Huron Yellow Perch in Saginaw Bay were stunted, taking five plus years to reach 200 mm. Comparatively, Pend Oreille basin Yellow Perch grew rapidly into a 200 mm size range in three years, suggesting fish were not stunted. Although, our data provided an estimation of length at age, our sample sizes of estimated ages for older age classes were small. We recommend future efforts prioritize age sample collections throughout the surveyed areas that insure adequate sample sizes for all sizes encountered.

While fish growth rates appear to be good, sporadic year class strength suggested recruitment is highly variable and is the likely cause of reduced angling opportunity in some years. Cyclic dynamics, where individual age classes dominate a Yellow Perch population for multiple years, have been observed in other fish communities (Sanderson et al. 1999). In this example, abundance of juvenile and mature adult Yellow Perch was most influential in the success of recruitment. Although our observed age distribution is consistent with a cyclic recruitment scenario, it does not conclusively remove the potential interaction of predatory fish or other habitat conditions on abundance. If sporadic recruitment were occurring due to cyclic dynamics related to the abundance of present year classes or other factors, we would expect periodic recruitment pulses to carry through from year to year with additional pulses occurring in out years. We recommend continued monitoring of Yellow Perch in association with future FWIN surveys to help confirm the mechanisms at work.

## RECOMMENDATIONS

- Continue FWIN surveys on a three year rotation to evaluate changes in relative abundance and distribution as well as corresponding shifts in non-target species.
- Monitor Yellow Perch in association with FWIN surveys to assess the influence of mortality on developing strong and weak year classes and the presence of quality size fish in the population.

## TABLES

Table 1. Catch summary of fish collected in 2014 FWIN survey of Lake Pend Oreille and the Pend Oreille River, Idaho. Summary statistics included catch (N) and percent catch by species, average total length (Avg TL), standard deviation of measured total lengths (Stdev WT), average weight (Avg WT), and standard deviation of measured fish weights (Stdev WT).

| Species | N | % Catch | Avg TL | Stdev TL | Avg WT | Stdev WT |
|---|---|---|---|---|---|---|
| Black Crappie | 33 | 1.3% | 162 | 61 | 105 | 225 |
| Bluegill | 1 | 0.0% | 110 | -- | 26 | -- |
| Black Bullhead | 7 | 0.3% | 248 | 35 | 211 | 79 |
| Bull Trout | 2 | 0.1% | 489 | 30 | 1002 | 214 |
| Brown Bullhead | 28 | 1.1% | 239 | 54 | 201 | 113 |
| Brown Trout | 14 | 0.5% | 465 | 69 | 1068 | 507 |
| Kokanee | 13 | 0.5% | 278 | 14 | 192 | 33 |
| Largemouth Bass | 6 | 0.2% | 338 | 111 | 827 | 821 |
| Longnose Sucker | 28 | 1.1% | 342 | 86 | 468 | 253 |
| Largescale Sucker | 61 | 2.4% | 422 | 124 | 1011 | 682 |
| Lake Whitefish | 463 | 17.8% | 330 | 63 | 304 | 175 |
| Mountain Whitefish | 15 | 0.6% | 293 | 52 | 234 | 94 |
| Northern Pike | 7 | 0.3% | 719 | 235 | 2268 | 1447 |
| Northern Pikeminnow | 250 | 9.6% | 340 | 86 | 427 | 348 |
| Peamouth | 401 | 15.5% | 259 | 66 | 126 | 104 |
| Pumpkinseed | 36 | 1.4% | 109 | 25 | 32 | 22 |
| Rainbow Trout | 5 | 0.2% | 360 | 54 | 424 | 137 |
| Cutthroat x Rainbow Hybrid | 1 | 0.0% | 450 | -- | 690 | -- |
| Smallmouth Bass | 138 | 5.3% | 330 | 94 | 680 | 557 |
| Tench | 115 | 4.4% | 431 | 72 | 1174 | 378 |
| Westslope Cutthroat Trout | 11 | 0.4% | 373 | 31 | 443 | 92 |
| Walleye | 105 | 4.0% | 465 | 142 | 1462 | 1309 |
| Yellow Perch | 854 | 32.9% | 152 | 31 | 38 | 38 |

