Cabinet Gorge and Noxon Reservoir
Fisheries Monitoring

2022 Annual Project Update

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

March 2023

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Recreational Fishery Enhancement Program
Appendix B

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TABLE OF CONTENTS

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 the 1970s, stemming from an illegal introduction in Dry Fork Reservoir of the Flathead River drainage first confirmed in 1953 (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 41,171 angler days in 2020 (MFWP 2022).

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 2022, bass tournaments were scheduled on five separate weekends on Noxon Reservoir. Additionally, two Northern Pike tournaments were scheduled for Noxon Reservoir and two 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 2022, 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).

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

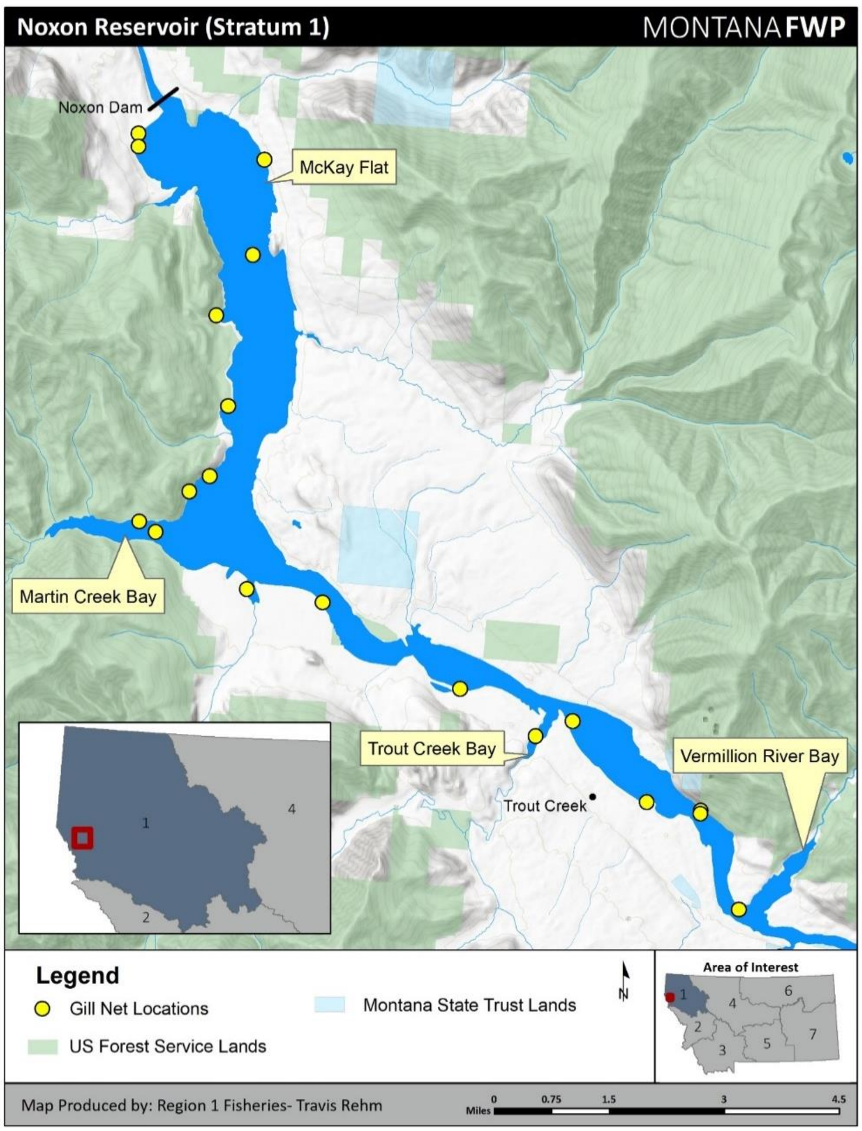

FIGURE 1. Gill net locations in Noxon Reservoir Stratum 1.

mouths, have been intentionally avoided to reduce Bull Trout by-catch 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.

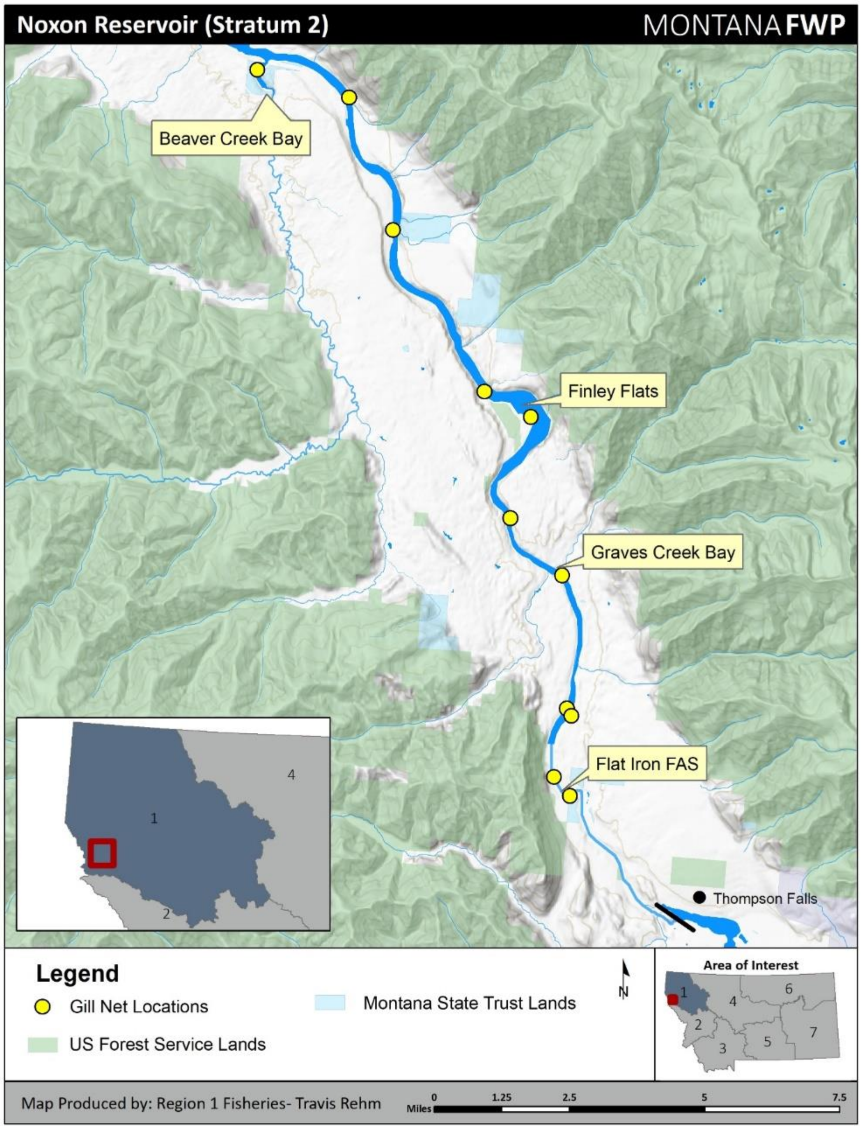

FIGURE 2. Gill net locations in Noxon Reservoir Stratum 2.

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., 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.

