Cabinet Gorge and Noxon Reservoir Fisheries Monitoring

2023 Annual Project Update

Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B

January 2024

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Recreational Fishery Enhancement Program
Appendix B

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Introduction

Noxon and Cabinet Gorge reservoirs, the two lowermost hydroelectric impoundments on the Clark Fork River in western Montana (Figures 1–3), have presented numerous and evolving challenges for fisheries management since reservoir construction was completed in the 1950s. Challenges have included blocked upriver access for migratory native species, including adfluvial Bull Trout *Salvelinus confluentus* from Lake Pend Oreille, degraded conditions in the impounded mainstem reaches for native salmonids, introductions of non-native species (authorized and unauthorized), and changes in agency objectives, angler and societal preferences, and reservoir operations. Huston (1985) documented the diversity of fish introductions and management actions from the early 1950s through the mid-1980s, including early efforts to establish cold-water salmonid fisheries in marginal habitats created by the reservoirs. In addition to altered thermal conditions, low water retention time in the two reservoirs (about three weeks in Noxon and one week in Cabinet Gorge), and wide water-level fluctuations historically limited options for developing stable lentic fisheries.

Initial fisheries management efforts to create cold-water salmonid fisheries on the newly formed reservoirs were largely unsuccessful (Huston 1985). Noxon and Cabinet Gorge reservoirs did not emerge as relevant fisheries until the 1980s. At that time, the introduction and establishment of both Largemouth Bass *Micropterus salmoides* and Smallmouth Bass *M. dolomieu* populations, two non-native predatory sportfish, was facilitated by a cooperative agreement between angler groups, Montana Fish, Wildlife and Parks (FWP), and Avista which eliminated large water-level fluctuations (Huston 1985) to facilitate stable bass habitat. The presence of Northern Pike *Esox lucius* was first documented in Noxon Reservoir in 1972 and Cabinet Gorge Reservoir in 1974, stemming from an illegal introduction in Lone Pine Reservoir of the Flathead River drainage in the 1950s (Huston 1985). Since that time, populations of these species as well as native and non-native non-game fish species have become well-established, and annual fishing pressure has increased considerably from about 800 angler days per year on Noxon in 1982 to 39,759 angler days in 2021 (MFWP 2023).

Based on angler mail-in surveys (MFWP 2017, 2019) and a recent creel survey (Blakney et al. 2017), bass remain popular target species, as well as non-native Northern Pike and Yellow Perch *Perca flavescens*. For 2023, bass tournaments were scheduled on six separate weekends on Noxon Reservoir. Additionally, one Northern Pike tournament was held on Noxon Reservoir and another on Cabinet Gorge Reservoir.

As early as the 1950s, management effectiveness in the two reservoirs was monitored occasionally by evaluating fish community structure, mainly through gillnetting. Fish community monitoring with gillnets had been standardized by 2000 and has continued to the present time. A quarter century after Huston’s (1985) review, Horn and Tholl (2010), and Scarnecchia et al.

(2014) used slightly different durations of the historical gillnet data sets to evaluate trends in fish community composition and individual species abundance. Both evaluations documented statistically significant declines in several native fishes such as Peamouth *Mylocheilus caurinus*, Largescale Suckers *Catostomus macrocheilus*, and Northern Pikeminnow *Ptychocheilus oregonensis*, species of little interest to anglers but likely important components of the food web. Contemporaneously, they observed an increase in the frequency of non-native piscivorous fishes (bass, Northern Pike and Walleye *Sander vitreus*), species actively sought by anglers.

Walleye were illegally introduced into Noxon Reservoir, likely several times between the 1980s and 1990s (WWP 1995, Horn and Tholl 2010). Since 2000, the population of Walleye has become self-sustaining and has increased in abundance relative to other species. Stemming from the illegal introduction in Noxon Reservoir, Walleye have since become established in the downriver waterbodies of Cabinet Gorge Reservoir, Lake Pend Oreille (LPO), and the Pend Oreille River through Idaho and into Washington. Based on information obtained during a previous telemetry study (Horn et al. 2009), FWP began spring surveys for Walleye on suspected spawning grounds in 2012. This work has continued through 2023, primarily using jet-boat electrofishing at night. Spring Walleye electrofishing is conducted from late March to early May to coincide with suitable spring spawning temperature and pre-runoff flows, (Willis and Stephen 1987). Efforts occur in two spawning areas in upper Noxon Reservoir directly downstream of Thompson Falls Dam, adjacent to the River's Bend Golf Course and upstream of the Highway 200 bridge (Figure 4).

Current harvest management on the reservoirs includes the use of general regional regulations for all species except for Cutthroat Trout *Oncorhynchus clarki spp.* (catch and release), Largemouth Bass, Smallmouth Bass, and Walleye (MFWP 2021). Special regulations have been enacted on both reservoirs to protect spawning bass. Both species of bass rely on nest-guarding males to protect newly hatched broods and angling during that time may negatively influence recruitment (Suski and Phillip 2004). These protective bass regulations include all three lower Clark Fork River reservoirs and extends from the mouth of the Thompson River downstream to the Idaho border (MFWP 2021). This special regulation allows five fish to be harvested daily and in possession of any size, except between June 15 and July 15 when only one fish daily with a minimum length of 559 mm (22 inches) can be kept and in possession. This regulation provides protection by limiting harvest of spawning and nest-guarding bass and prevents tournaments from occurring during this time. Saffel (2003), found age-0 Largemouth Bass in Noxon Reservoir hatched between June 21 and July 3 in both low-water and high-water years. Because incubation of Largemouth Bass eggs is 3–5 days (Scott and Crossman 1973), it was assumed that spawning in Noxon began after June 15 even on low-water years, hence the reasoning behind the June 15 to July 15 exception. The regulation for Walleye is no limit in both Noxon and Cabinet Gorge Reservoirs, as opposed to the catch, keep and report requirement for the rest of Montana's

Western Fishing district. Walleye have become established in both reservoirs following illegal introductions and the keep and report requirements are not warranted.

Fish community monitoring continues to be conducted in both Noxon and Cabinet Gorge reservoirs with gillnets to assess trends in fish community composition and species abundance. Monitoring fish lengths and catch composition during bass tournaments remains an important part of the monitoring program as bass have low capture vulnerability in gillnets. Specific objectives of the current reservoir monitoring plan are to:

1) Monitor trends in fish populations in Noxon and Cabinet Gorge reservoirs with emphasis on species of recreational value and potential predators of native salmonids which inhabit the reservoirs.
2) Monitor the overall status of the bass fishery in Noxon Reservoir.
3) Monitor the population of illegally introduced Walleye in Noxon Reservoir.

For a more thorough description of the study area and methods, refer to: Kreiner and Tholl (2013), Kreiner and Tholl (2016), Horn and Tholl (2010), and Scarnecchia et al. 2014.

Study Area

The Clark Fork River is Montana's largest river by discharge. It has its origins near Butte, Montana at the Continental Divide and flows for approximately 380 km before merging with the Flathead River near Paradise, Montana. The Lower Clark Fork River (LCFR) begins at the confluence with the Flathead River and continues northwestward 165 km before entering LPO, a large (380 km^2), deep (350 m) natural lake in the Idaho panhandle.

The LCFR historically was an important migratory corridor for Bull Trout and Westslope Cutthroat Trout *Oncorhynchus clarki lewisi* which spawned in Montana tributaries but matured in LPO (Huston 1985). Other native non-game species also migrated extensively through the LCFR (e.g., Catastomids, Leuciscids). However, in the 20th century, three dams were constructed that have restricted migrations of native fishes and greatly altered the hydrology and habitat of the river. Thompson Falls Dam, the uppermost of the three dams and not a focus of this report, is also the oldest, completed in 1915 by Montana Power (currently owned by NorthWestern Energy). Cabinet Gorge Dam (completed 1952) and Noxon Rapids Dam (completed 1959) are owned and operated by Avista. Noxon Reservoir, the middle reservoir, is the largest LCFR reservoir with a surface area of 3,200 Ha, a maximum depth of greater than 61 meters, and a length of approximately 62 km. Just inside the Idaho border, Cabinet Gorge Dam creates a reservoir that is 1,200 Ha and approximately 31 km long. All three LCFR reservoirs are considered mainstream or run-of-the-river reservoirs (Kalff 2002) and are characterized by their short water retention times. Noxon Reservoir has a water retention time of three weeks during low-water and less than one week during run-off, while Cabinet Gorge Reservoir's retention time is never greater than seven days (Huston 1985). As a result, the reservoirs retain both lotic and lentic characteristics throughout. Many of the narrow upstream channels have visible current, while many bays, flats, and lacustrine areas above the dams are lake-like in appearance.

The run-of-the-river nature of these reservoirs impacts most of the fish species, especially those that evolved in more stable lentic habitats. For example, during larger run-off years, high water levels and cold-water temperatures delay Largemouth Bass spawning and reduce overwinter survival of age-0 Largemouth Bass (Saffel 2000). Additionally, low water retention time associated with high runoff from snow melt across the Clark Fork basin is generally associated with less successful spawning by reservoir-dwelling Walleye, similar to other populations in North America (Willis and Stephens 1987).

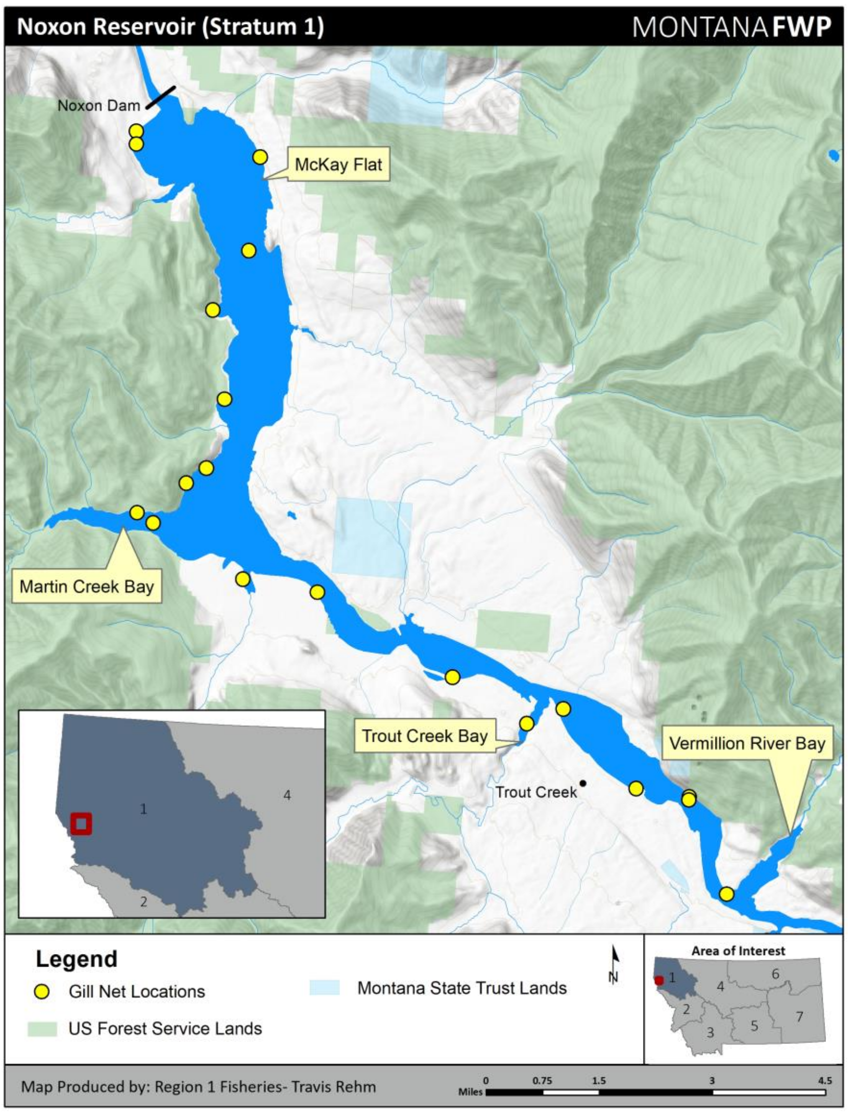

Figure 1. Gill net locations in Noxon Reservoir, Montana (stratum 1).

Methods

Fall Gillnetting

Standardized annual fall gillnetting in Noxon and Cabinet Gorge reservoirs provides the most comprehensive index of relative abundance for fish species and fish community composition in both reservoirs. Standard gillnet surveys are conducted annually in Noxon and Cabinet Gorge reservoirs in early October. The surveys have consisted of 45 total overnight gillnets sets, 30 in Noxon Reservoir and 15 in Cabinet Gorge Reservoir (Figures 1–3). In Noxon Reservoir, 19 sites are in the lower portion of the reservoir below Beaver Creek Bay (stratum 1), while the remaining 11 sites are in the upper riverine portion (stratum

2). Standardized (i.e., identical) sites have been sampled annually since 2000. Coldwater sites such as tributary mouths, have been intentionally avoided to reduce Bull Trout bycatch and mortality.

Nylon multifilament experimental sinking gillnets have been used during all gillnetting efforts. The nets are 38 m long and 1.8 m deep with five separate 7.6 m panels consisting of 1.9 cm, 2.5 cm, 3.2 cm, 3.8 cm, and 5.1 cm square mesh. The length and mesh sizes of these nets have been consistent throughout the duration of this monitoring and are the same specifications of standard experimental gillnets used throughout the state by FWP.

Gillnets are set in the afternoon, fished overnight, and retrieved the following morning. Most nets (87%) are set perpendicular to the shoreline with the net stretched just far enough to achieve full vertical extension (1.8 m). The small mesh (1.9 cm) end of each gillnet is set closest to shore for all near-shore net sets. The other six nets (13%) are open-water sets in which the net is set parallel to shore and both the front and back of the net anchored in deep water. Depths of sets has ranged from 1.5 to almost 35 m but has been consistent among locations and between years. Although minor variation has occurred between net-set durations through the years, nets have been set and pulled in an identical order each year, resulting in little annual variation in soak times among nets set at a given site. All gillnet data is summarized as total and species-specific catch per unit effort (i.e.,

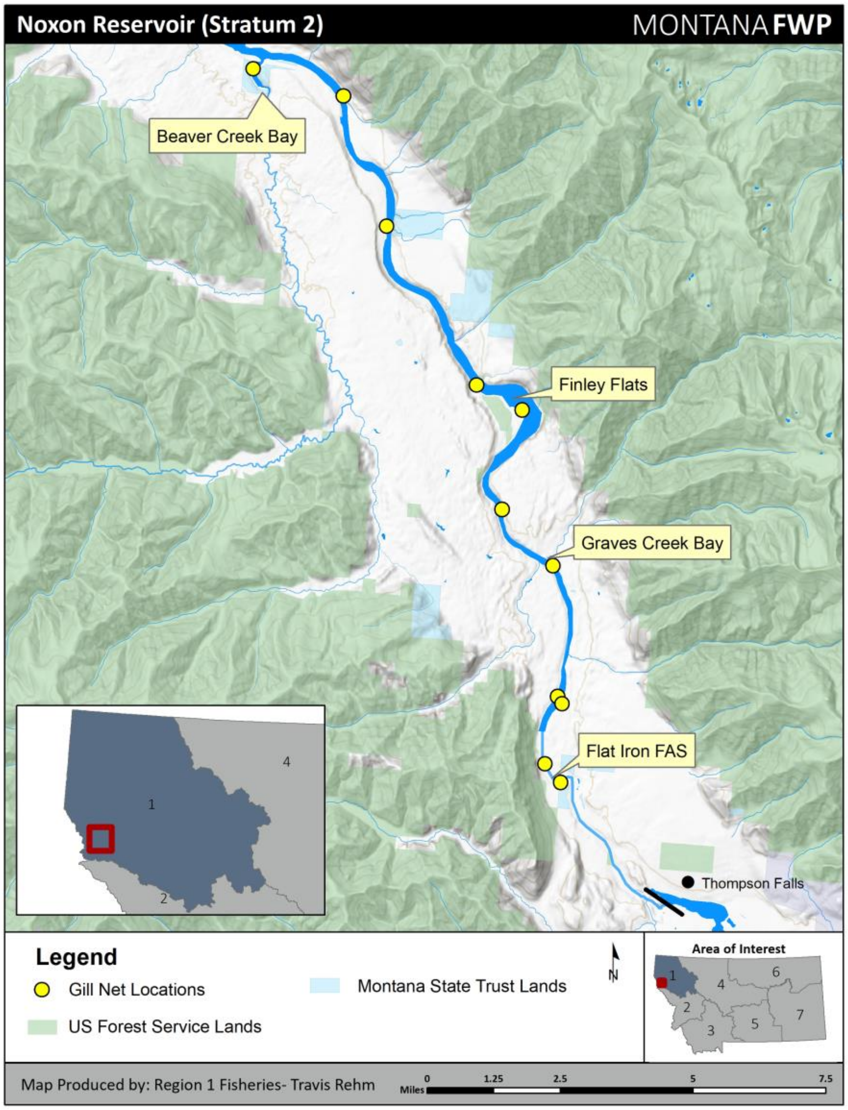

Figure 2. Gill net locations in Noxon Reservoir, Montana (stratum 2).

number of fish per gillnet night). Species composition is based on total number of each species captured, as percent of total catch, and as a percent of total weight.