**FIGURES**

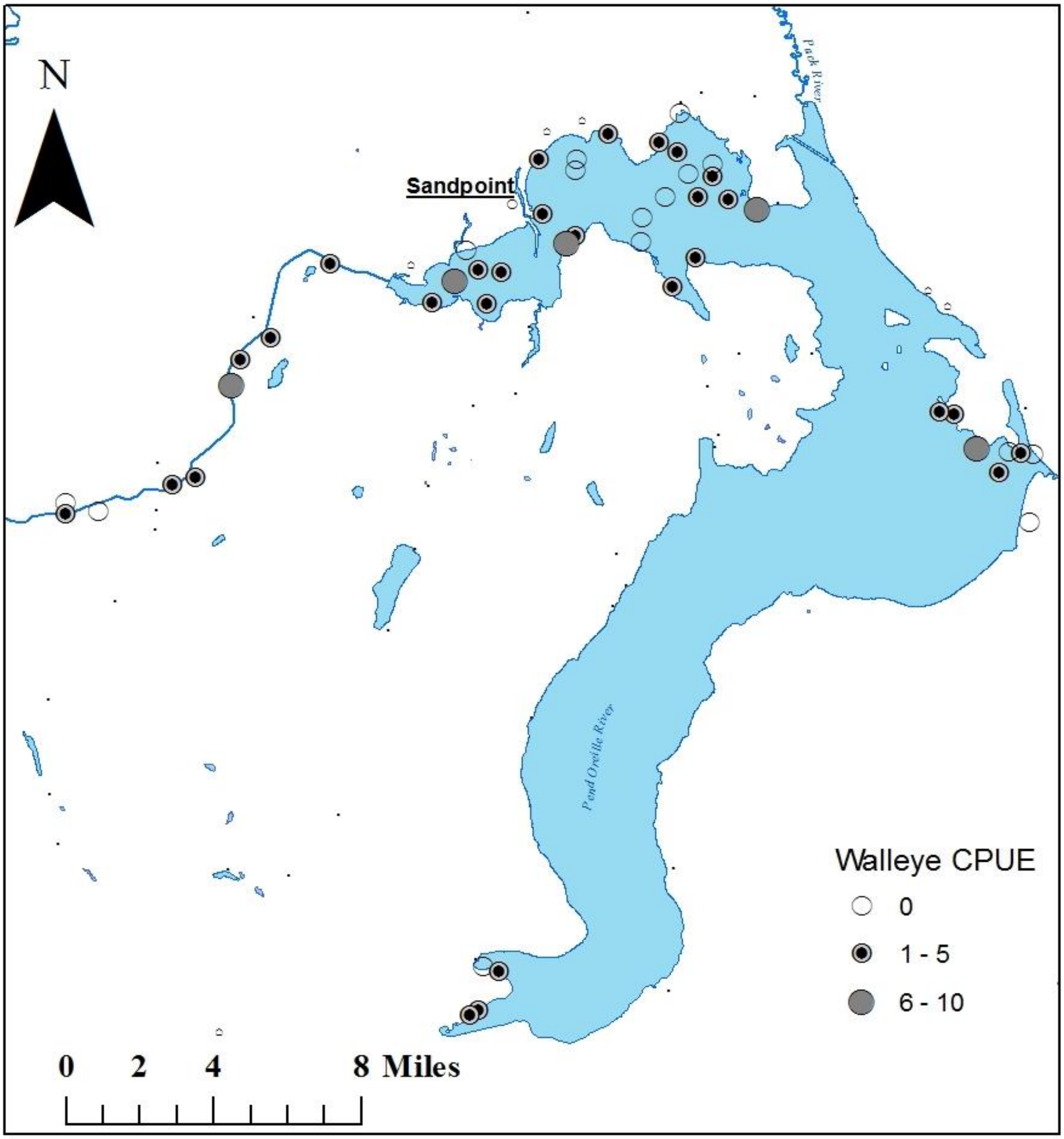


Figure 1. Fall Walleye index netting sample locations in the Pend Oreille Basin, Idaho 2014. Sample sites displayed by catch per unit effort (CPUE, net night).