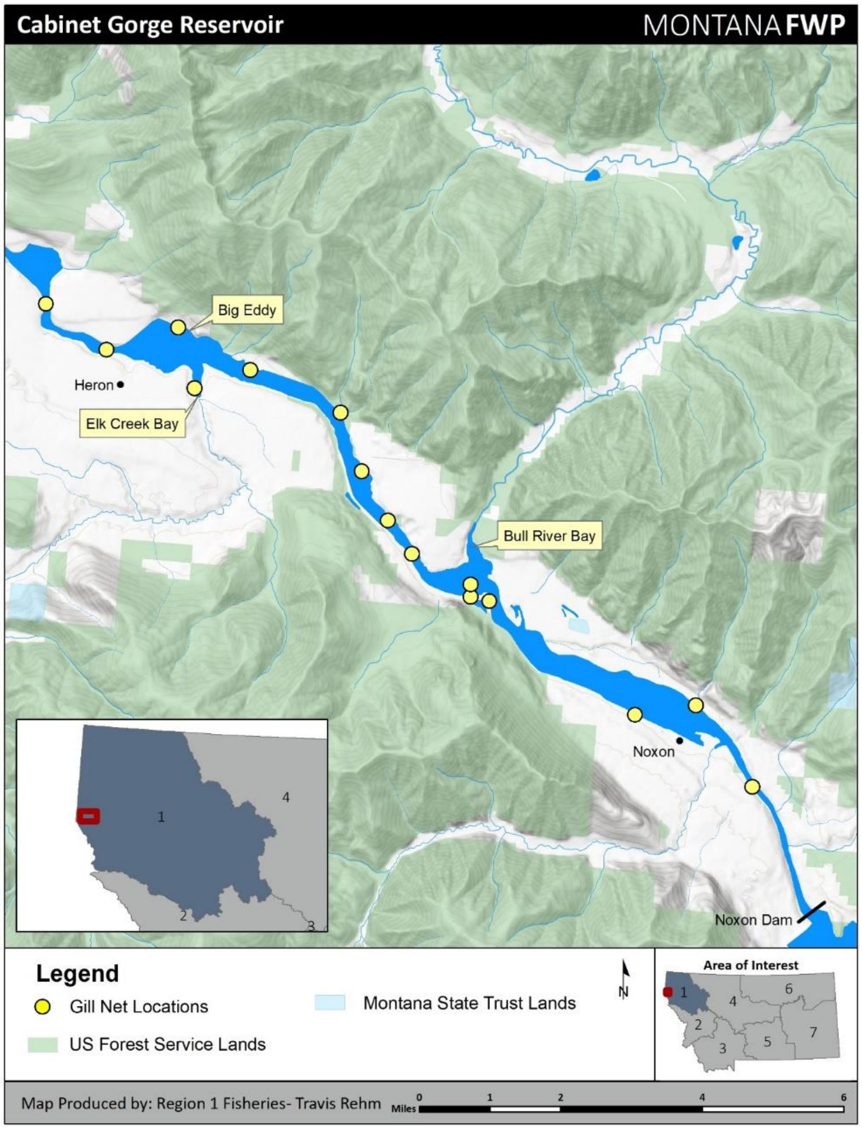

FIGURE 3. Gillnet locations in Cabinet Gorge Reservoir.

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, growth curves were fitted for both 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.

Spring Walleye Monitoring

Additional sampling of illegally introduced 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, 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.

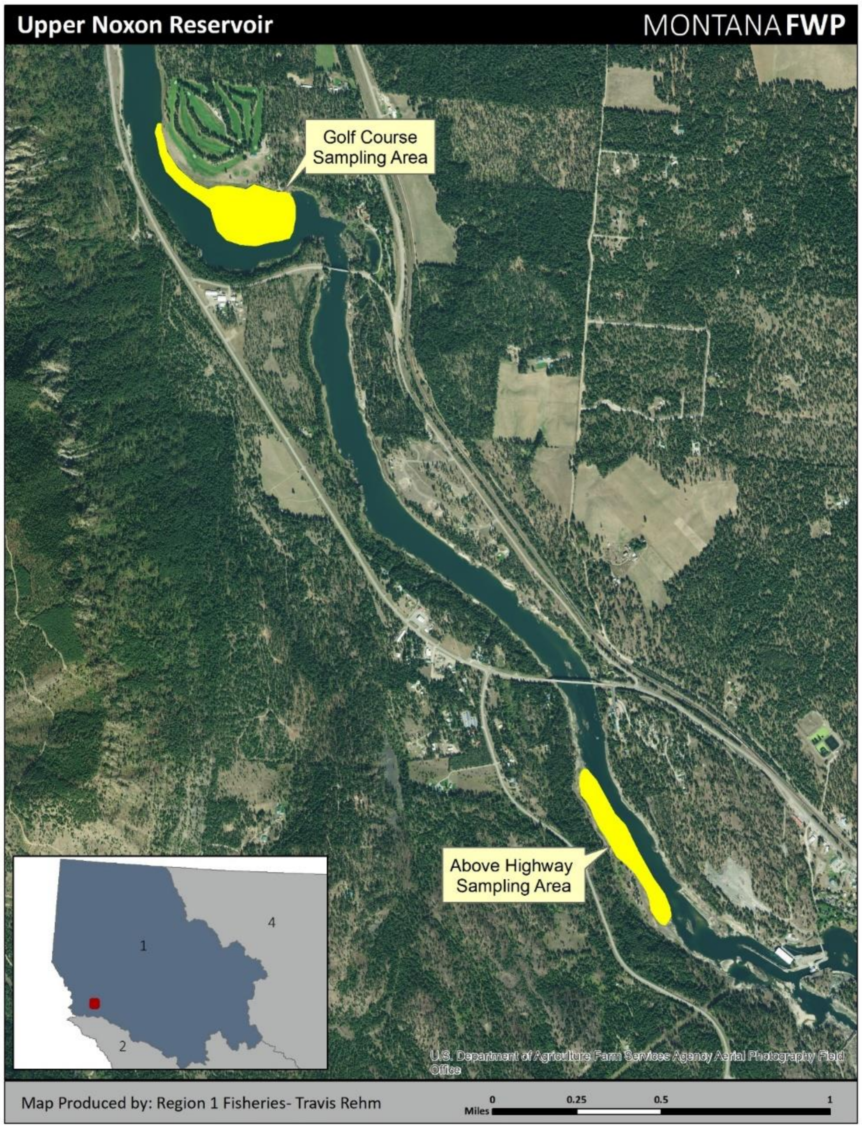

FIGURE 4. Map of two spring Walleye sampling locations in upper Noxon Reservoir, Montana.

Walleye were collected by jet-boat mounted boom electrofishing during nighttime hours from April 6th to May 5rd of 2022. 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 growth curves for both 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, one to three bass tournaments have been monitored per year.

Noxon Reservoir bass tournaments require that bass had 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 could not be accurately estimated.