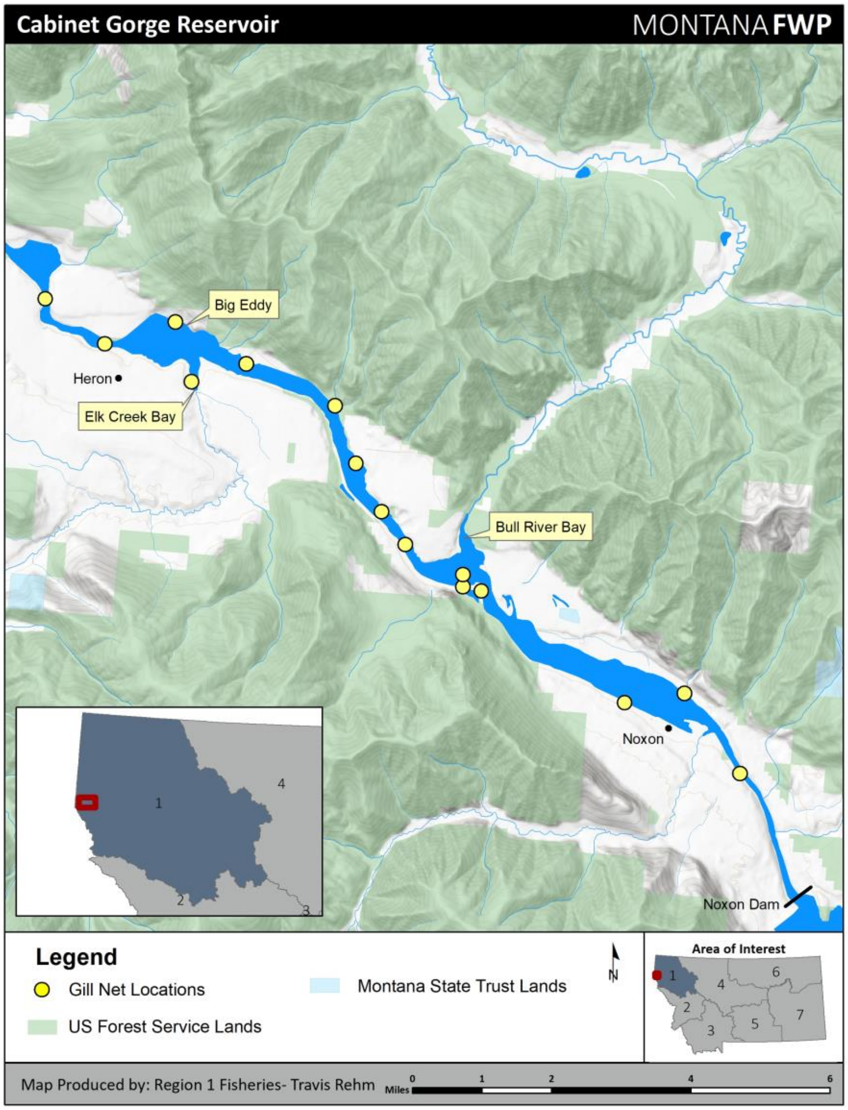

Figure 3. Gillnet locations in Cabinet Gorge Reservoir, Montana.

Retrieved gillnets are shuttled to a shoreline location where fish are removed from the nets and the appropriate data collected and recorded. Since the 1990s, processing of fish and nets has been a cooperative effort among FWP, Avista, and students from University of Idaho Fisheries Management class. Data collected from each fish include its species, total length (TL; mm), and weight (g), identified separately by individual net. Additionally, all Walleye previously marked via dorsal spine removal are scanned for passive integrated transponder (PIT) tags.

Since 2013, all Walleye captured have been identified to sex and their otoliths collected for age determination. Otoliths of walleye were removed using the “up through the gills method” (Stevenson and Campana 1992), embedded in epoxy, and transversely sectioned using a low-speed isometric saw. Sections are then aged independently by two readers and any fish with age discrepancies are aged by a third reader (Quist and Isermann 2017). Using ages derived from otolith analysis, separate growth curves were fitted for male and female Walleye populations (von Bertalanffy 1938).

Conditions of fishes were calculated as an index, using relative weight (Wr; Wege and Anderson 1978; Pope and Kruse 2007). Size structure was described using proportional size distribution, where species-specific lengths refer to stock, quality, preferred, memorable, and trophy length fish (Gabelhouse 1984; Neumann et al. 2012). Condition was compared between length groups using one-way ANOVA and Tukey's Honestly Significant Difference (Ogle 2016). Long-term trends in catch per unit effort (CPUE) and condition were investigated using linear regression.

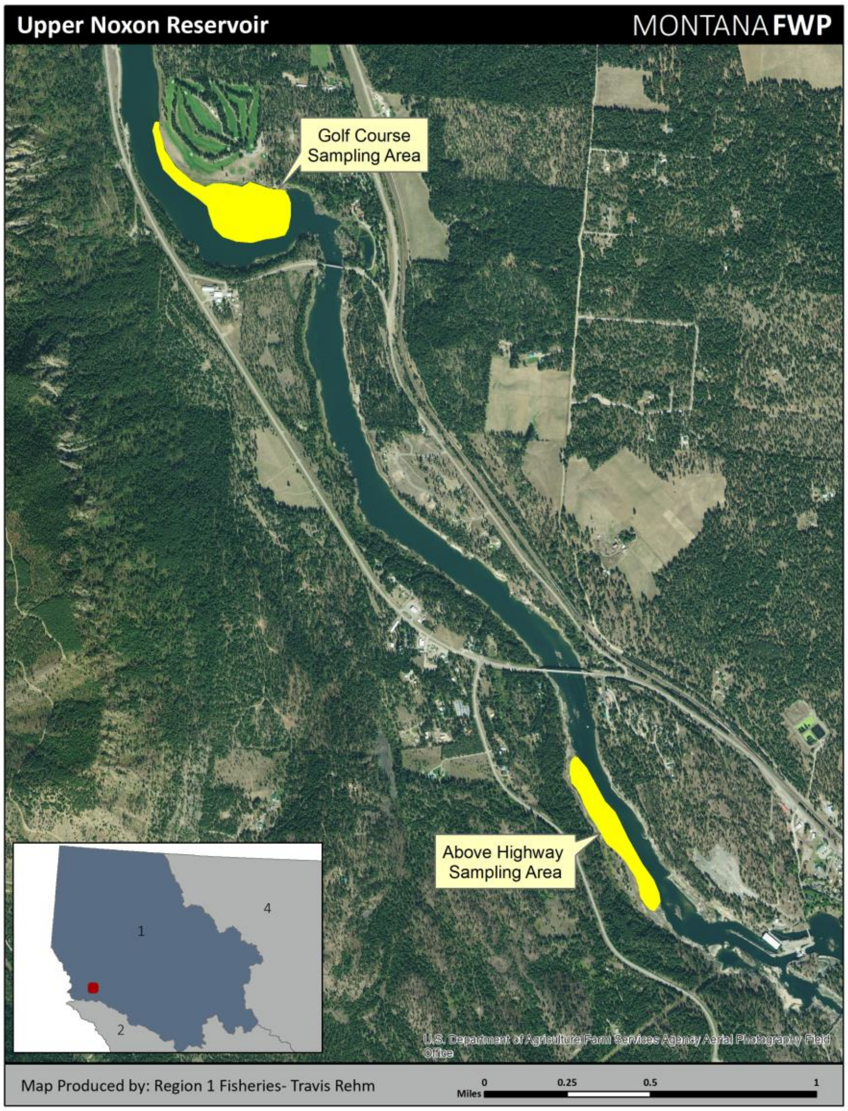

Figure 4. Map of two spring Walleye sampling locations in upper Noxon Reservoir, Montana.

Spring Walleye Monitoring

Additional sampling of Walleye occurs on upper Noxon Reservoir each spring. With varying degrees of effort, Walleye have been monitored using nighttime electrofishing during late March through early May since 2012. The objectives of spring sampling are to monitor year-class strength, the spawning population abundance, and collect fish for age and growth estimates. The primary sampling location was above the Montana state highway 200 bridge near Thompson Falls, based on information obtained from a previous telemetry study (Horn et al. 2009; Figure 4). Additional sampling began near the River's Bend Golf Course across from Flat Iron Fishing Access Site in 2016.

Walleye were collected by jet-boat mounted boom electrofishing during nighttime hours from April 3 to May 1 of 2023. Walleye captured were measured (TL; mm) and weighed (g). A subsample of up to five Walleye of each sex in 25 mm length bins for Walleye up to 500 mm and up to five Walleye of each sex in 50 mm length bins for Walleye greater than 500 mm in length were sacrificed for age analysis. Sex and maturity of Walleye was assessed by visual inspection of gonads of sacrificed fish or manipulating the abdomen following methodology outlined by

Duffy et al. (2000). All remaining Walleye were scanned, and if not found to be previously tagged, were implanted with passive integrated transponders (PIT tags), the dorsal spine removed for additional identification, and the fish were released. Otoliths of sacrificed Walleye were removed using the "up through the gills method" (Stevenson and Campana 1992), embedded in epoxy, and transversely sectioned using a low-speed isometric saw. Sections were then aged independently by two readers and any fish with age discrepancies were aged by a third reader (Quist and Isermann 2017).

Ages derived from otolith analysis were used to construct age-length keys using Fisheries Stock Assessment (FSA) v0.8.12; R v3.3.2 (Ogle 2010; R Core Team 2020). Age-length keys were constructed for both female and male Walleye using 10 mm length bins and ages were assigned to all unaged fish based on the corresponding age-length keys (Isermann and Knight 2005; Ogle 2016). Using ages derived from otolith analysis we also fitted separate growth curves for male and female Walleye spawning populations (von Bertalanffy 1938).

Bass Tournament Monitoring

The status of adult Largemouth and Smallmouth bass populations has been assessed annually since 1997 by monitoring bass tournaments on Noxon Reservoir. In most years, between five and seven two-day bass tournaments occurred on Noxon Reservoir. Recently, two to three bass tournaments have been monitored per year.

Noxon Reservoir bass tournaments require that bass have a minimum length of 305 mm (12 inches) to be weighed in. Therefore, only bass this size or larger were monitored at tournaments. Indices collected at Noxon Reservoir tournaments since the 1990s include the percentage of quality fish weighed in (fish greater than 380 mm or 15 inches; Gabelhouse 1984), mean length of fish weighed in (>305 mm), and proportion of species brought to weigh-in (Smallmouth versus Largemouth Bass). All tournaments held on Noxon Reservoir allow high-grading or culling (i.e., the replacement of smaller fish captured with larger fish after a 5-fish limit was attained) so catch rates cannot be accurately estimated.

Results and Discussion

Fall Gillnetting

Noxon Reservoir

Gill netting was conducted in Noxon Reservoir October 8–10, 2023. A total of 1,320 fish representing 12 species were captured (Table 1). Catch per unit effort trends are shown as a function of mean fish/net in Appendix B for commonly captured fish species 2000–2023. The catch rate of 44 fish/net was up from recent years and above the historic average (2000–2022 mean catch 33.7 fish/net). Yellow Perch were the most abundant species captured representing over 45.5% of the total catch (n = 600). The mean number of Yellow Perch captured in 2023 was 20 fish/net which is substantially greater than the mean 2000-2022 catch of 12.2 fish/net (Figure 5). This was the highest number observed since standardized netting began in 2000. Pumpkinseed *Lepomis gibbosus* was the second most abundant fish species caught and comprised 24.7% of the total catch (n = 326). The mean catch rate for Pumpkinseed was 10.9 fish/net in 2023, which was more than double the 2000-2022 mean of 4.4 fish/net and was highest number observed since standardized netting began in 2000. (Figure 5). Pumpkinseed abundance has increased over time (linear regression, $r^2 = 0.28$, $p = 0.01$) in Noxon Reservoir. Lake Whitefish abundance has also increased over the sampling period (linear regression, $r^2 = 0.33$, $p = 0.006$), representing over 4.1% of the total catch in 2023. The mean number of Lake Whitefish captured in 2023 was 1.8 fish/net which is substantially greater than the mean 2000-2022 catch of 0.8 fish/net.

Yellow Perch, Pumpkinseed, and Lake Whitefish are likely an important prey base for the top four predators (i.e., Largemouth Bass, Smallmouth Bass, Northern Pike, and Walleye) in Noxon Reservoir. Close monitoring of these prey populations and their relative abundance over time is important to inform management decisions in this predator-heavy system (Scarnecchia et al. 2014; Scarnecchia and Lim 2016).

Table 1. Mean catch rates (fish/net night), total number caught, percentage of total species composition by number and biomass (percent of total weight), mean weight, weight range, mean length, and length range for species captured in Noxon Reservoir during gill netting surveys conducted in 2023. Species abbreviations are specified in Appendix B.

Species	Mean fish/net (STDEV)	Total # caught	Species Comp. (%)	Percent of Total Weight (%)	Mean Weight (g)	Weight Range (g)	Mean Length (mm)	Length Range (mm)
YP	20.0 (17.0)	600	45.5%	11.6%	78.4	30–275	181.8	115–290
PUMP	10.9 (11.1)	326	24.7%	4.6%	56.9	15–210	132.2	60–245
YLBH	3.0 (3.8)	89	6.7%	6.4%	288.9	35–550	261.6	139–325
SMB	2.6 (4.4)	79	6.0%	9.6%	490.8	40–1765	294.2	146–475
NP	2.2 (2.9)	67	5.1%	28.1%	1687.4	185–3870	614.7	315–796
LWF	1.8 (3.2)	54	4.1%	13.7%	1020.7	340–1730	458.9	234–573
WE	1.7 (2.7)	52	3.9%	11.3%	894.6	195–2590	435.8	290–639
NPMN	0.9 (1.0)	27	2.0%	7.5%	1113.0	50–1985	456.3	160–580
LSSU	0.5 (1.2)	16	1.2%	6.0%	1511.6	920–2520	500.5	440–619
LMB	0.3 (0.5)	8	0.6%	0.4%	198.1	40–625	212.0	131–325
PEA	<0.1 (0.2)	1	0.1%	0.1%	510.0	510–510	365.0	365–365
LL	<0.1 (0.2)	1	0.1%	0.6%	2505.0	2505–2505	636.0	636–636

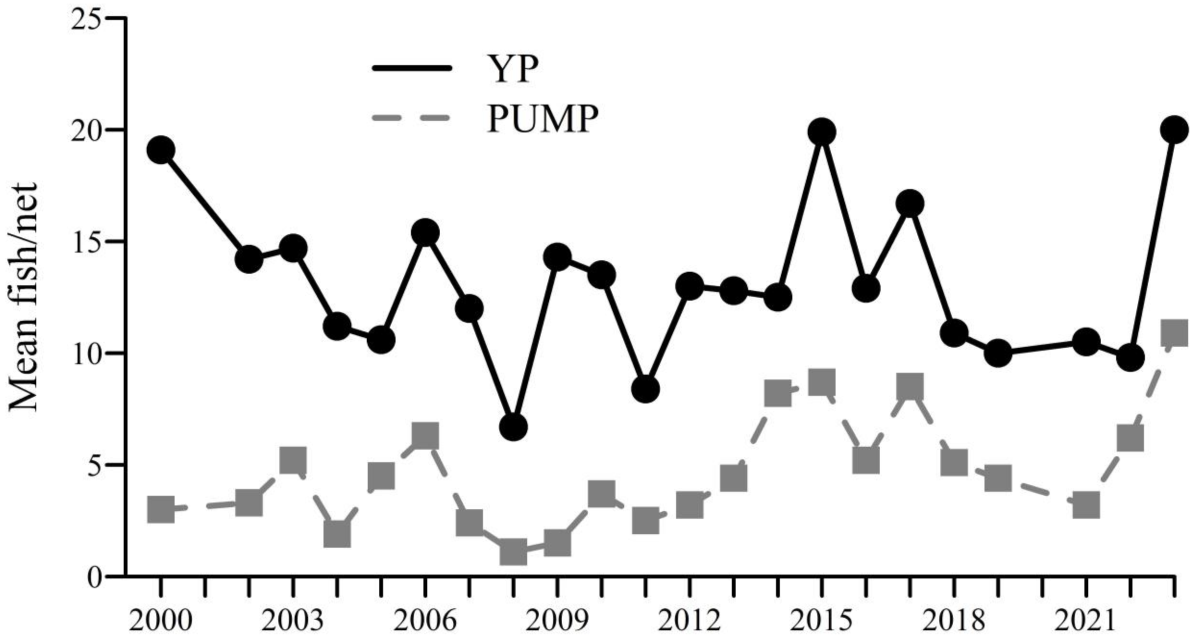

Figure 5. Mean number of fish per net for Yellow Perch and Pumpkinseed 2000–2023 in Noxon Reservoir during annual fall gill netting.