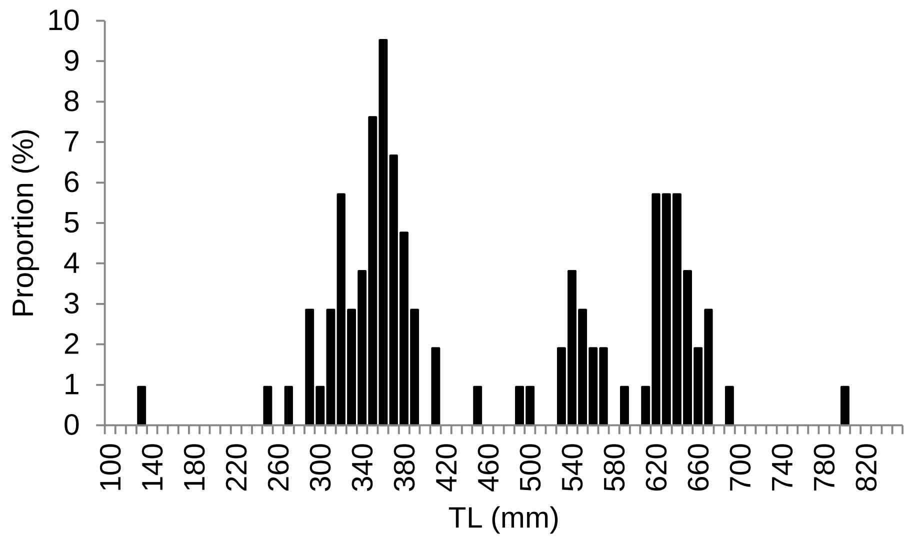


Figure 2. Proportion of sampled Walleye by total length collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho.

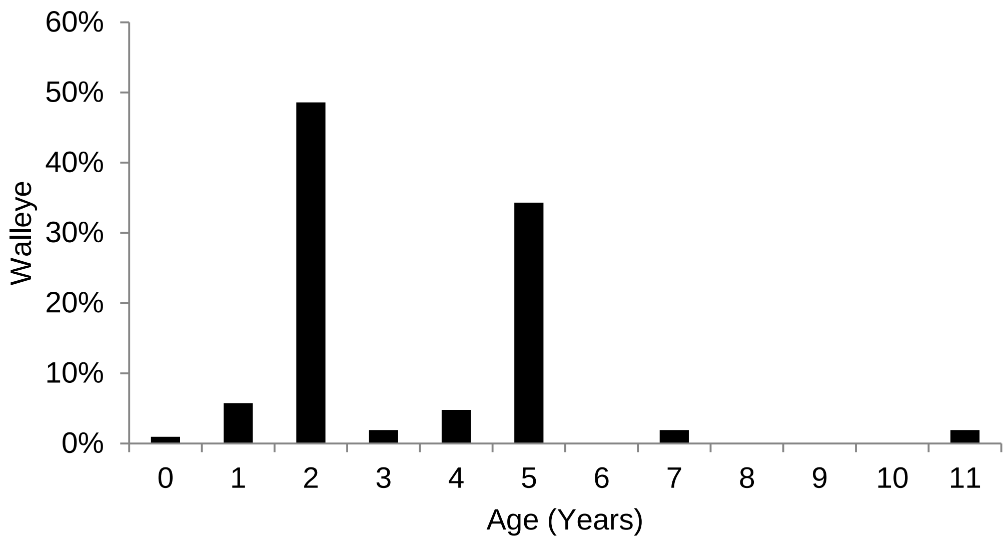


Figure 3. Proportion of sampled Walleye by age collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho.