Results and Discussion

Fall Gillnetting

Noxon Reservoir

Gill netting was conducted in Noxon Reservoir October 9–11, 2022. A total of 852 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 2000–2022. Yellow Perch were the most abundant species captured representing over 34.4% of the total catch (n = 293). The mean number of Yellow Perch captured in 2022 was 9.8 fish/net which is less than the mean 2000-2021 catch of 13 fish/net (FIGURE 5). Pumpkinseed *Lepomis gibbosus* was the second most abundant fish species caught and comprised 21.7% of the total catch. The mean catch rate for Pumpkinseed was 6.2 fish/net in 2022, which is greater than the mean 2000-2021 catch of 4.3 fish/net (FIGURE 5). Both Yellow Perch and Pumpkinseed are likely an important prey base for the top four predators (i.e., Largemouth Bass, Smallmouth Bass, Northern Pike, and Walleye) in Noxon Reservoir, and declines in their relative abundance over time may indicate top-down impacts 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 2022. 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)
LL	<0.1 (0.2)	1	0.1	0.2	665.0	665–665	406.0	406–406
LMB	0.3 (0.7)	9	1.1	0.5	215.0	35–430	224.7	140–290
LSSU	0.6 (1.2)	18	2.1	7.1	1439.2	1065–2300	492.2	440–570
LWF	1.7 (3.3)	51	6.0	15.2	1093.2	45–2105	465.9	182–582
NP	2.4 (2.5)	72	8.5	31.8	1616.5	85–3610	593.8	240–812
NPMN	1.4 (1.8)	42	4.9	9.3	834.5	65–1780	407.0	203–558
PEA	0.1 (0.1)	4	0.5	0.6	525.0	460–580	373.3	356–398
PUMP	6.2 (9.1)	185	21.7	2.6	52.8	10–155	129.1	89–197
SMB	2.4 (3.5)	73	8.6	8.5	445.7	35–1200	297.0	137–445
WE	2.2 (2.2)	67	7.9	13.9	758.7	95–3100	405.7	240–650
YLBH	1.2 (1.6)	37	4.3	3.6	370.8	180–645	277.5	156–325
YP	9.8 (10.1)	293	34.4	6.7	86.1	30–305	188.2	100–315

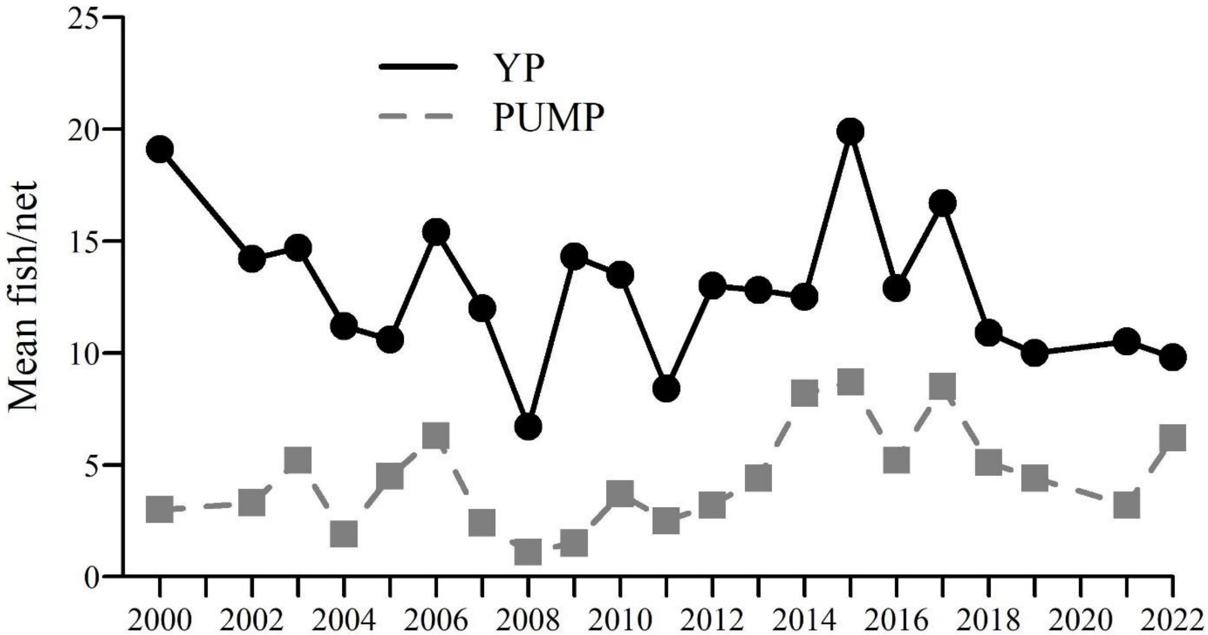

FIGURE 5. Mean number of fish per net for Yellow Perch and Pumpkinseed 2000–2022 in Noxon Reservoir during annual fall gill netting.

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 appear to be 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 7.9% of the total catch (n = 67), which is substantially down from 2021 when the highest number since standardized netting began in 2000 was recorded (96). However, a substantial increase has been observed in Walleye abundance (linear regression, $r^2 = 0.70$, $p < 0.001$) over time, mean catch was 2.2 fish/net, which is a substantial increase from 2019 (1.7 fish/net) and the mean 2000–2021 catch of 1 fish/net. All Walleye captured during fall gill netting efforts had ages estimated with the exception of a single Walleye whose age was unable to be determined (TABLE 2). Sex was unable to be determined for 23 Walleye captured during fall gill netting efforts (TABLE 2). The majority of Walleye captured were comprised of year classes 2019 (40.9%), 2021 (27.3%) and 2020 (19.6%; TABLE 2; FIGURE 6). The once dominate 2015 year-class has shown signs of decline representing only 10.6% of Walleye captured in 2022 (19.8% in 2021). However, this is the first time strong 2020 and 2021 year-classes have been detected. Walleye from the 2020 and 2021 year-classes have not yet recruited to the spawning population sampled during spring electrofishing. Based on past sampling, we expect males from those age classes to begin to enter the spawning populations in 2023 and 2024 respectively.

TABLE 2. Mean length-at-age of fall caught Walleye from Noxon Reservoir in 2022.

Age	Males			Females			Total		
	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD
1	3	262	21.4	4	295	10.4	18	278	26.8
2	2	383	66.5	8	369	24.2	13	381	47
3	14	446	34.2	10	466	24.1	27	452	30.5
4	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-
7	3	542	21.9	2	648	0	7	584	54.3
8	-	-	-	1	650	-	1	650	-