Gillnets are an effective method to monitor relative abundance of two of the four top predators in Noxon Reservoir: Walleye and Northern Pike. In general, bass are not susceptible to being captured in gillnets when compared to most other species in the reservoirs. Smallmouth Bass are captured at a higher rate than Largemouth Bass, but both species are underrepresented to an unknown degree in relation to their abundance in the fish community.

Walleye were the third most abundant top predator species captured representing 3.9% of the total catch (n = 52), which is substantially down from 2021 when the highest number since standardized netting began in 2000 was recorded (n = 96). However, Walleye abundance has increased over time (linear regression, $r^2 = 0.77$, $p < 0.001$), and the 2023 mean catch rate was still 1.7 fish/net, which was substantially higher than the prior mean 2000–2022 catch rate of 1.1 fish/net. All Walleye captured during fall gill netting efforts had sex determined with the exception of a single Walleye (Table 2). The majority of Walleye captured were comprised of year classes 2021 (50%), 2019 (30.8%), and 2020 (11.5%; Table 2; Figure 6). The once dominant 2015 year-class has shown signs of decline representing only 5.8% of Walleye captured in 2023 (10.6% in 2022; 19.8% in 2021). However, this was the second year in a row the strong 2021 year-class was detected. Walleye from the 2021 year-class have not yet recruited to the spawning population sampled during spring electrofishing. Based on past sampling, we expect males from that age class to begin to enter the spawning populations in 2024.

Table 2. Mean length-at-age of fall caught Walleye from Noxon Reservoir in 2023.

	Males			Females			Total		
Age	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD
2	15	349	26.4	10	378	25.1	26	359	29
3	3	415	25	3	454	81.4	6	435	58.1
4	4	470	66.1	12	536	26	16	520	47.4
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	1	578	-	-	-	-	1	578	-
8	2	536	22.6	1	639	-	3	570	61.6

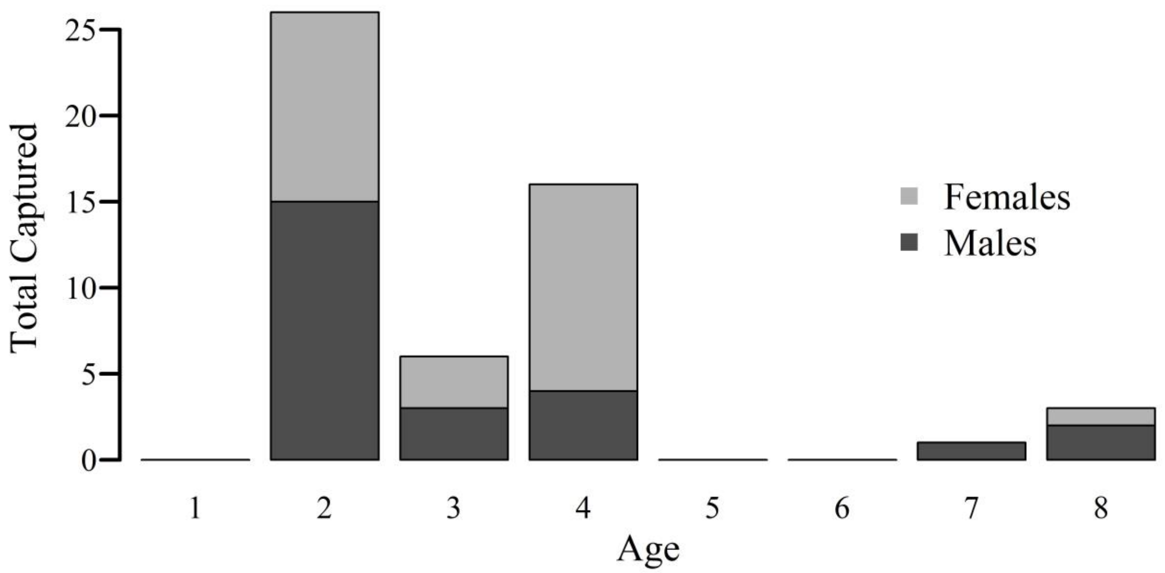

Figure 6. Age frequency distribution of fall caught Walleye from Noxon Reservoir in 2023.

Mean Wr for Walleye was 87.2 in 2023, which is less than the 2002–2022 mean (Wr = 96.4; Figure 7). A significant decline in mean Wr of Walleye has occurred over time (linear regression, $r^2 = 0.58$, $p < 0.001$; Figure 9). However, Walleye at all length groups are near average condition when compared to Walleye caught using standardized gill nets in large standing waters in North America (Figure 7). We expect Walleye condition to decline as the population grows and competition for prey increases. Condition of male Walleye (Wr = 84.6) was slightly lower than females (Wr = 89.8).

Proportional size distribution for Walleye captured during fall of 2023 (65) points to a relatively large size structure within Noxon that likely represents sporadic recruitment and moderate to low levels of mortality for adults (Anderson and Weithman 1978). Walleye condition among length groups showed no statistically significant difference (Figure 7; stock = 165–213 mm, quality = 297–338 mm, preferred = 371–455 mm, and memorable = 488–528 mm). Similar to recent years, trends of increasing abundance and decreasing condition within Walleye in Noxon Reservoir were observed.

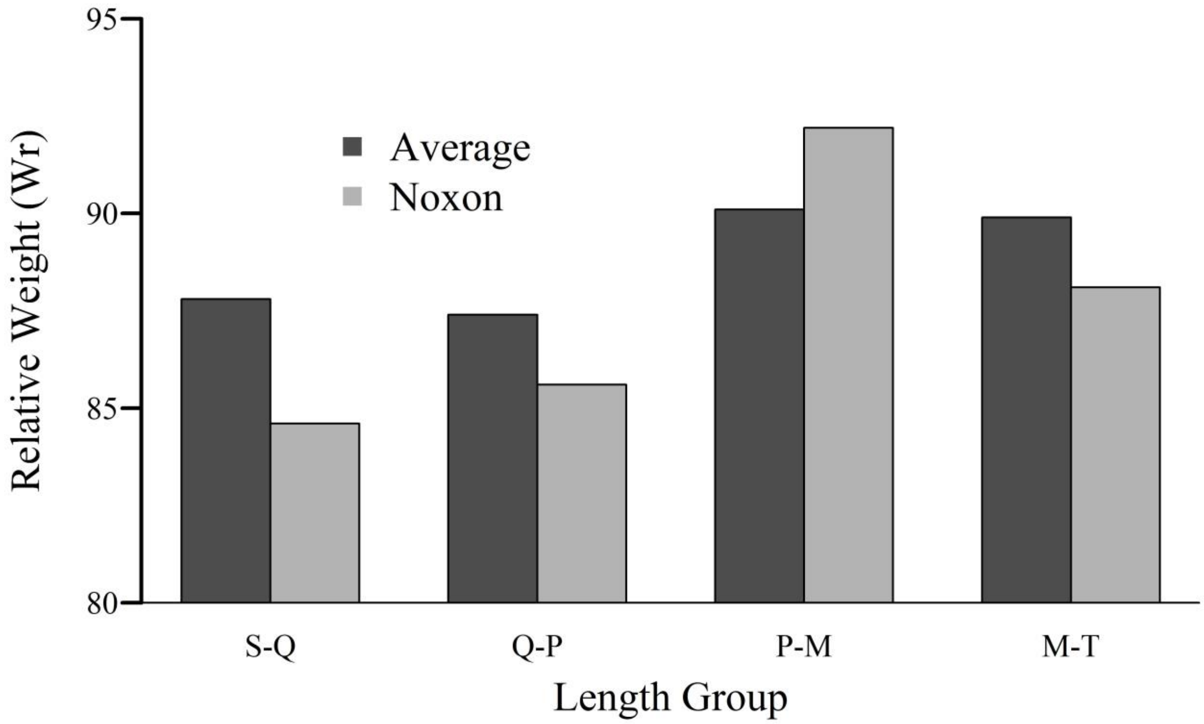

Figure 7. Average condition of Walleye caught using standardized gill nets in large standing waters in North America (Bonar et al. 2009) and average condition of fall caught Walleye from Noxon Rapids Reservoir in 2023. S = stock, Q = quality, P = preferred, M = memorable, and T = Trophy (Gabelhouse 1984).

Growth curves and parameters (Appendix D) were calculated for both males and females using the 52 Walleye used for age analysis (Table 2). Of those fish, 25 were male, 26 were female, and 1 was unknown. Supporting reported mean length-at-age data, female Walleye growth rates were greater than males.

During 2023 gill netting only one Walleye was recaptured that had previously been tagging during spring Walleye electrofishing (Table 3). This fish had been tagged in the spring of 2020 and recaptured after four growing seasons. Recapture rates for fish PIT tagged in 2020 were < 1%.

Table 3. Mean yearly growth of recaptured Walleye sampled during fall 2023.

PIT Tag Number	Initial Capture Date	Initial Capture Length (mm)	Recapture Date	Recapture Length (mm)	Sex	Mean Yearly Growth (mm)
982000362929639	4/20/2020	459	10/8/2023	520	M	18

Northern Pike comprised 5.1% of the netted fish and were the second most abundant predator species sampled within Noxon Reservoir. Northern Pike represent the highest amount of biomass at 28.1% of total weight of captured fish. Mean catch rate for Northern Pike in 2023 was 2.2 fish/net (Table 1), which is substantially higher than the 2002–2022 mean catch rate (1.3 fish/net). Northern Pike abundance has increased significantly since standardized gillnetting began (linear regression, $r^2 = 0.74$, $p < 0.001$). Mean Wr for Northern Pike in 2023 was 98.3 which continues a significant decline since 2000 (linear regression, $r^2 = 0.74$, $p < 0.001$). While mean Wr in Northern Pike has declined from the 2000–2022 mean (Wr = 109.3; Figure 9), Northern Pike condition is still considered near the 50th percentile for large standing waters of North America (Figure 8; Bonar et al. 2009).

Trends of increasing abundance and decreasing condition observed in Northern Pike were similar to those in Walleye. Proportional size distribution for Northern Pike captured during fall of 2023 (85) still points to a large size structure within Noxon Reservoir that represents high mortality of young fish and moderate to low levels of mortality for adults (Anderson and Weithman 1978). Northern Pike of preferred ($p = 0.009$) and quality ($p = 0.006$) length were in significantly better condition than those of stock length. Northern Pike condition among other length groups showed no statistically significant difference (sub-stock = <350 mm, stock = 350–529 mm, quality = 530–709 mm, preferred = 710–859 mm, and memorable = 860–1119 mm).

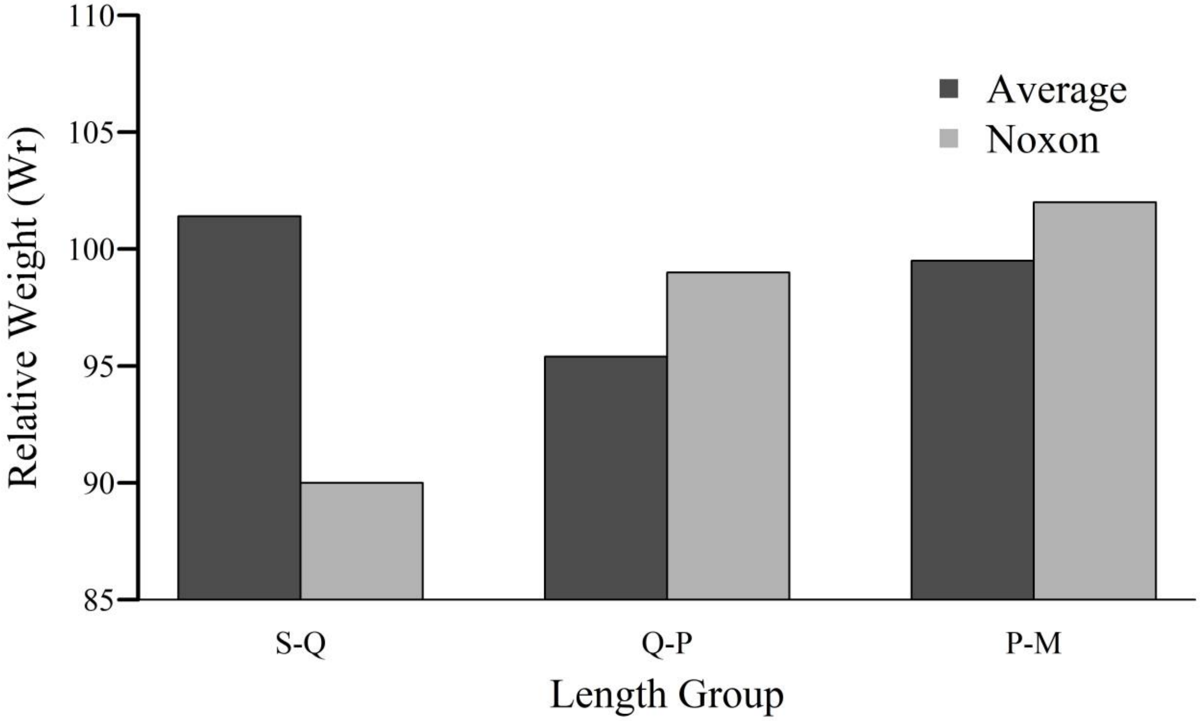

Figure 8. Average condition of Northern Pike caught using standardized gill nets in large standing waters in North America (Bonar et al. 2009) and average condition of fall caught Northern Pike from Noxon Reservoir in 2023. S = stock, Q = quality, P = preferred, M = memorable, and T = Trophy (Gabelhouse 1984)

Smallmouth Bass were the most abundant top predator species captured within Noxon Reservoir, representing 6% of the total catch (n = 79; Table 1), which was the highest number since standardized netting began in 2000. Mean catch rate for Smallmouth Bass in 2023 was 2.6 fish/net (Table 1), which is substantially higher than the 2002–2022 mean catch rate (1 fish/net). This is the second consecutive year we have observed historic high catches of Smallmouth Bass. However, it is difficult to determine if the increase in catch per unit effort is due to unseasonably warm weather during both sampling events that increased susceptibility to capture in gillnets or a dramatic increase in abundance. Even with the notable difficulty catching the species in gillnets, future gill net surveys should shed light on the distinction. Condition of Smallmouth Bass captured within Noxon Reservoir was similar to historic mean values in 2023 (Wr= 96.8). Smallmouth Bass mean Wr has ranged from a low of 84.1 (n = 11) in 2008 to a high of 102.9 (n = 63) in 2013 (Figure 9). No decline has been detected over the sampled period (linear regression, $p = 0.96$). As stated earlier, the downward trends in Walleye and Northern Pike Wr may be indicative of increasing competition for prey resources and habitat among top predators in this complex ecosystem. It is much less clear if the Wr of Smallmouth Bass is representative of the actual population given the notable difficulty in catch the species in gillnets. Future efforts should be made to evaluate the potential for taking “snapshots” of the Noxon food web using stable isotopes and diet analysis which may provide a better understand of interactions among predators, prey, and environmental conditions in the reservoir.