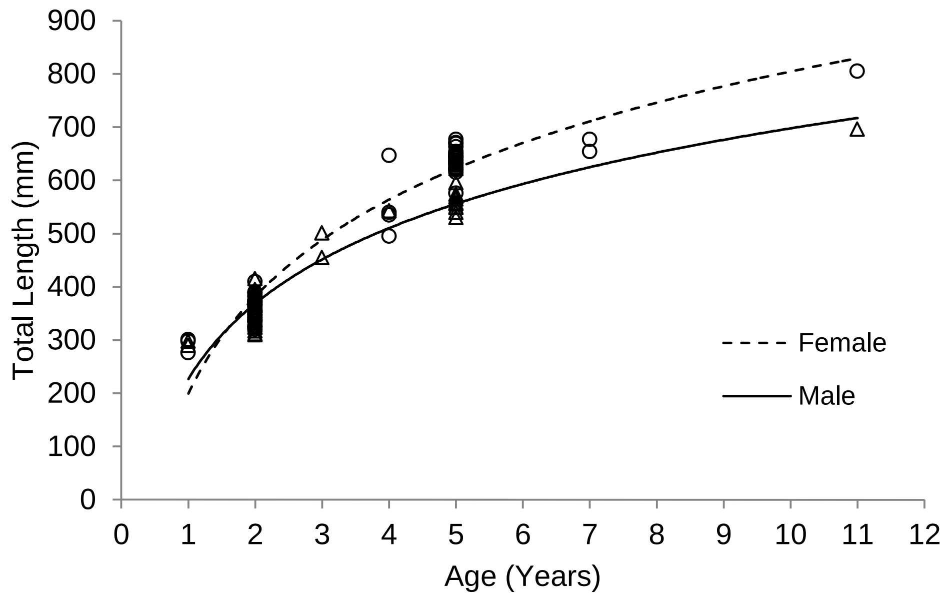


Figure 4. Mean total length at age of male and female Walleye collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho.

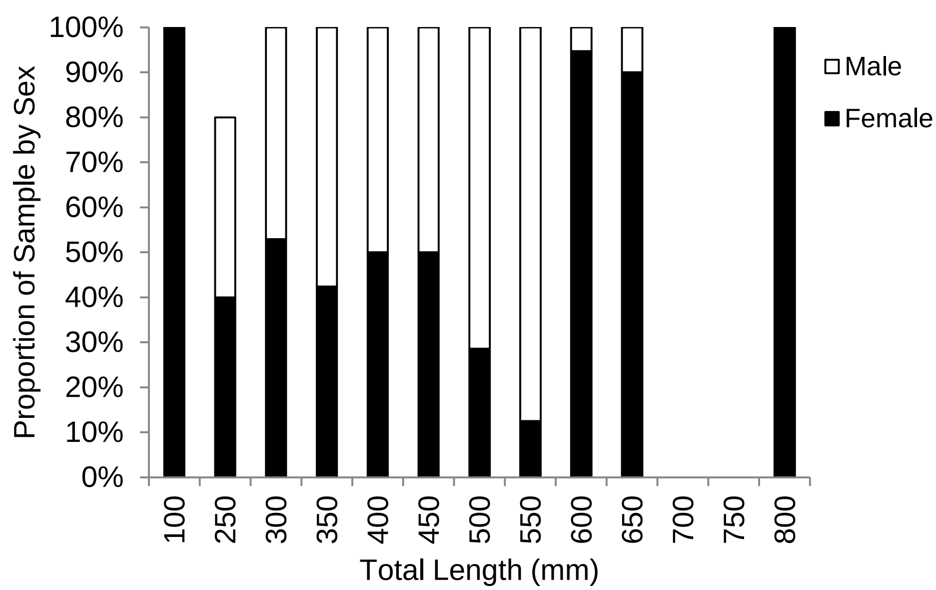


Figure 5. Proportions of male and female Walleye collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho.