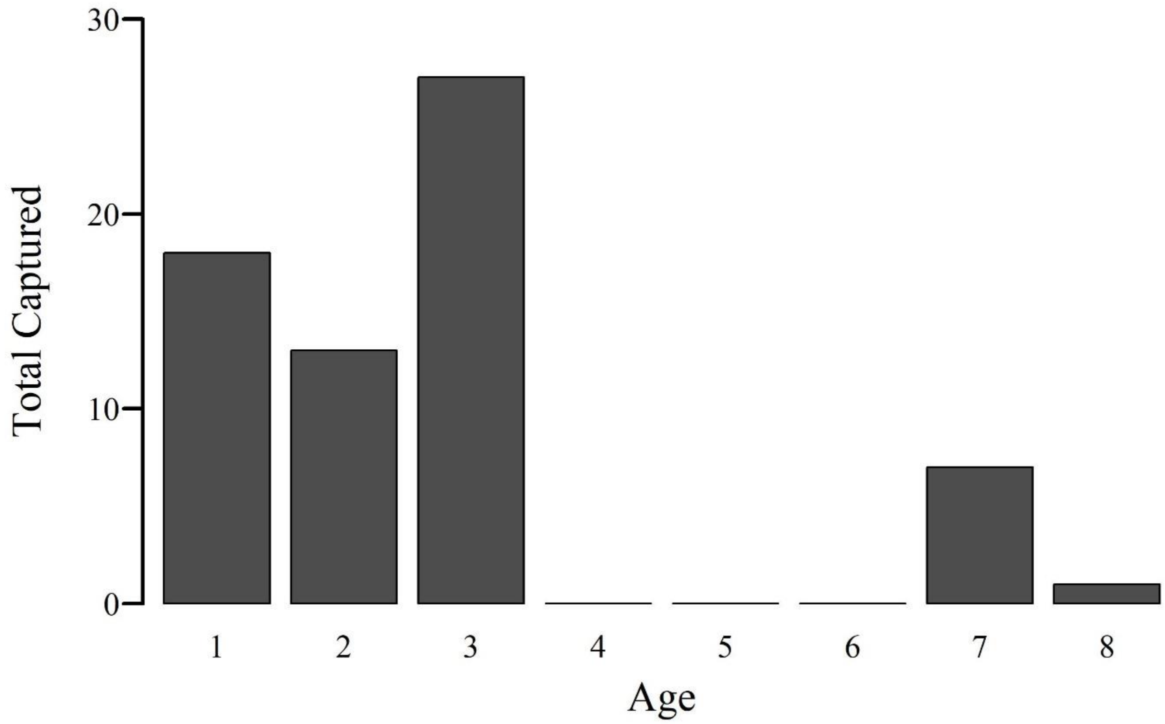

FIGURE 6. Age frequency distribution of fall caught Walleye from Noxon Reservoir in 2022.

Mean Wr for Walleye was 87.5 in 2022, which is less than the 2002–2021 mean (Wr = 96.9; FIGURE 7). A significant decline in mean Wr of Walleye has occurred over time (linear regression, $r^2 = 0.54$, $p < 0.001$; 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 continue to decline as the population grows and competition for prey increases. Condition of male Walleye (Wr = 87.8) was slightly higher than females (Wr = 84.8).

Proportional size distribution for Walleye captured during fall of 2022 (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 showed no statistically significant difference between length groups (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.

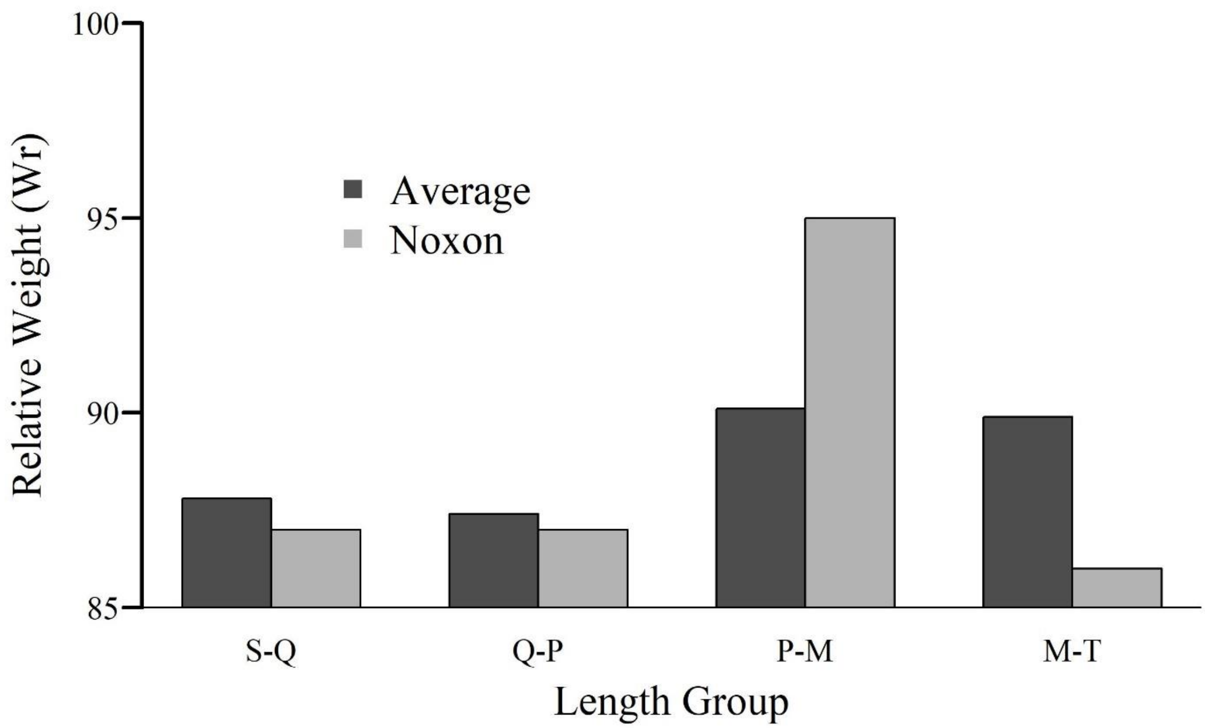

FIGURE 7. Average condition of Walleye caught using standardized gill nets in large standing waters in North America (Bonar et al. 2009) and average condition of fall caught Walleye from Noxon Rapids Reservoir in 2022. S = stock, Q = quality, P = preferred, M = memorable, and T = Trophy (Gabelhouse 1984).

Growth curves and parameters (Appendix D) were calculated for both males and females using the 66 Walleye used for age analysis (TABLE 2). Of those fish, 22 were male, 25 were female, and 19 were unknown. Supporting reported mean length-at-age data, female Walleye growth rates were greater than males.

During 2022 gill netting four Walleye were recaptured that had previously been tagging during spring Walleye electrofishing (TABLE 3). Most of the recaptured fish had been tagged in the spring of 2022 (75%), the remaining fish after on growing season (25%; TABLE 3). Recapture rates for fish PIT tagged in 2021 and 2022 were <1% and 1%, respectively.

TABLE 3. Mean yearly growth of recaptured walleye sampled during fall 2022.

PIT Tag Number	Initial Capture Date	Initial Capture Length (mm)	Recapture Date	Recapture Length (mm)	Sex	Mean Yearly Growth (mm)
982000362929506	4/12/2021	489	10/10/22	525	M	166
982000365414953	4/13/2022	509	10/10/22	515	M	-
982091070216201	4/26/2022	364	10/10/22	385	M	-
982091070216244	5/5/2022	369	10/11/22	391	M	-

Northern Pike comprised 8.5% of the netted fish and were the second most abundant predator species sampled within Noxon Reservoir. Mean catch rate for Northern Pike in 2022 was 2.2 fish/net (TABLE 1) which is substantially higher than the 2002–2021 mean catch rate (1.3 fish/net). Northern Pike abundance has increased significantly since standardized gillnetting began (linear regression, $r^2 = 0.46$, $p < 0.001$). Mean Wr for Northern Pike in 2022 was 99.6; this continues a significant decline for the species since 2000 (linear regression, $r^2 = 0.72$, $p < 0.001$). While mean Wr in Northern Pike has declined from the 2000–2021 mean (Wr = 109.8; 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 2022 (84) 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 condition showed no statistically significant difference among length groups (sub-stock = <350 mm stock = 350–529 mm, quality = 530–709 mm, preferred = 710–859 mm, and memorable = 860–1119 mm).