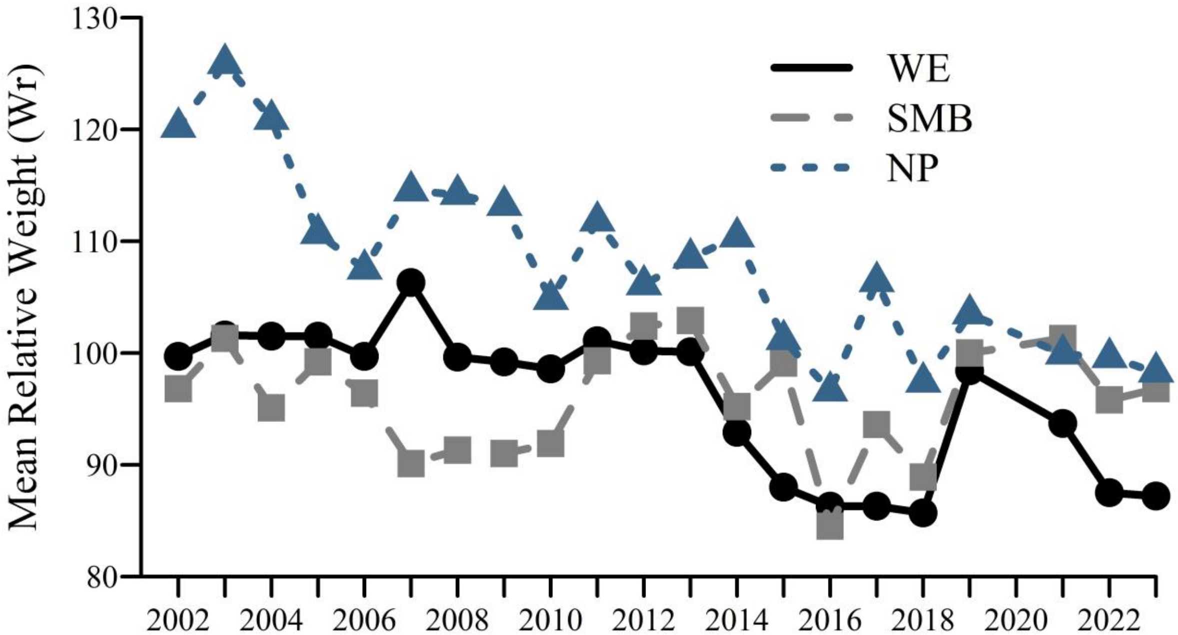

Figure 9. Mean relative weight of fall-captured Northern Pike, Smallmouth Bass and Walleye over time in Noxon Reservoir.

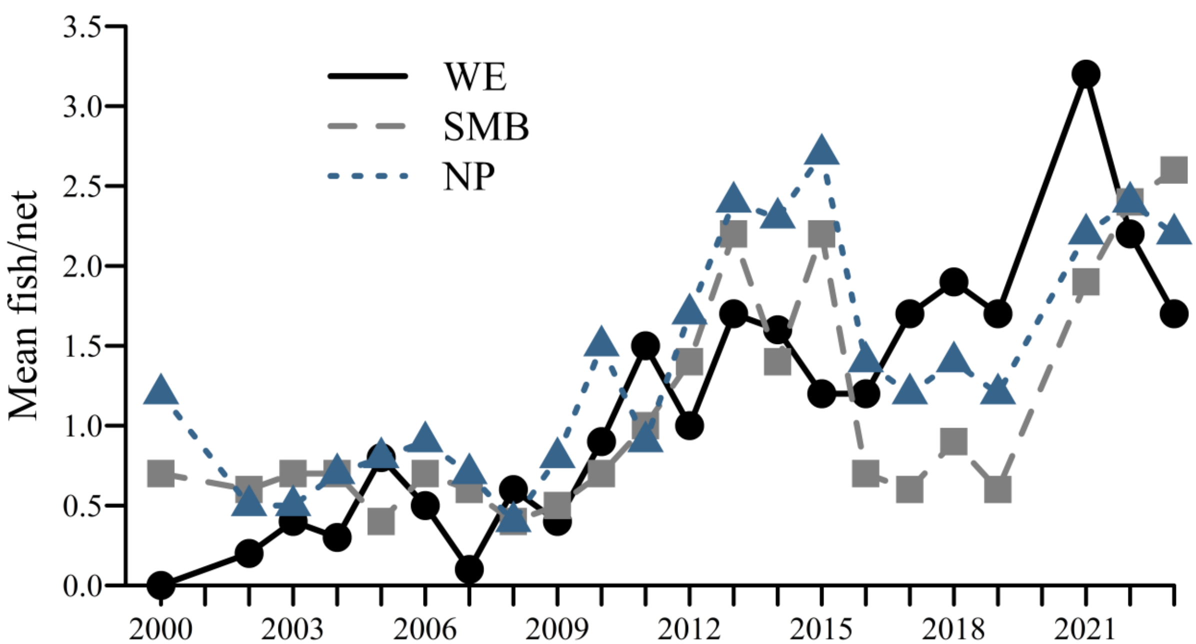

Figure 10. Mean number of fish per net for Walleye, Smallmouth Bass, and Northern Pike 2000–2023 in Noxon Reservoir during annual fall gill netting.

Native non-gamefish species such as Northern Pikeminnow, Peamouth, and Largescale Suckers continue to be captured at low levels. In 2023, 27 Northern Pikeminnow were captured comprising 2% of the sample (Table 1). A significant decline in the species has been documented since 2000 (linear regression, $r^2 = 0.93$, $p < 0.001$), where 6.1 fish/net was documented in 2000 (n = 178) and 3.6 fish/net in 2011 (n =108), compared to 0.9 fish/net in 2023 (n = 27) (Appendix B; Figure 11).

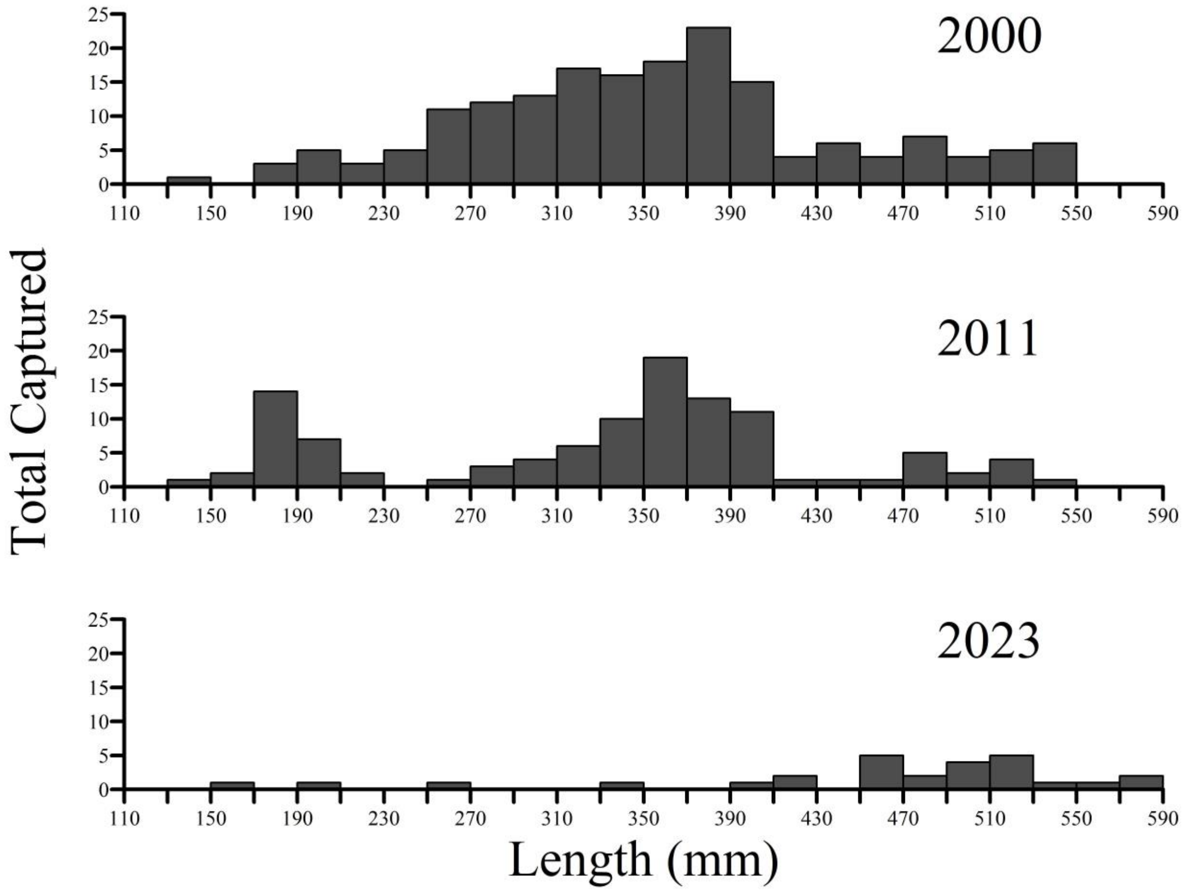

Figure 11. Length Frequency distribution of fall caught Northern Pikeminnow during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 178), 2011 (n = 108), and 2023 (n = 27).

Sixteen Largescale Suckers were captured in 2023 (0.5 fish/net), compared to 36 fish in 2010 (1.2 fish/net), and 56 fish in 2000 (1.9 fish/net; Table 1; Figure 12). Largescale Suckers have also shown a significant decline since standardized gillnetting began (linear regression, $r^2 = 0.77$, $p < 0.001$; Appendix B).

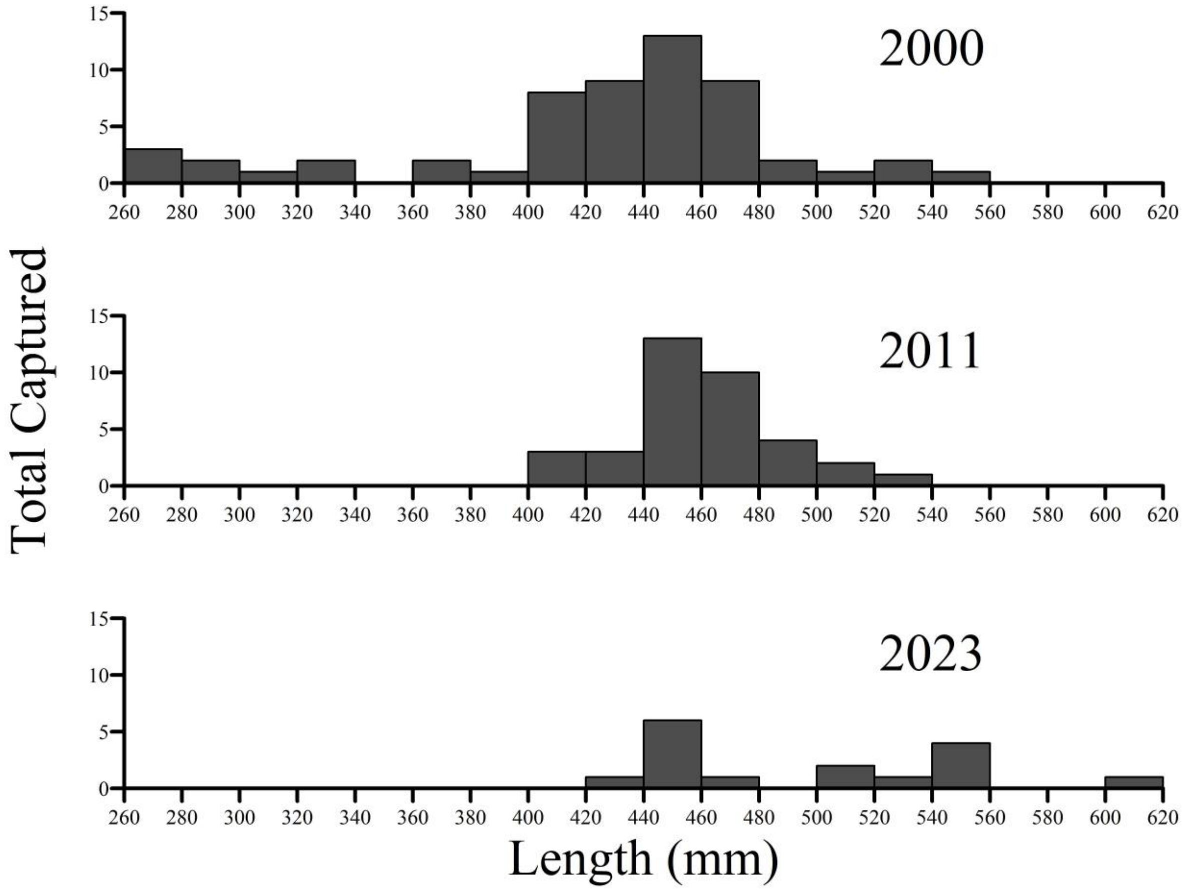

Figure 12. Length Frequency distributions of fall caught Largescale Suckers during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 56), 2011 (n = 36), and 2023 (n = 16).

The most dramatic decline has been observed in Peamouth (linear regression, $r^2 = 0.91$, $p < 0.001$) where a mean catch of 11.6 fish/net (n = 338) was recorded in 2000 and 5.3 fish/net (n = 157) in 2011, compared to <0.1 fish/net in 2023 (n = 1; Figure 13; Appendix B). We are likely witnessing the local extirpation of this species in Noxon Reservoir that as has been observed for this species in Cabinet Gorge Reservoir (Rehm et al. 2022). Size structure of each of these native minnow and sucker populations, which have likely served as an important prey resource for gamefish species, indicate little if any successful recruitment. Additionally, these populations generally appear to be comprised of historically low numbers of larger, older individuals and could be in danger of local extirpation.

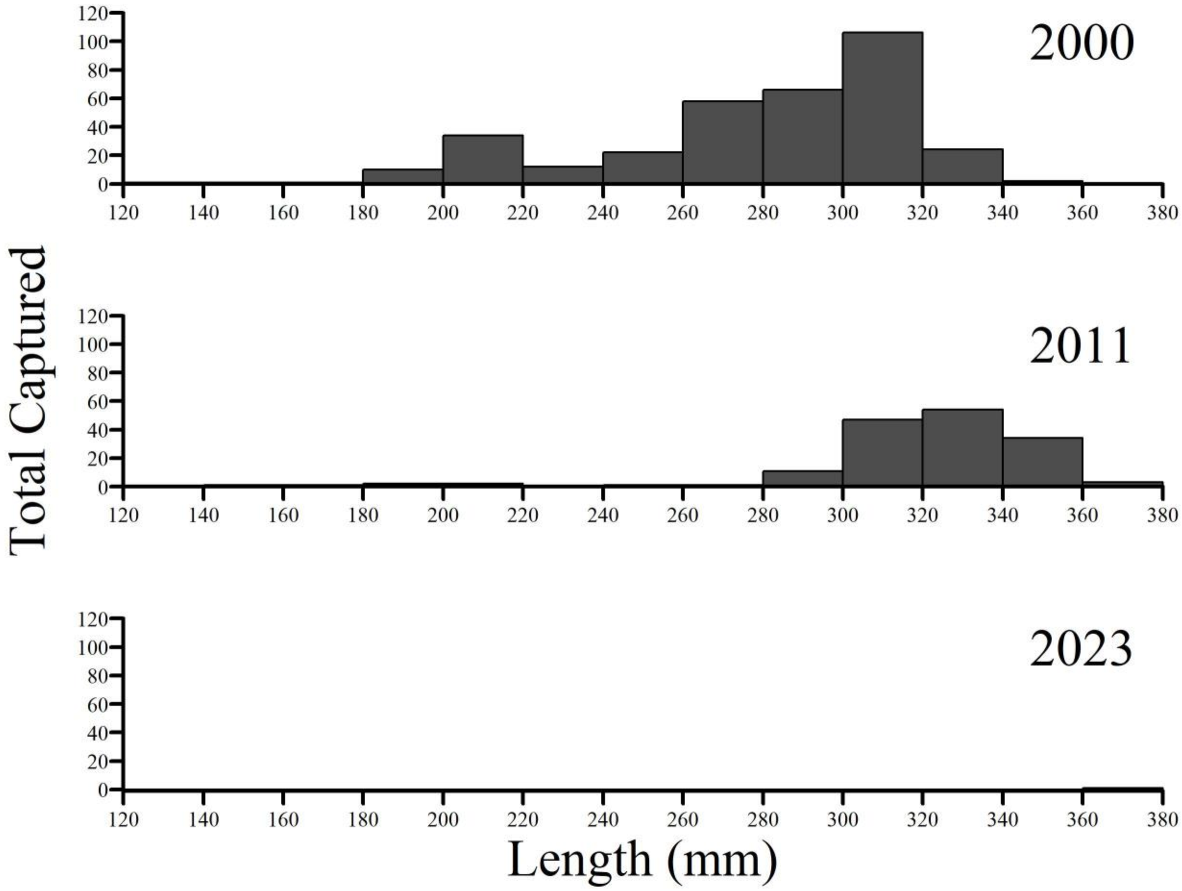

Figure 13. Length frequency distributions of fall caught Peamouth during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 337), 2011 (n = 157), and 2023 (n = 1).