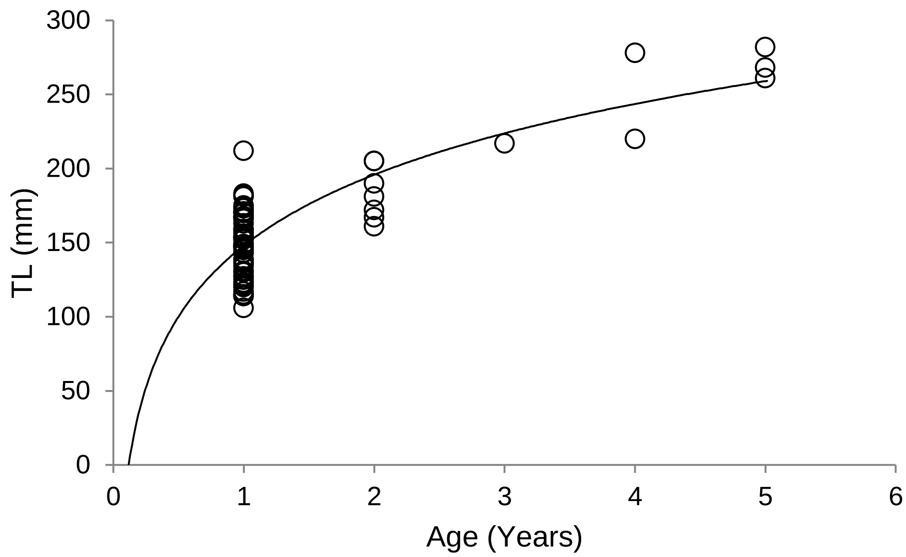


Figure 6. Mean total length (mm) at age of Yellow Perch collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho

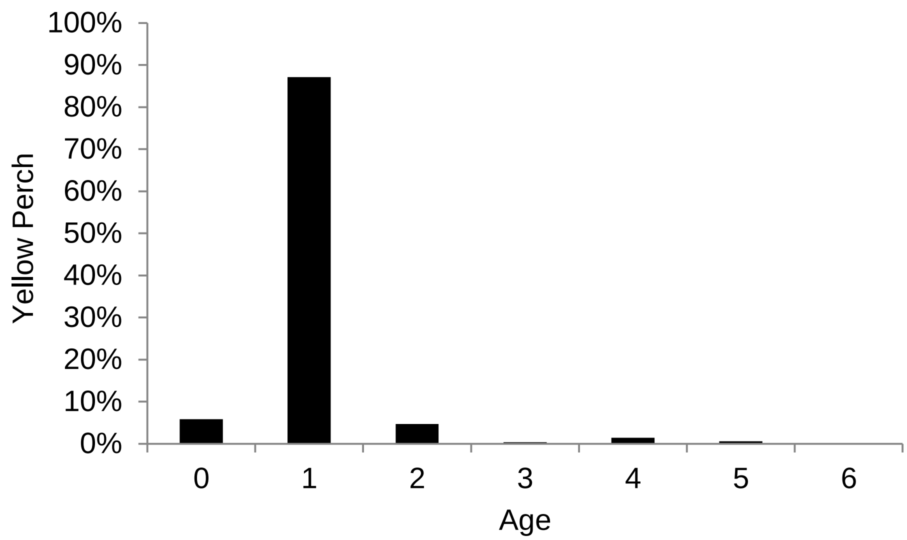


Figure 7. Proportion of sampled Yellow Perch by age (years) collected in 2014 FWIN sampling of Lake Pend Oreille and the Pend Oreille River, Idaho.

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