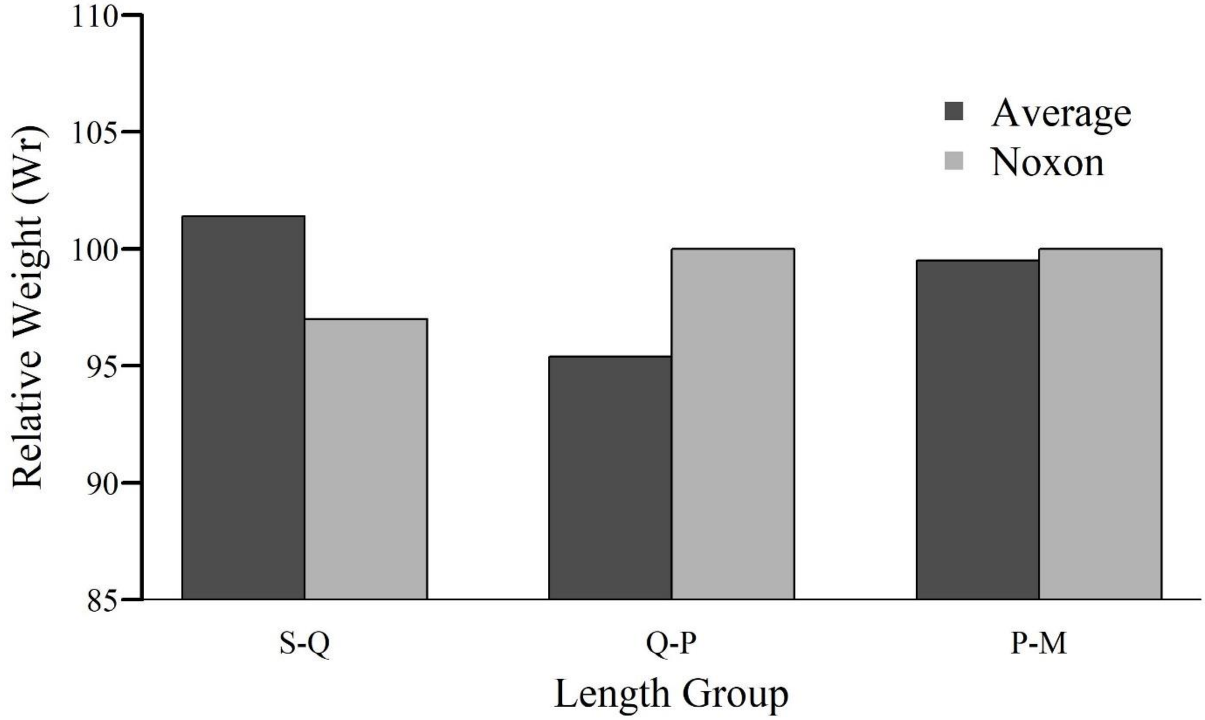

FIGURE 8. Average condition of Northern Pike caught using standardized gill nets in large standing waters in North America (Bonar et al. 2009) and average condition of fall caught Northern Pike from Noxon Reservoir in 2022. S = stock, Q = quality, P = preferred, M = memorable, and T = Trophy (Gabelhouse 1984).

Smallmouth Bass were the most abundant top predator species captured within Noxon Reservoir, representing 8.6% of the total catch (n = 73; TABLE 1), which was the highest number since standardized netting began in 2000. Mean catches were 2.4 fish/net, which is also a historic high (2000–2021 mean catch 0.9 fish/net; Appendix B). It is unclear if this increase in Smallmouth Bass catch per unit effort is due to unseasonably warm weather during sampling 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 2022 (Wr= 95.8). 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, $p = 0.89$). 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.

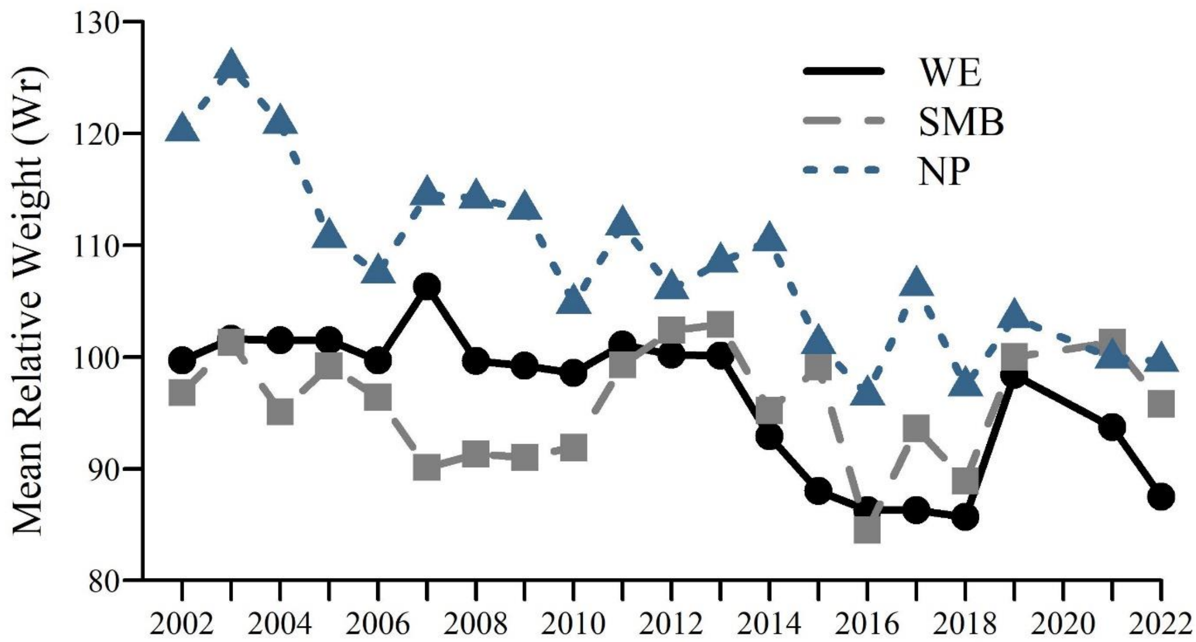

FIGURE 9. Mean relative weight of fall-captured Northern Pike, Smallmouth Bass and Walleye over time in Noxon Reservoir.

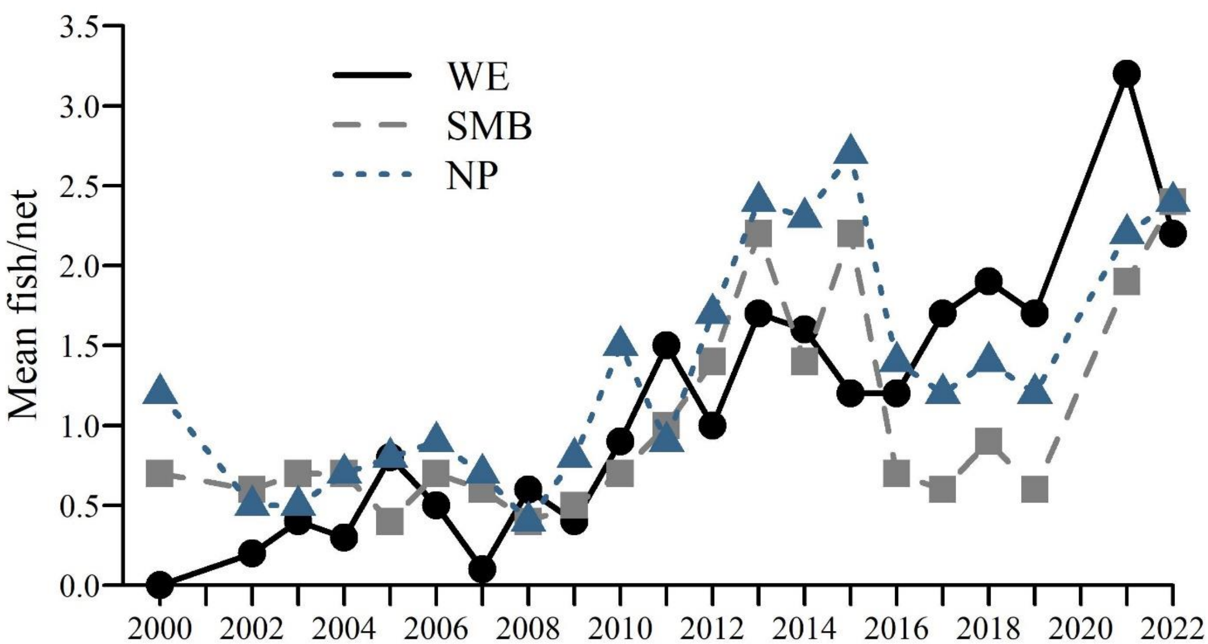

FIGURE 10. Mean number of fish per net for Walleye, Smallmouth Bass, and Northern Pike 2000–2022 in Noxon Reservoir during annual fall gill netting.