Cabinet Gorge Reservoir

Gill netting was conducted in Cabinet Gorge Reservoir October 8–9, 2023 and produced a total of 217 fish representing 10 species (Table 4). Catch per unit effort trends are shown as a function of mean fish/net in Appendix C for commonly captured fish species 2000–2023. The catch rate of 14.5 fish/net is up from recent years and above the historic average (2000–2022 mean catch 13.3 fish/net). Yellow Perch were the most abundant species captured in 2023, representing 42.9% of the total catch (n = 93). The mean number of Yellow Perch captured in 2023 was 6.2 fish/net which is more than the 2000–2022 mean catch of 3.8 fish/net (Table 4).

Table 4. Catch rates (fish/net), total number caught, percentage of total species composition by number and biomass (percent of total weight), mean weight, weight range, mean length and length range for species captured in Cabinet Gorge Reservoir during gill netting surveys conducted in 2023. Species abbreviations are specified in Appendix A.

Species	Mean fish/net (STDEV)	Total # caught	Species Comp. (%)	Percent of Total Weight (%)	Mean Weight (g)	Weight Range (g)	Mean Length (mm)	Length Range (mm)
YP	6.2 (8.2)	93	42.9%	5.7%	72.6	25–185	180.6	134–286
SMB	2.1 (2.6)	32	14.7%	18.8%	661.9	79–1360	336.7	177–445
NPMN	1.4 (1.7)	21	9.7%	19.3%	1091.5	85–2390	436.1	221–600
NP	1.1 (1.4)	16	7.4%	23.9%	1688.4	750–2645	612.7	481–714
LSSU	1.0 (1.6)	15	6.9%	14.5%	1088.7	850–1410	460.9	433–506
WE	0.8 (1.2)	12	5.5%	6.4%	600.4	150–2055	381.3	272–558
PUMP	0.7 (2.3)	11	5.1%	0.3%	30.0	20–50	111.6	98–136
LL	0.5 (0.6)	8	3.7%	7.5%	1051.9	120–1630	460.5	241–582
LWF	0.4 (0.7)	6	2.8%	3.3%	746.0	715–765	413.3	370–429
LMB	0.2 (0.6)	3	1.4%	0.4%	156.7	80–220	208.0	165–238

Similar to Noxon Reservoir, gillnets are an effective method to monitor relative abundance of two of the four top predators in Cabinet Reservoir: Walleye and Northern Pike. In general, bass are not susceptible to being captured in gillnets when compared to most other species in the reservoirs. Smallmouth Bass are captured at a higher rate than Largemouth Bass, but both species are underrepresented to an unknown degree in relation to their abundance in the fish community.

Northern Pike were the second most abundant top predator species captured, representing 7.4% of the total catch (n = 16; Table 4). This was a substantial decline from 2021 (1.6 fish/net), which had the highest number since standardized netting began in 2000 (Figure 14). Mean catch was 1.1 fish/net, which was near the historic average (2000–2022 mean catch 0.7 fish/net; Appendix C). Northern Pike abundance has shown a significant increase since standardized gillnetting began (linear regression, $r^2 = 0.32$, $p = 0.01$). Mean Wr for Northern Pike was 104.8 in 2023, this is the highest condition factor we have observed since 2015. However, overall the Northern Pike condition has been in decline since 2000 (linear regression, $r^2 = 0.32$, $p = 0.01$). While Wr in Northern Pike has declined from the 2000–2022 mean (111.7), Northern Pike condition is still considered greater than the 50th percentile in large standing waters of North America (Figure 15; Bonar et al. 2009).

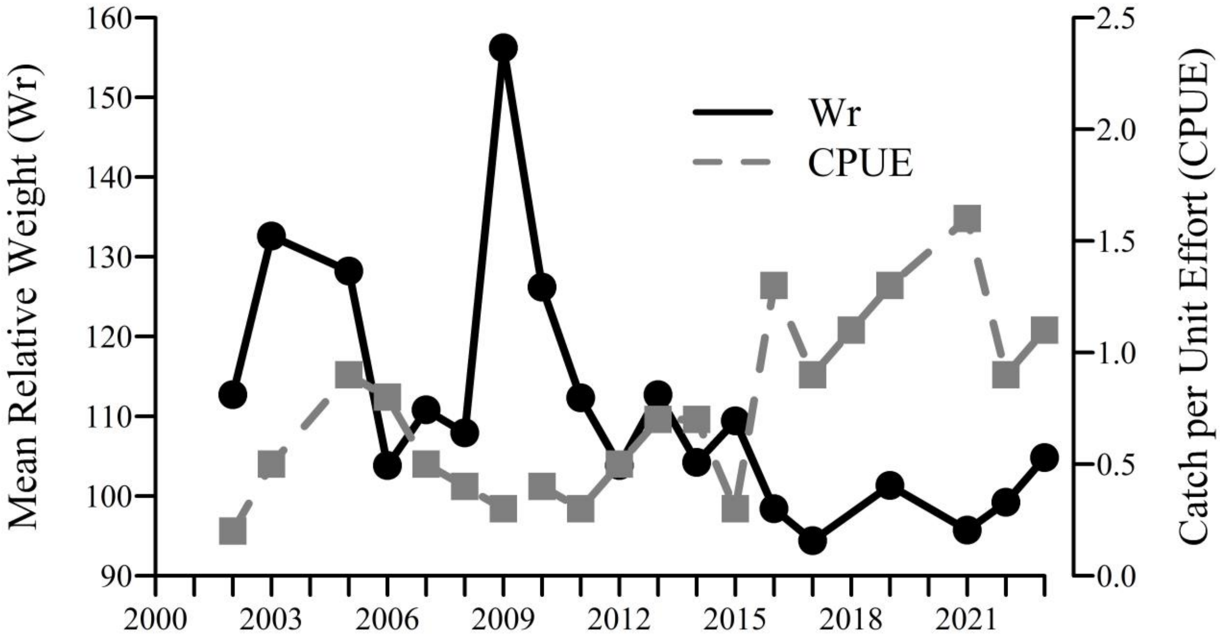

Figure 14. Mean relative weight and number of fish per net of fall-captured Northern Pike over time in Cabinet Gorge Reservoir.

Proportional size distribution for Northern Pike captured during fall of 2023 (88) still points to a relatively large size structure within Cabinet Gorge Reservoir. This represents high mortality of young fish and moderate to low levels of mortality for adults (Anderson and Weithman 1978), it also may be indicative of a population that is maintained by immigration from upstream sources as opposed to spawning within Cabinet Gorge Reservoir (Bernall and Moran 2005). Length groups showed no statistically significant difference (sub-stock = <350 mm stock = 350–529 mm, quality = 530–709 mm, preferred = 710–859 mm, and memorable = 860–1,119 mm). Trends of increasing abundance and decreasing condition observed in Northern Pike were similar to those observed in Noxon Reservoir.

Walleye catch (0.8 fish/net, n = 12) in 2023 was greater than the 2000–2022 (mean 0.2 fish/net). This was the highest number observed in Cabinet Gorge Reservoir since standardized netting began in 2000. However, we have not observed the same increases in the Cabinet Gorge Walleye population as those in Noxon Reservoir. This is likely due to the lower water residence time in Cabinet Gorge and the inability of Walleye to recruit within the reservoir. We suspect Walleye captured within Cabinet Gorge are spawned and subsequently washing down from Noxon Reservoir. Beginning in 2023 submersible Biomark antenna systems were deployed in Cabinet Gorge Reservoir directly below Noxon Dam as part of the of the Fish Passage/Native Salmonid Restoration Plan (Appendix C), *Upstream Fish Passage Program*. Two Walleye tagged in 2019 and 2022 during spring Walleye sampling above Noxon Dam were detected on these submersible PIT tag arrays in 2023. These detections provide evidence that entrainment in

Cabinet Gorge Reservoir is also affecting some proportion of adult Walleye population in Noxon Reservoir.

Walleye captured in 2023 were comprised of the 2021 (50%), 2020 (8%), 2019 (33%), and 2017 (8%) year-classes. Similar to Noxon Reservoir, the 2021 and 2019 year-classes represent the majority of Walleye captured.

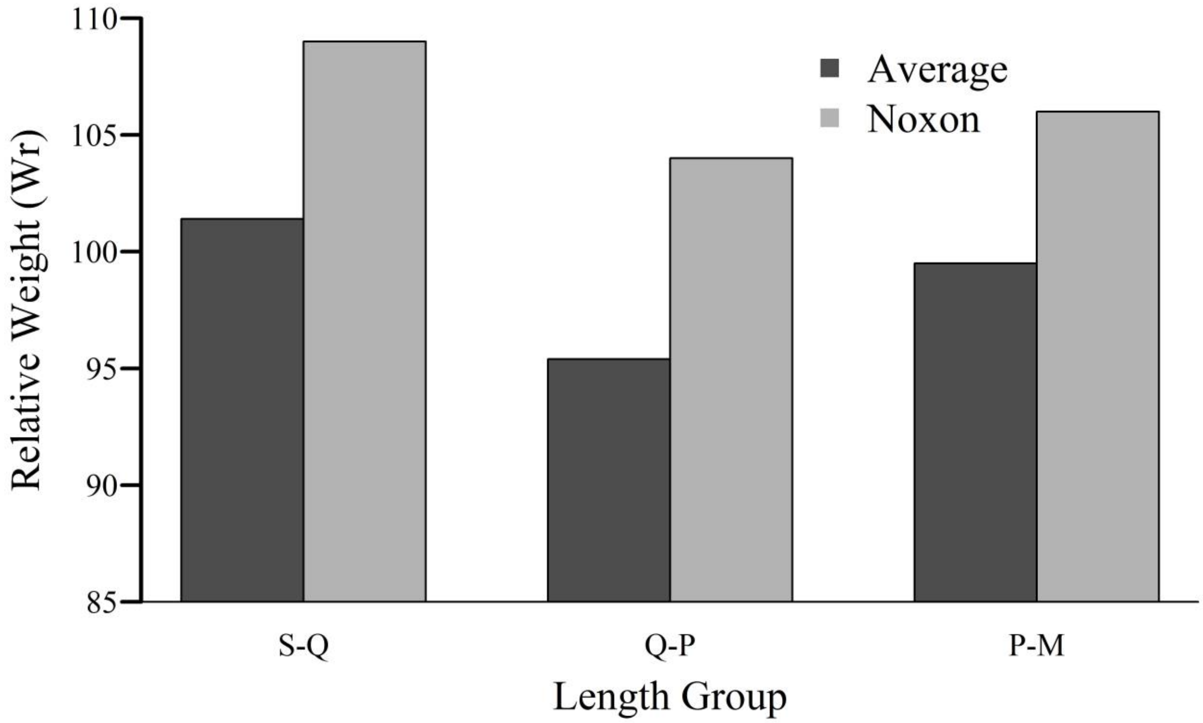

Figure 15. Average condition of Northern Pike caught using standardized gill nets in large standing waters in North America (Bonar et al. 2009) and average condition of fall caught Northern Pike from Cabinet Gorge Reservoir in 2023. S = stock, Q = quality, P = preferred, M = memorable, and T = Trophy (Gabelhouse 1984)

Smallmouth Bass were the most abundant top predator species captured, representing 14.7% of the total catch (n = 32; Table 4). Mean catch (2.1 fish/net) in 2023 was greater than the 2000–2022 (mean 0.6 fish/net). This is similar to 2022 catch of 2.3 fish/net which was the highest number observed since standardized netting began in 2000. Similar to the recent high catch rates of Smallmouth Bass in Noxon Reservoir, it is unclear if this increase in catch per unit effort is due to unseasonably warm weather during both sampling events that increased susceptibility to capture in gillnets or a dramatic increase in abundance. Even with the notable difficulty catching the species in gillnets, future gill net surveys should shed light on the distinction. Condition of Smallmouth Bass captured within Cabinet Gorge Reservoir continues to be high with a mean Wr of 104 in 2023. Smallmouth Bass mean Wr has ranged from a low of 88.6 (n = 3) in 2017 to a high of 112.4 (n = 8) in 2000 and no decline has been detected over the sampled period (linear regression, $p = 0.07$). The downward trend in Northern Pike Wr may be indicative of increasing competition for prey resources and habitat among top predators in this complex ecosystem. It is much less clear if the Wr of Smallmouth Bass is representative of the actual population given the species is notable difficulty to catch using gillnets. Future efforts should be made to evaluate the potential for taking "snapshots" of the Cabinet Gorge food web using stable isotopes and diet analysis which may help to provide a better understand of interactions among predators, prey, and environmental conditions in the reservoir.

Native non-gamefish species such as Northern Pikeminnow, Peamouth, and Largescale Suckers continue to be captured at low levels in Cabinet Gorge. In 2023, 21 Northern Pikeminnow were captured comprising 9.7% of the total fish community (Table 4). A significant decline in the species has been documented since 2000 (linear regression, $r^2 = 0.77$, $p < 0.001$), when 7.1 fish/net in 2000 (n = 99) and 3.4 fish/net were documented in 2011 (n = 51), compared to 1.4 fish/net in 2023 (n = 21) (Figure 16).

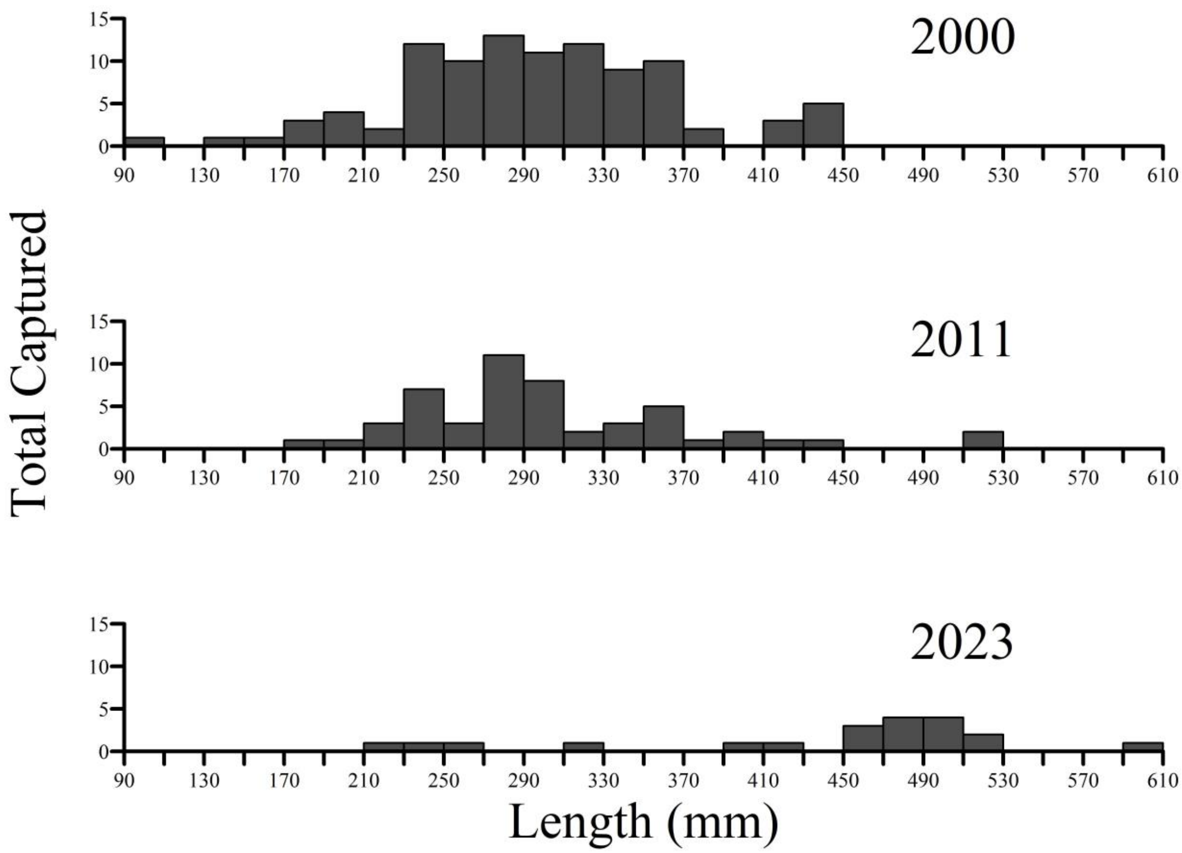

Figure 16. Length Frequency distribution of fall caught Northern Pikeminnow during annual gillnet monitoring in Cabinet Gorge Reservoir in 2000 (n = 99), 2011 (n = 51), and 2023 (n = 21).