Native non-gamefish species such as Northern Pikeminnow, Peamouth, and Largescale Suckers continue to be captured at low levels. In 2022, 42 Northern Pikeminnow were captured comprising 4.9% of the total fish community (TABLE 1). A significant decline in the species has been documented since 2000 (linear regression, $r^2 = 0.92$, $p < 0.001$), where 6.1 fish/net was documented in 2000 (n = 178) and 3.6 fish/net in 2011 (n =108), compared to 1.4 fish/net in 2022 (n = 42) (Appendix B; FIGURE 11).

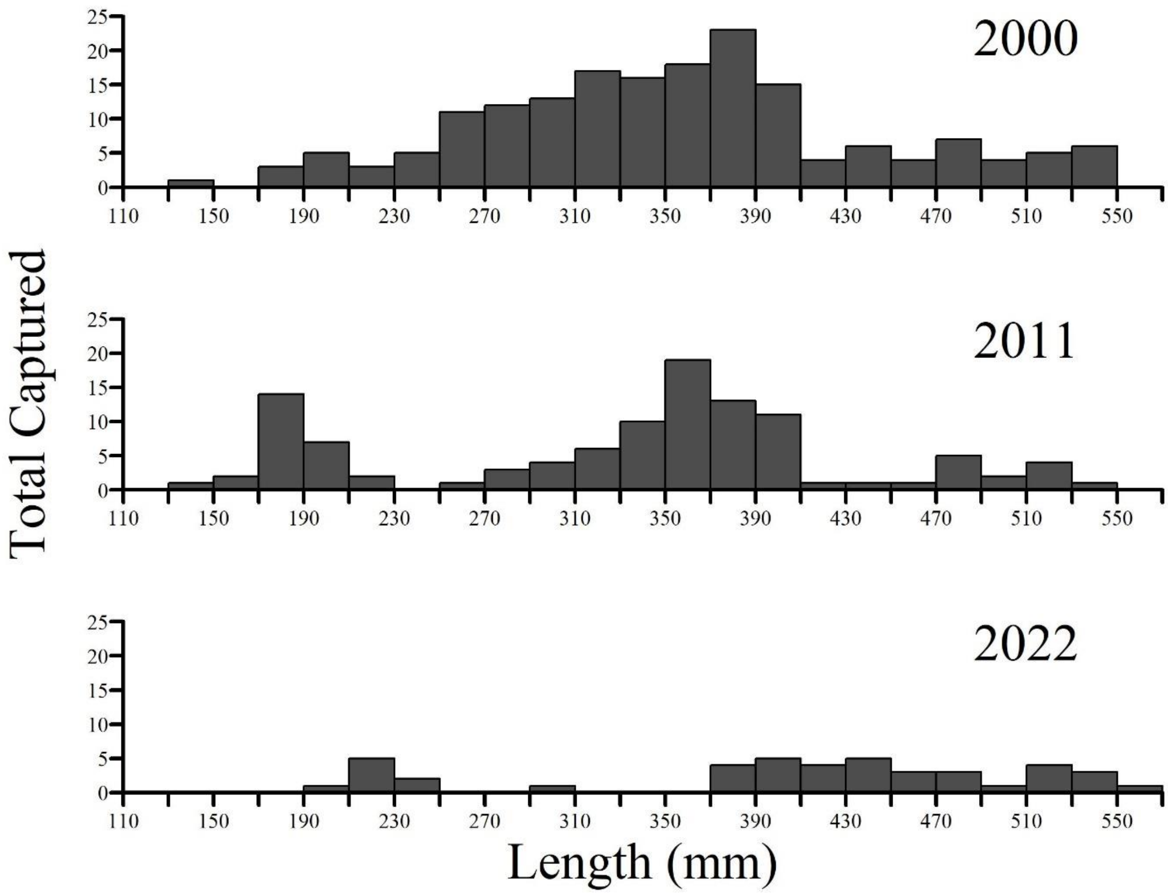

FIGURE 11. Length Frequency distribution of fall caught Northern Pikeminnow during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 178), 2011 (n = 108), and 2022 (n = 42).

Eighteen Largescale Suckers were captured in 2022 (0.6 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, $r^2 = 0.76$, $p < 0.001$; Appendix B).

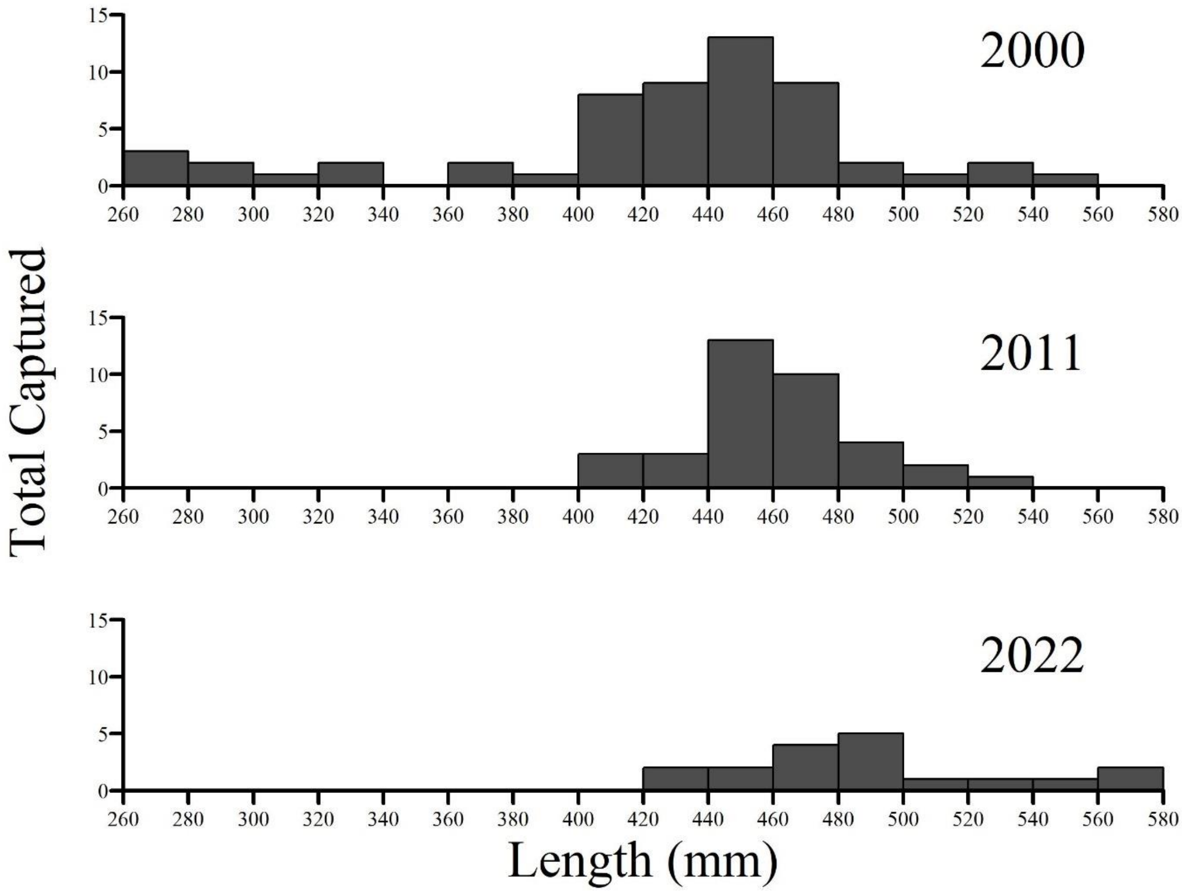

FIGURE 12. Length Frequency distributions of fall caught Largescale Suckers during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 56), 2011 (n = 36), and 2022 (n = 18).

The most dramatic decline has been observed in Peamouth (linear regression, $r^2 = 0.92$, $p < 0.001$) 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 2022 (n = 4; FIGURE 13; Appendix B). 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.

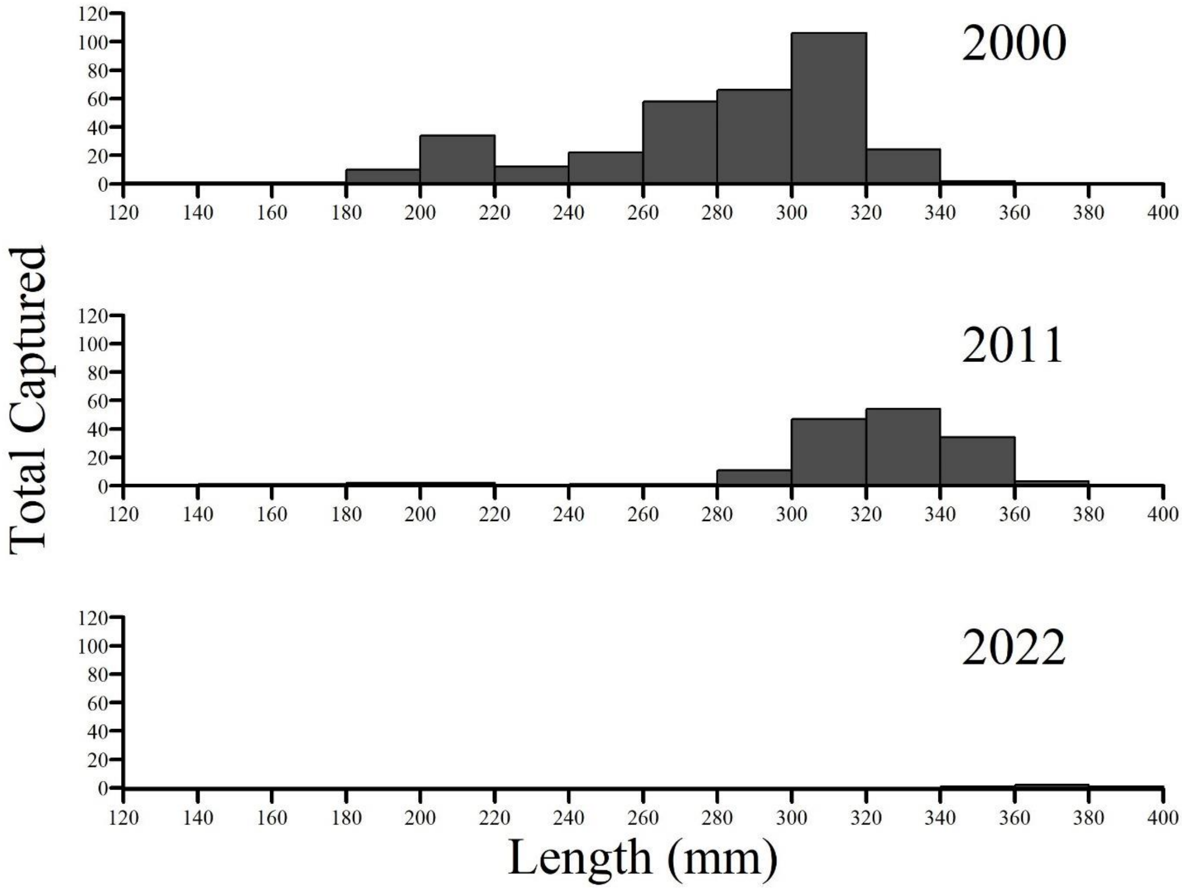

FIGURE 13. Length Frequency distributions of fall caught Peamouth during annual gillnet monitoring in Noxon Reservoir in 2000 (n = 337), 2011 (n = 157), and 2022 (n = 4).

Cabinet Gorge Reservoir

Gill netting was conducted in Cabinet Gorge Reservoir October 9–10, 2022 and produced a total of 131 fish representing 9 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 2000–2022. The catch rate of 8.7 fish/net is down from the 2021 (11.7 fish/net) and below historic averages (2000–2021 mean catch 13.6 fish/net). Yellow Perch, in recent years the most abundant species captured, were the second most abundant species in 2022, representing 21.4% of the total catch (n = 28). The mean number of Yellow Perch captured in 2022 was 1.9 fish/net which is less than the 2000–2021 mean catch of 3.9 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 2022. 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)
LL	0.1 (0.4)	2	1.5	2.5%	1060.0	140–1980	418.0	240–596
LSSU	0.9 (1.0)	13	9.9	15.8%	1021.5	860–1230	449.5	430–490
LWF	0.3 (0.8)	4	3.1	4.5%	940.0	535–1510	470.5	405–575
NP	0.9 (1.1)	14	10.7	26.4%	1586.1	375–2280	607.6	394–692
NPMN	1.4 (1.8)	21	16.0	26.1%	1097.3	76–1845	447.8	209–539
PUMP	0.7 (1.8)	10	7.6	0.4%	37.5	15–90	112.2	93–155
SMB	2.3 (3.3)	34	26.0	19.8%	521.4	75–1020	315.7	184–420
WE	0.3 (0.5)	5	3.8	2.0%	416.3	120–985	363.5	250–484
YP	1.9 (3.2)	28	21.4	2.6%	86.0	35–200	186.5	140–236

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 as susceptible to capture in gillnets as most other species in the reservoirs. Smallmouth Bass appear to be captured at a higher rate than Largemouth Bass, but both species are underrepresented to an unknown degree in relation to the abundance in the fish community.

Northern Pike were the second most abundant top predator species captured, representing 10.7% of the total catch (n = 14; 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 0.9 fish/net, which was near the historic average (2000–2021 mean catch 0.7 fish/net; Appendix C). Northern Pike abundance has shown a significant increase since standardized gillnetting began (linear regression, $r^2 = 0.51$, $p = 0.004$). Mean Wr for Northern Pike was 99.2 in 2022, this continues a significant decline for the species since 2009 (linear regression, $r^2 = 0.34$, $p = 0.01$). While Wr in Northern Pike has declined from the 2000–2021 mean (112.4), Northern Pike condition is still considered greater than the 50th percentile in large standing waters of North America (Bonar et al. 2009).