Fifteen Largescale Suckers, comprising 6.9% of the total fish community, were captured in 2023 (0.9 fish/net), compared to 51 fish in 2011 (3.4 fish/net) and 99 fish in 2000 (6.6 fish/net; Table 4; Figure 17). Largescale Suckers have also shown a significant decline since standardized gillnetting began (linear regression, $r^2 = 0.25$, $p = 0.02$). Declines in the Cabinet Gorge Reservoir Largescale Sucker population have not been as prominent as other native non-gamefish species. However, length-frequency histograms still show a size structure that continues to increase, suggesting an aging population with limited recruitment (Figure 17). Size structure of native minnow and sucker populations, which have likely served as an important prey resource for gamefish species, indicate little if any successful recruitment and these population generally appear to be comprised of historically low numbers of larger, older individuals and appear to be in danger of local extirpation. For the sixth consecutive year, no Peamouth were captured in Cabinet Gorge Reservoir. It appears that Peamouth have been functionally extirpated from Cabinet Gorge Reservoir.

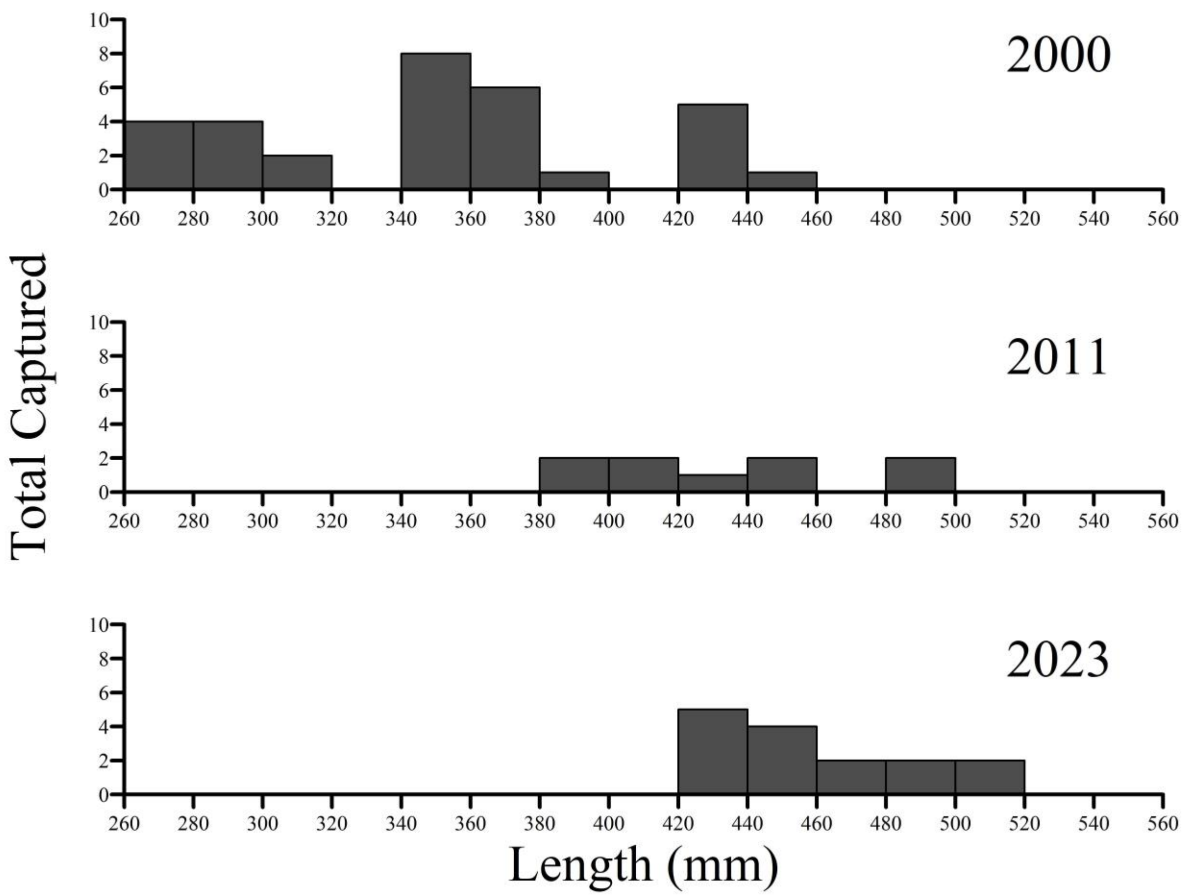

Figure 17. Length Frequency distribution of fall caught Largescale Sucker during annual gillnet monitoring in Cabinet Gorge Reservoir in 2000 (n = 31), 2011 (n = 9), and 2023 (n = 15).

Over the past decade, the major fish community change in Noxon and Cabinet Gorge reservoirs has been the result of establishment and continued increase of Walleye and to a less degree continued increases in Northern Pike abundance (Kreiner and Tholl 2016; Kreiner et al. 2020; Rehm et al. 2022). Concurrently, abundance of native sucker and minnow species has declined. Recent declines in condition of Walleye and Northern Pike, also indicate that the increase in total piscivores has ultimately resulted in a substantial decrease of forage fishes. If trends in condition, growth, and prey abundance continue on this trajectory, both the native species and quality of angling for non-native predators could suffer. The continued monitoring of the fish community and population of Walleye in Noxon Reservoir and Cabinet Gorge Reservoir will be paramount to informing management decisions into the future.

Spring Walleye Sampling

Montana Fish, Wildlife and Parks electrofished upper Noxon Reservoir for Walleye on seven separate occasions during the spring of 2023. Sampling effort and dates were affected by boat ramp accessibility due to low reservoir levels in spring. Unlike past years, all sampling occurred in the area above the Highway 200 bridge (Figure 4). No sampling was conducted in the area adjacent to the River's Bend Golf Course due to low spring flows. A total of 272 sexually mature fish were captured, of which 65 (24%) were females and 206 (76%) were males (Figure 18). Sex was not able to be determined for one Walleye. Of the 272 fish captured, 80 (29%) were sacrificed for age analysis.

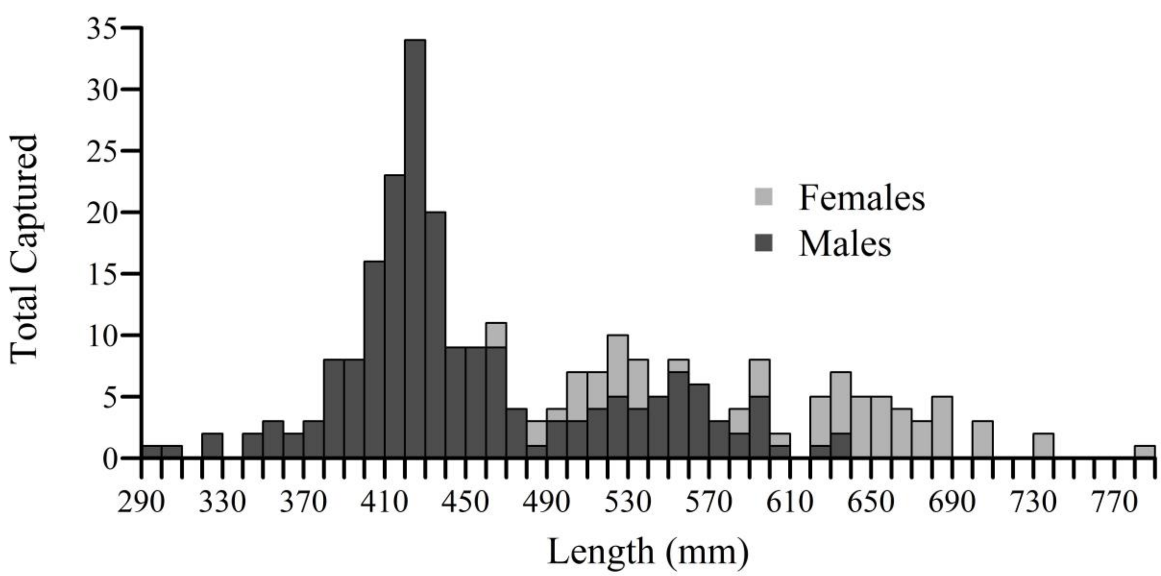

Figure 18. Length frequency distribution of spring caught walleye from Noxon Reservoir in 2023.

A strong 2019 year-class was first detected during 2021 fall gill netting efforts (Rehm et al. 2022). This year class has continued to be observed in both fall gill netting efforts and spring Walleye sampling in 2022 (Rehm et al. 2023). As predicted, females of the 2019 year-class have begun to recruit to the spawning population. However, the majority of females have yet to mature and are expected to recruit to the spawning population at age 5.

Males were represented primarily by the 2019 year-class (74%) followed by the 2015 year-class (17%; Figure 19). Females' most abundant year-class continues to be 2015 (54%) followed next by the 2019 year-class (29%; Figure 19). Mature males and females were captured from eight different year-classes (Table 5). Spring Walleye sampling in 2023 showed a spawning population dominated by the 2015 and 2019 year-classes (age 8 and 4; Figure 19). Past monitoring has shown that even moderate year classes can make noticeable contributions to the overall population up to seven years later (Kreiner et al. 2020 and Blakney and Tholl et al. 2021). Walleye from the 2019 year-class will persist for several more years and will have the opportunity to contribute to another strong year-class when favorable spawning conditions permit. Walleye data collected during fall gill netting suggests that a strong year-class was produced in 2021. We expect males of 2021 year-class to begin showing up in spring sampling in 2024. Females of that year-class should recruit to the spawning population during the spring of 2025-2026.

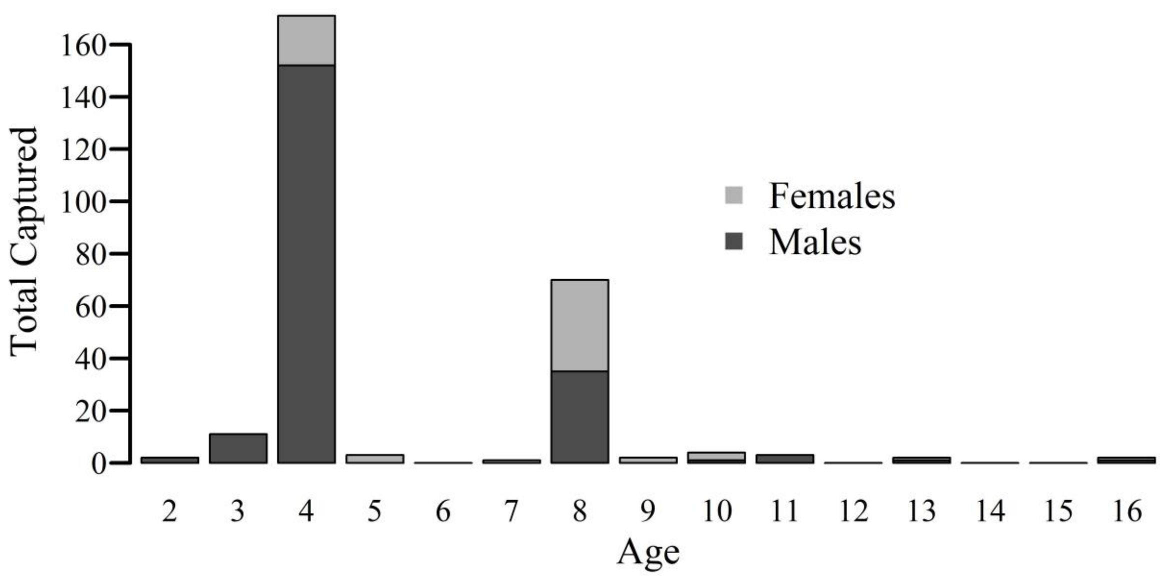

Figure 19. Age frequency distribution of spring caught Walleye from Noxon Reservoir in 2023.

Mean length of males captured was 453 mm (range = 296–635; Table 5). Of these fish, 177 (86%) exceeded 400 mm in length. Size structure has begun to increase with strong influence from the 2019 year-class as it continues to grow. In contrast, mean length of females captured was 608 mm (range = 462–782; Table 5). All females exceeded 400 mm in length with the majority still being represented by the 2015 year-class. Size structure of the female spawning population of Walleye continues to grow due to the aging of the 2015 year-class. Over the next couple of years, we predict that overall size structure will decrease as we expect influx of Walleye from the 2019–2021 year-class to recruit to the spawning population. Additionally, while we have shown that Walleye can persist in Noxon Reservoir for up to 18 years (Rehm et al. 2022), we expect the majority of the 2015 year-class to begin to age out the population over the coming years.

Table 5. Mean length-at-age for male and female of spring caught Walleye from Noxon Reservoir in 2023.

	Males			Females		
Age	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD
2	2	300	5.6	-	-	-
3	11	360	25.1	-	-	-
4	152	431	30	19	509	21.7
5	-	-	-	3	545	8.7
6	-	-	-	-	-	-
7	-	-	-	1	585	-
8	35	560	24.7	35	648	28.7
9	-	-	-	2	678	2.1
10	1	621	-	3	716	10
11	3	554	2.1	-	-	-
12	-	-	-	-	-	-
13	1	635	-	1	782	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-
16	1	635	-	1	735	-

Overall catch rate was 50.4 fish per hour and ranged 2.6–133.8 fish per hour. Total catch peaked on May 1 when water temperature was 12.3°C and flow was 20,300 cfs (Figure 20). Female catch rate remained relatively low until April 17 and peaked on May 1 at 20.7 per hour. Total fish captured was highest just prior to the increasing limb of the hydrograph, when Walleye are responding to spring temperature and flows and moving to spawning areas (Colby et al. 1979). However, as flows continued to rise, the catchability with our sampling equipment quickly declined as did catch rates.

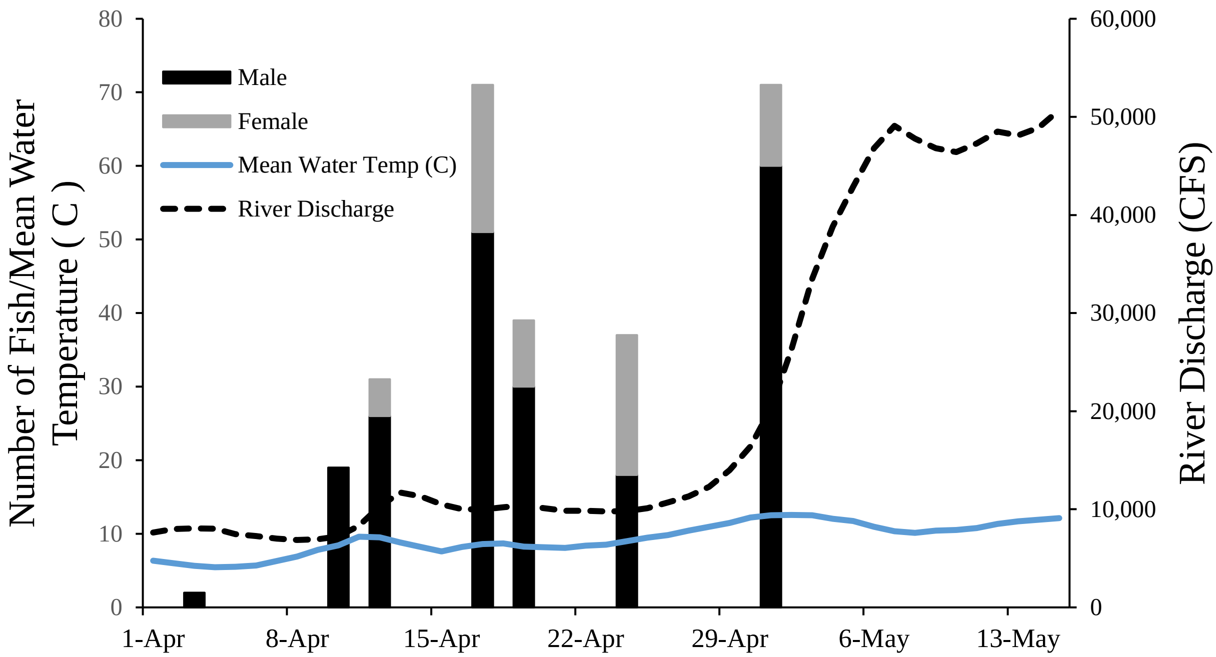

Figure 20. Catch per unit effort of Walleye during spring 2023, with river discharge and mean water temperature.

Of the 155 fish PIT tagged and released alive, 9 were subsequently captured during a later sampling date in 2023 (within year recaptures), and 38 additional fish captured in 2023 had been captured and tagged in prior years (previous year recaptures). Most of the Walleye tagged in previous years were recaptured after only one growing season (32%). However, Walleye recaptured after four growing seasons is still common (24%), this is likely due to the high number (n=521) tagged in the spring of 2019. The remaining fish were captured after two (24%), three (18%) and seven (3%) growing seasons (Table 6). Recapture rates for fish PIT tagged in 2016 and 2019 through 2022 were <1%, 2%, 4%, 6% and 7% respectively. The majority of recaptured Walleye were male, little inferences may be drawn from this as most previously PIT tagged Walleye are also male. The mean length of recaptured fish was 542 mm. Recaptured fish grew between 14 and 70 mm per year with a mean value of 40 mm (Table 6).

Table 6. Mean yearly growth of recaptured walleye sampled during spring 2023.

PIT Tag Number	Initial Capture Date	Initial Capture Length (mm)	Recapture Date	Recapture Length (mm)	Sex	Mean Yearly Growth (mm)
900226000731132	4/11/2016	379	4/12/2023	550	Male	43
982000363519220	4/9/2019	393	4/19/2023	547	Male	39
982000363519280	4/18/2019	409	4/24/2023	530	Male	30
982000362691559	4/22/2019	385	4/10/2023	598	Male	54
982000362691513	4/22/2019	408	4/17/2023	601	Male	48
982000362929639	4/23/2019	401	4/17/2023	550	Male	37
982000362929565	4/23/2019	340	4/17/2023	495	Male	39
982000362691492	4/23/2019	375	4/19/2023	521	Male	37
982000362929580	4/25/2019	430	4/17/2023	552	Male	41
982000362929617	4/25/2019	504	4/17/2023	656	Female	51
989001026318184	4/13/2020	545	5/1/2023	665	Female	40
989001026318198	4/20/2020	435	5/1/2023	546	Male	37
989001026318145	4/20/2020	447	4/24/2023	536	Male	30
982000362929427	4/28/2020	443	4/19/2023	555	Male	38
982000362929404	4/30/2020	426	5/1/2023	527	Male	34
982000362929473	5/5/2020	548	4/17/2023	597	Male	24
982000362929510	5/5/2020	503	5/1/2023	555	Male	25
982000362929545	4/7/2021	522	4/24/2023	610	Female	43
982000362929482	4/7/2021	619	4/12/2023	690	Female	36
982000362929507	4/12/2021	545	4/17/2023	625	Female	40
982000357016331	4/19/2021	576	4/17/2023	660	Female	42
982000357016359	4/19/2021	631	4/19/2023	660	Female	15
982000357016273	4/19/2021	527	4/24/2023	626	Female	49
982000357016328	4/19/2021	303	4/17/2023	410	Male	55
982000357016304	4/19/2021	399	4/12/2023	437	Male	39
982000365414941	5/3/2021	550	5/1/2023	580	Male	29
982091070216184	4/18/2022	391	4/12/2023	424	Male	34
982091070216152	4/20/2022	410	4/19/2023	467	Male	58
982091070216197	4/25/2022	394	4/24/2023	439	Male	45
982091070216128	4/26/2022	390	5/1/2023	425	Male	35
982091070216182	4/26/2022	405	4/12/2023	472	Male	70
982091070216213	4/26/2022	595	4/24/2023	640	Female	45
982091070216133	4/27/2022	416	4/12/2023	463	Male	50
982091070216130	4/27/2022	375	4/17/2023	424	Male	52
982091070216224	5/5/2022	381	4/24/2023	406	Male	26
982091070216232	5/5/2022	407	5/1/2023	476	Male	70
982091070216237	5/5/2022	379	4/12/2023	550	Male	43
982091070216267	5/5/2022	393	4/19/2023	547	Male	39

Growth curves and parameters (Appendix E) were calculated for all Walleye and both sexes from otoliths of 48 males and 31 females. Supporting reported mean length-at-age data, female Walleye growth rate was greater than that of males (Table 5; Appendix E).

Bass Tournament Monitoring

Three bass tournaments, two spanning two days and one a single day, were monitored to help assess the overall status of the bass fishery in Noxon Reservoir. The first being the MT Bass Nation Buddy Tournament (May 6 and 7), the second The Bass Federation (TBF) and American Bass Association (ABA) Buddy Series Qualifier (May 20), and the third was the Tri-State Buddy Tournament (July 29 and 30). Three other Bass tournaments occurred but were not monitored in 2023. Similar to recent years, mean length and proportion of quality fish were high for both species (Table 7, Figures 21 and 22). Bass weighed in at tournaments continued to be mostly Largemouth Bass (67 %; Table 7). A total of 812 Bass were measured during the three tournaments with a mean length of 423 mm for Largemouth Bass and 407 mm for Smallmouth Bass. Of checked-in bass, 13% of Largemouth Bass and 11% of Smallmouth Bass were greater than 460 mm (18 inches; Table 7).

Table 7. Catch statistics for Largemouth (LMB) and Smallmouth Bass (SMB) caught during bass tournaments (listed by dates held) monitored in 2023. Numbers DO NOT include culled fish.

Statistic	Species	5/6-5/7	5/20	7/29-7/30	Combined
% of Catch	LMB	70	86	60	67
	SMB	30	14	40	33
% ≥ 380 mm	LMB	91	96	84	89
	SMB	90	76	68	74
	Both	90	93	78	84
	LMB	17	13	10	13
% ≥ 460 mm	SMB	16	29	6	11
	Both	17	15	9	12
Total Caught	LMB	197	103	248	548
	SMB	85	17	162	264
	Both	282	120	410	812
Mean Length (mm)	LMB	429	432	415	423
	SMB	427	421	395	407

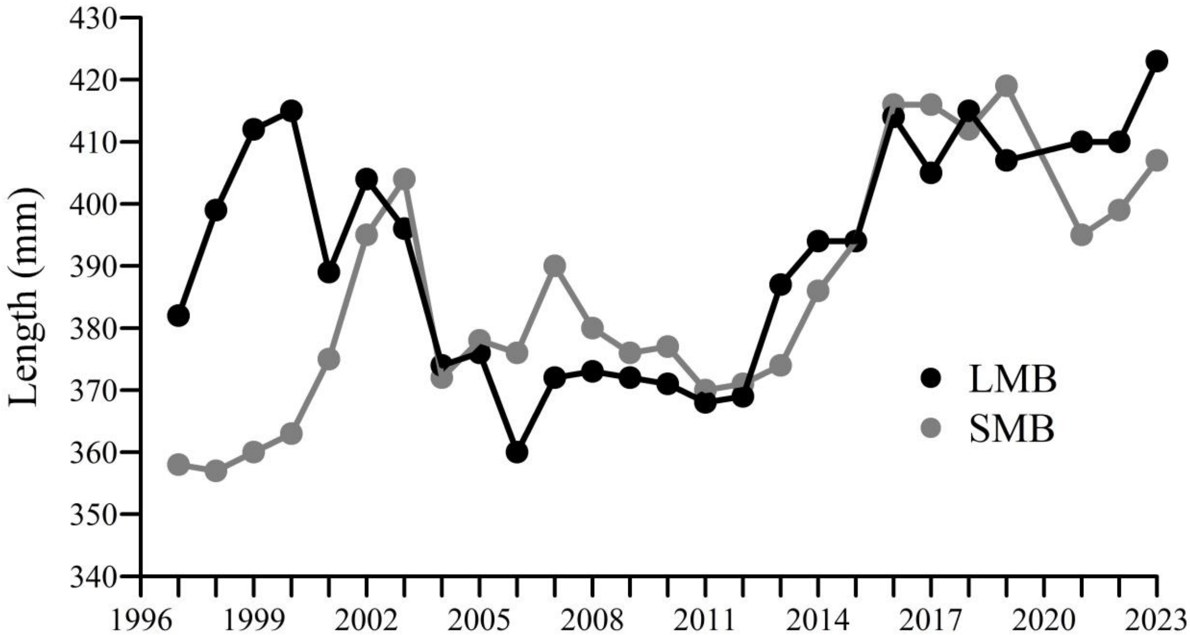

Figure 21. Mean length of both bass species checked in at monitored bass tournaments over time.

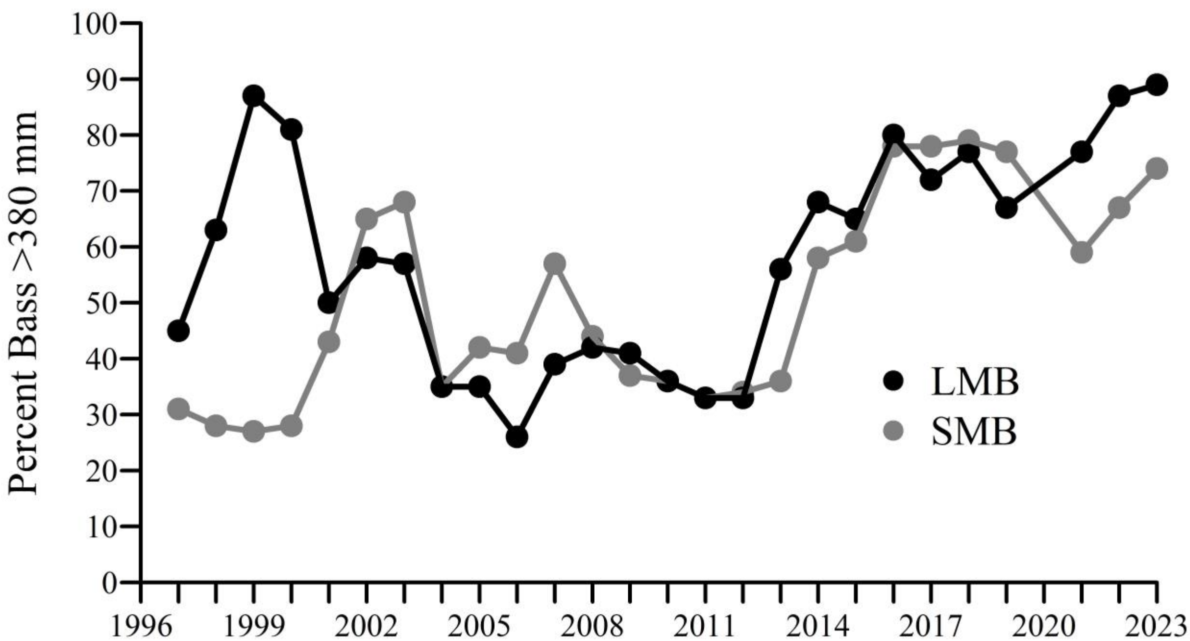

Figure 22. Percent 'quality' fish (≥380 mm) checked in at bass tournaments over time.

Bass tournament monitoring continues to show a productive bass fishery in Noxon Reservoir. Sizes and proportion of quality fish of both Largemouth and Smallmouth Bass captured during tournaments are at or near record highs. Additionally, anecdotal observations from anglers of Noxon Reservoir have shown high satisfaction with the current bass fishery, no doubt due in part to the consistently higher percentage of quality size bass recorded since 2013. Continued monitoring of bass tournaments will be important moving forward, particularly if abundance of other predators (i.e., Walleye and Northern Pike) within Noxon Reservoir increases.

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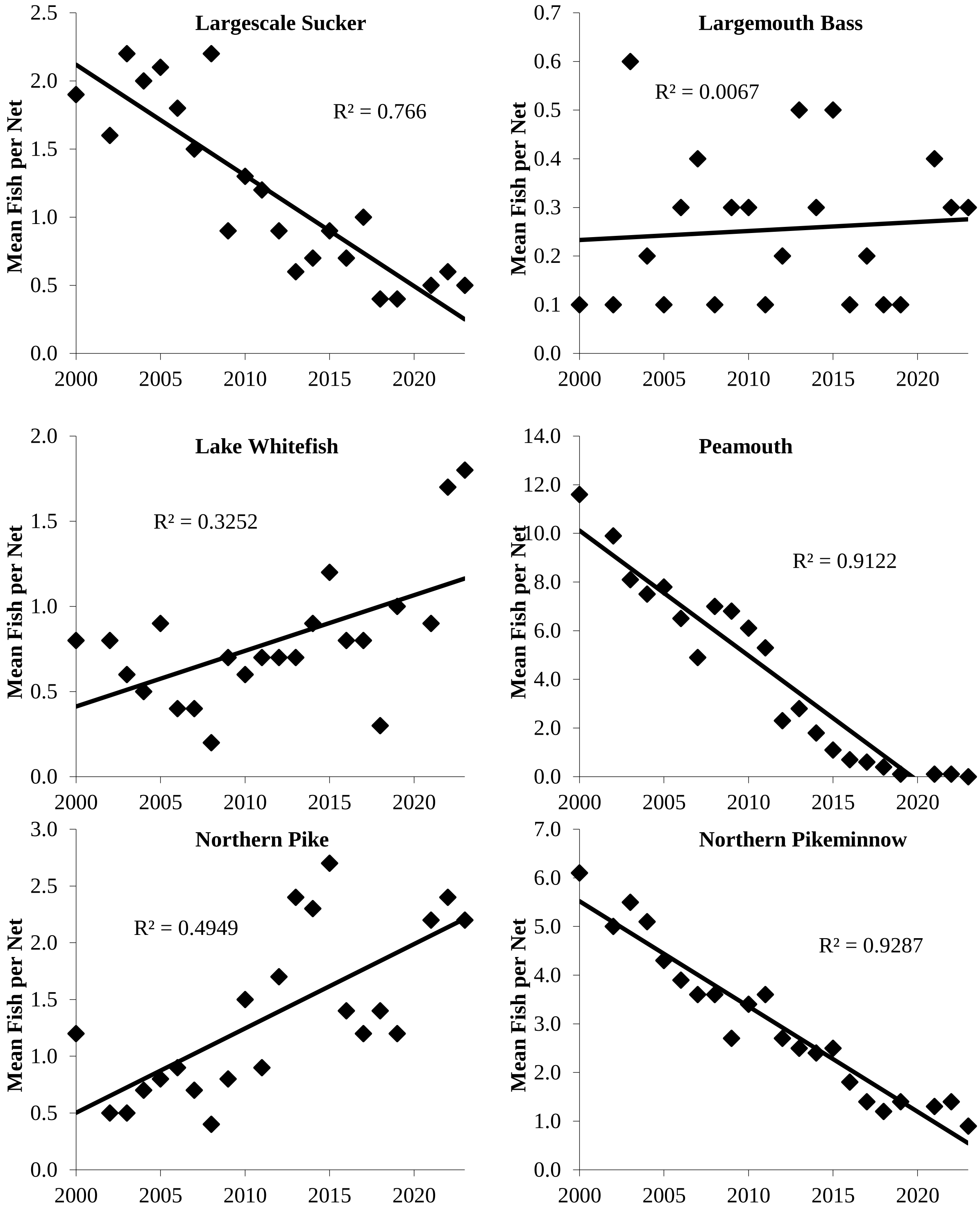
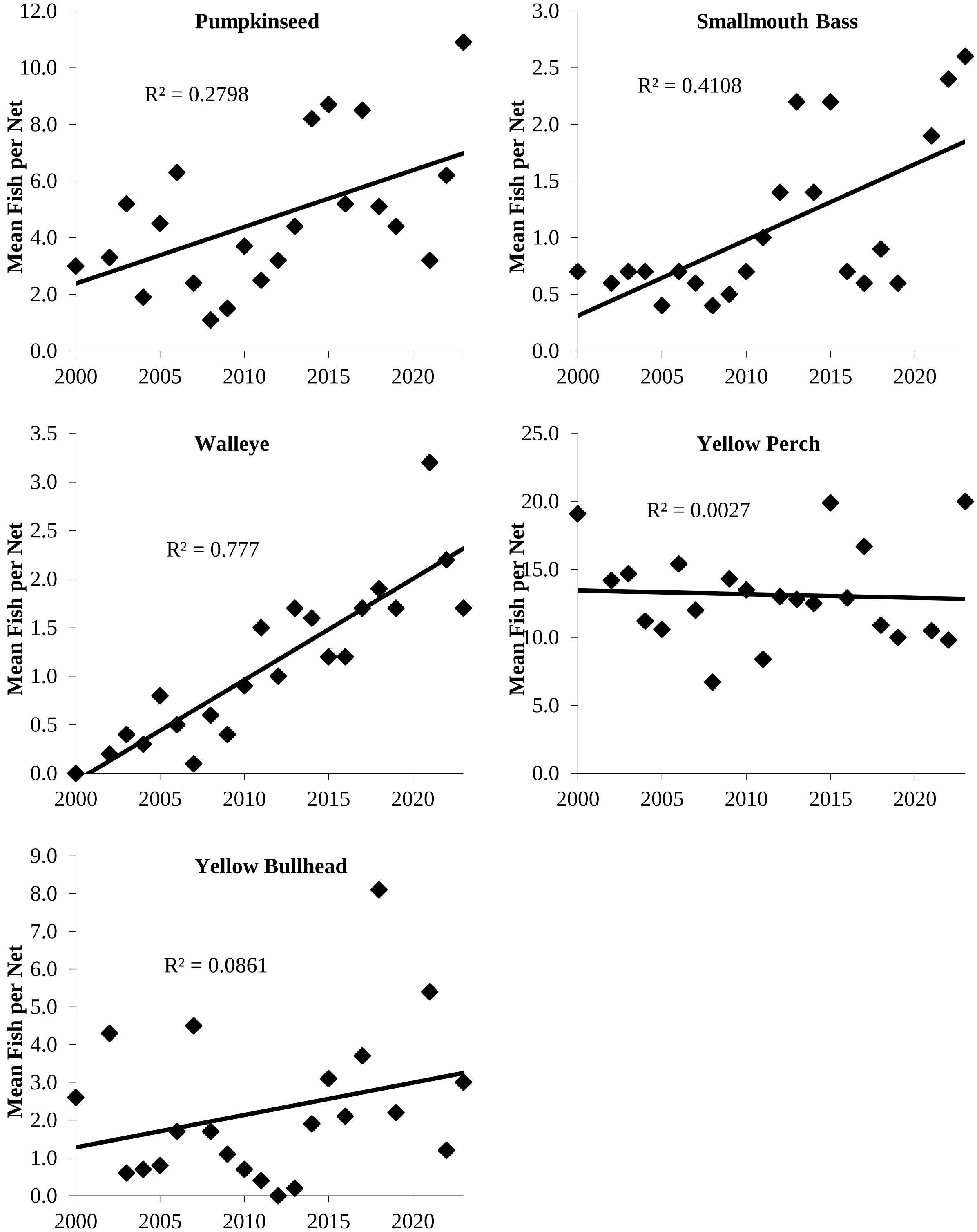
Appendix A. Species abbreviations and scientific names of fish in Noxon and Cabinet Gorge reservoirs

BLBH	Black Bullhead *Ameiurus melas*
EB	Brook Trout *Salvelinus fontinalis*
LL	Brown Trout *Salmo trutta*
LWF	Lake Whitefish *Coregonus clupeaformis*
LMB	Largemouth Bass *Micropterus salmoides*
LSSU	Largescale Sucker *Catostomus macrocheilus*
MWF	Mountain Whitefish *Prosopium williamsoni*
NP	Northern Pike *Esox lucius*
NPMN	Northern Pikeminnow *Ptychocheilus oregonensis*
PEA	Peamouth *Mylocheilus caurinus*
PUMP	Pumpkinseed *Lepomis gibbosus*
RB	Rainbow Trout *Oncorhynchus mykiss*
SMB	Smallmouth Bass *Micropterus dolomieu*
WE	Walleye *Sander vitreus*
YLBH	Yellow Bullhead *Ameiurus natalis*
YP	Yellow Perch *Perca flavescens*

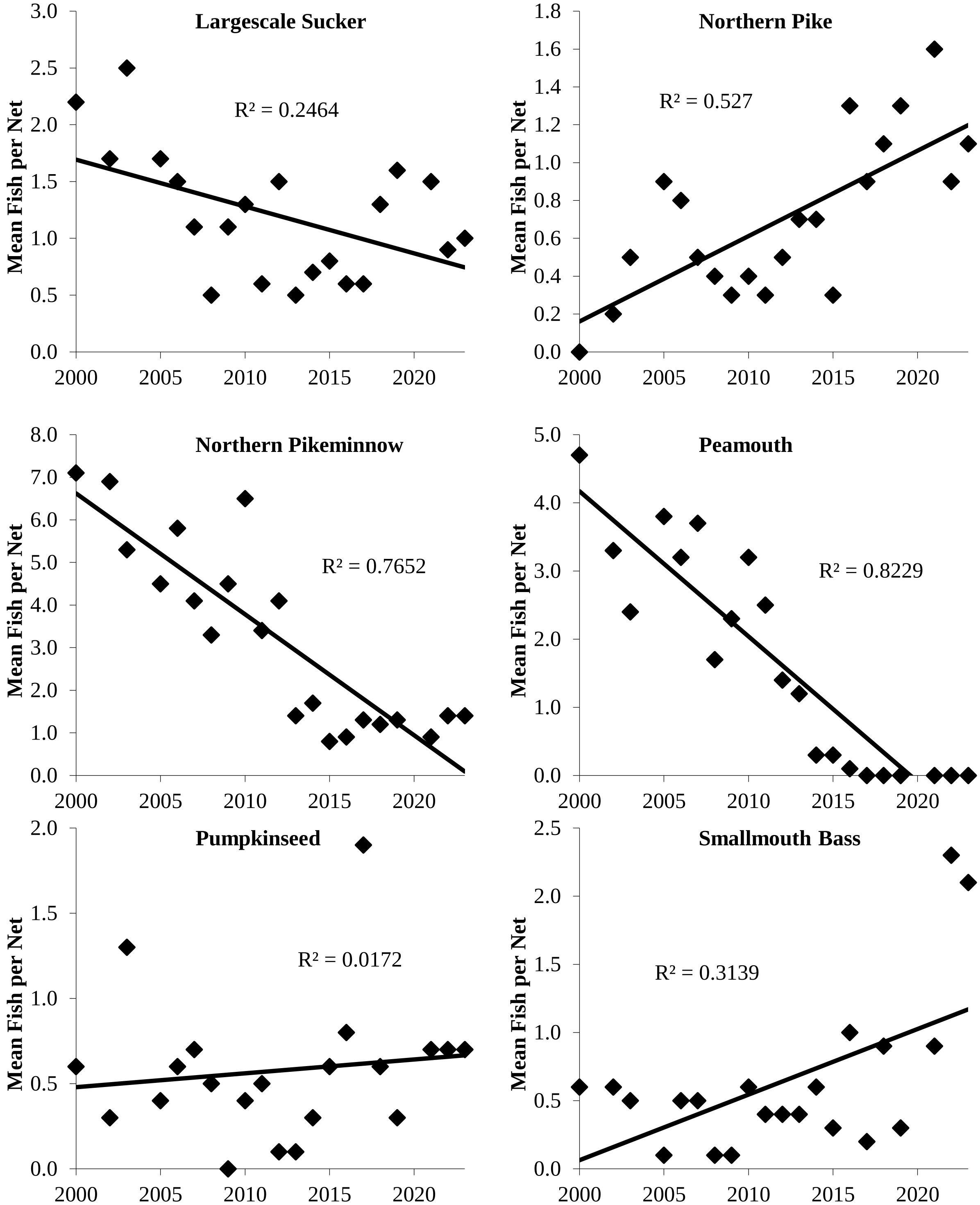
Appendix B. Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Noxon Reservoir, 2000-2023.



Appendix B (continued). Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Noxon Reservoir, 2000-2023.



Appendix C. Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Cabinet Gorge Reservoir, 2000–2023.



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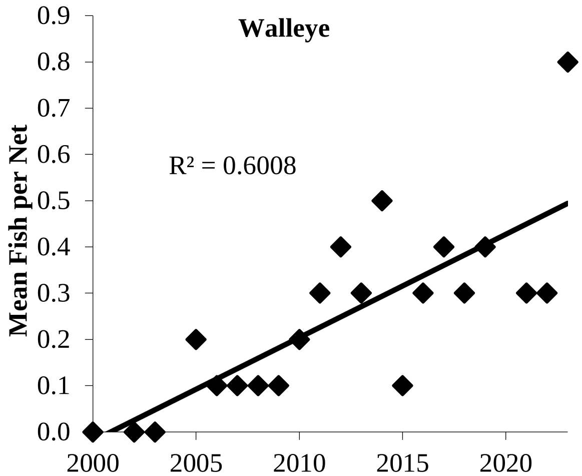
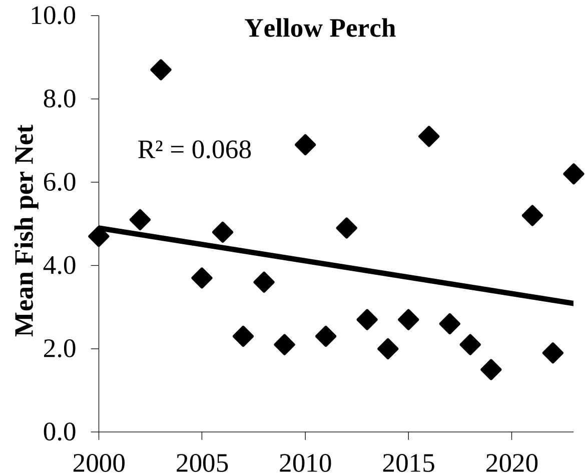
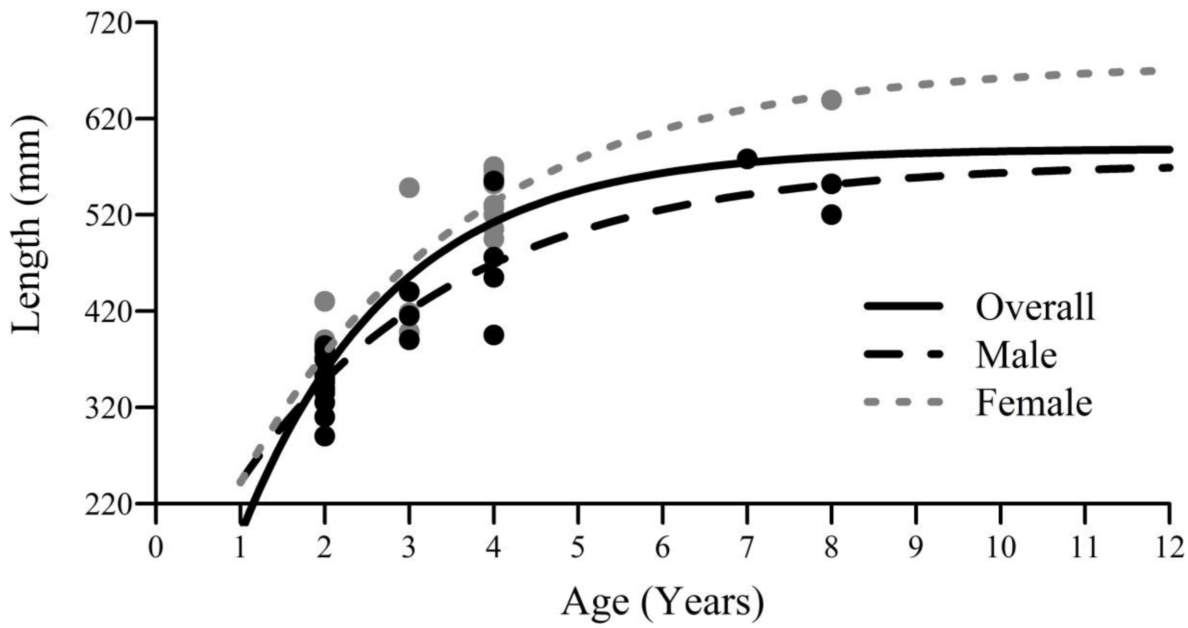




Appendix D. Von Bertalanffy growth curves and parameters for both male and female Walleye using estimates derived from Walleye collected from Noxon Reservoir in Fall 2023.

Von Bertalanffy parameter estimates derived from Walleye collected from Noxon Reservoir in Fall 2023.

von Bertalanffy parameter	Data Source					
	Female		Male		All Walleye	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
L_{inf}	678	657–699	574	492–656	589	534–644
K	0.37	0.12–0.62	0.39	0.1–0.68	0.55	0.28–0.82
T_0	-0.2	-1.18– 0.78	-0.43	-1.57– 1.02	0.3	-0.37– 0.97

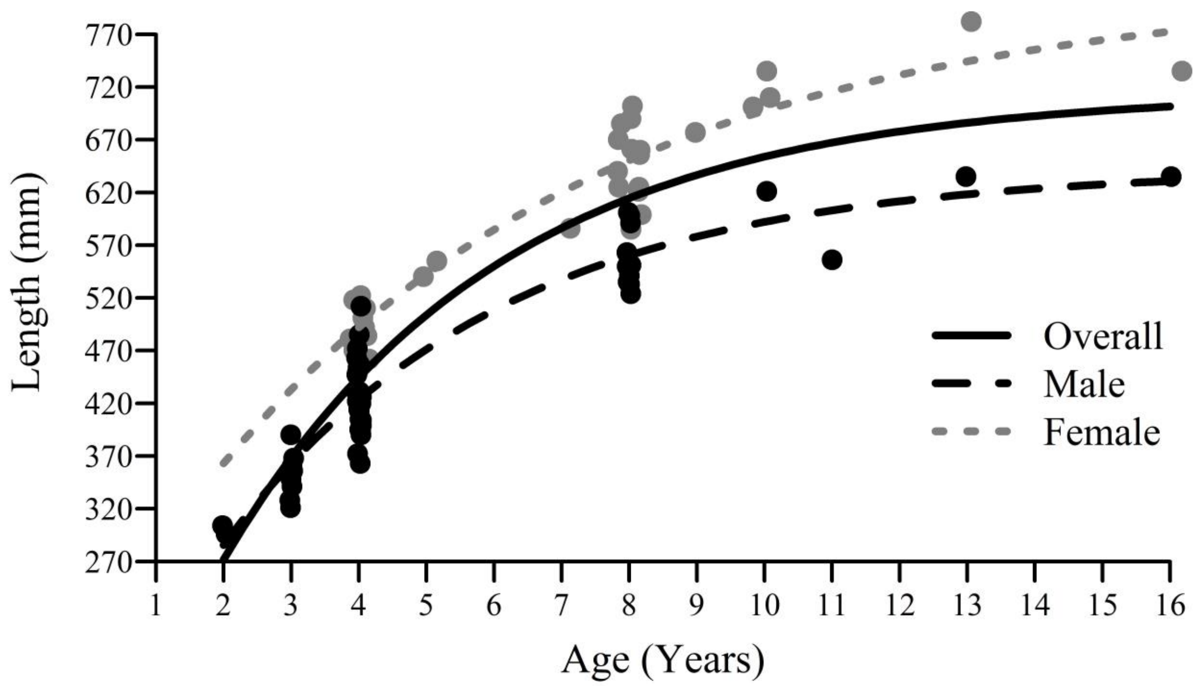


Von Bertalanffy growth curves for Walleye using estimates derived from Walleye collected from Noxon Reservoir in fall 2023.

Appendix E. Von Bertalanffy growth curves and parameters for both male and female Walleye using estimates derived from Walleye collected from Noxon Reservoir in spring 2023.

Von Bertalanffy parameter estimates derived from Walleye collected from Noxon Reservoir in spring 2023.

von Bertalanffy parameter	Data Source					
	Female		Male		All Walleye	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
L_{inf}	816	712–920	642	591–693	715	656–774
K	0.17	0.1–0.27	0.24	0.15–0.33	0.25	0.16–0.34
T_0	-1.5	-3.5– 0.54	-0.4	-1.38– 0.58	0.07	-0.83– 0.97



Von Bertalanffy growth curves for Walleye using estimates derived from Walleye collected from Noxon Rapids Reservoir in spring 2023.