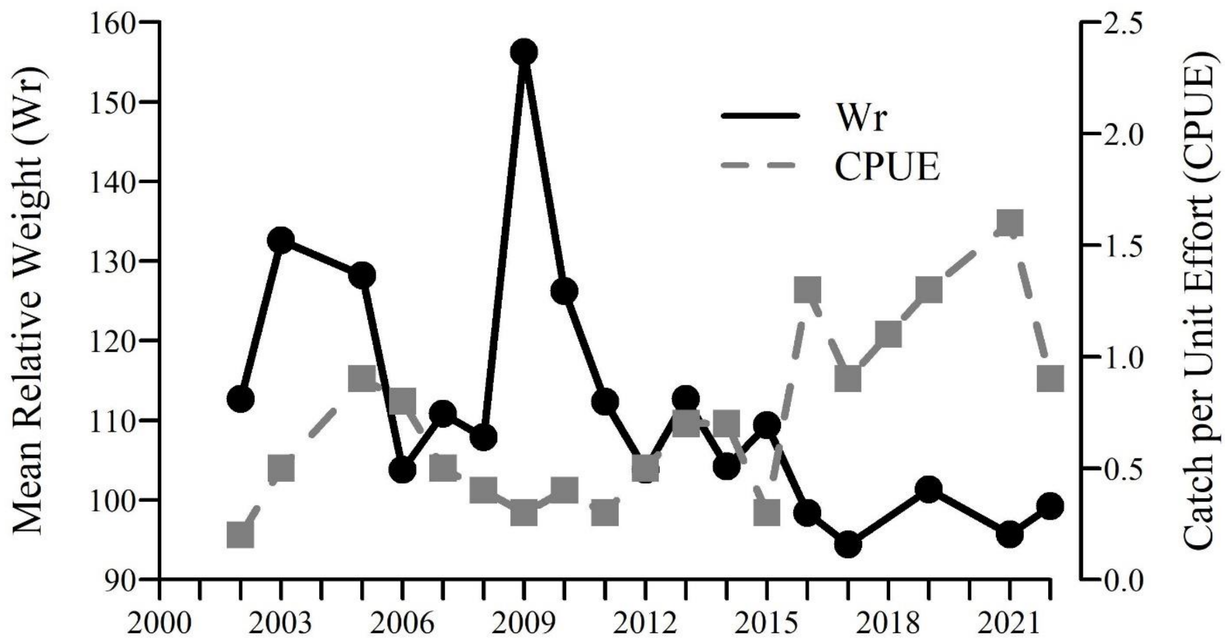

FIGURE 14. Mean relative weight and number of fish per net of fall-captured Northern Pike over time in Cabinet Gorge Reservoir.

Proportional size distribution for Northern Pike captured during fall of 2021 (93) 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). 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 (0.3 fish/net, n = 5) in 2022 was similar to 2000–2021 (mean 0.2 fish/net). We have not observed the same recent increases in Cabinet Gorge Walleye 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. Walleye captured in 2022 were comprised of the 2021, 2020, 2019, and 2017 year-class. Scavenging by crayfish prevented one of the five Walleye from being aged.

Smallmouth Bass were the most abundant top predator species captured, representing 26% of the total catch (n = 34; TABLE 4), which was the highest number since standardized netting began in 2000. Mean catches were 2.3 fish/net, which is also a historic high (2000–2021 mean catch 0.5 fish/net; Appendix C). It is unclear if this increase in Smallmouth Bass catch per unit effort is due to unseasonably warm weather during sampling 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 98.5 in 2022. 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, $p = 0.09$). 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 2022, 21 Northern Pikeminnow were captured comprising 16% of the total fish community (TABLE 4). A significant decline in the species has been documented since 2000 (linear regression, $r^2 = 0.78$, $p < 0.001$), 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 2022 (n = 21) (FIGURE 15).

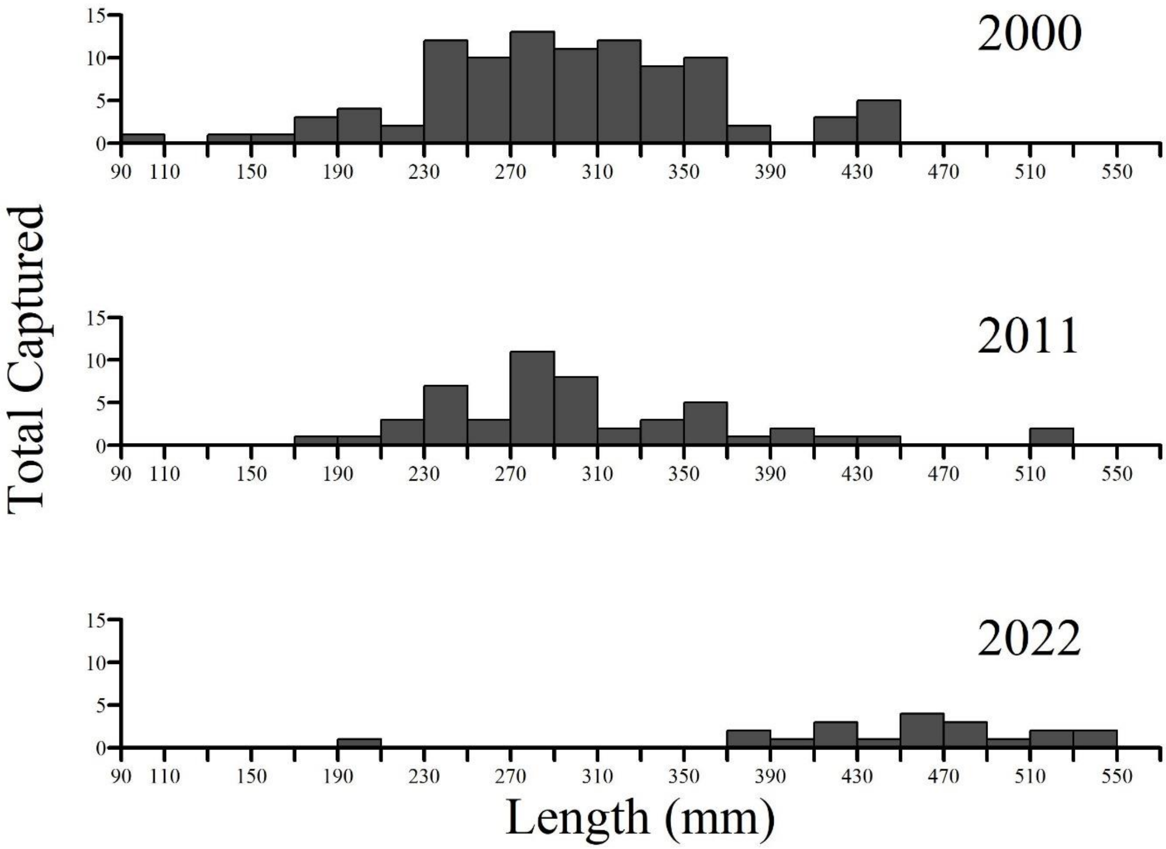

FIGURE 15. Length Frequency distribution of fall caught Northern Pikeminnow during annual gillnet monitoring in Cabinet Gorge Reservoir in 2000 (n = 99), 2011 (n = 51), and 2022 (n = 21).

Thirteen Largescale Suckers were captured in 2022 (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 16). 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 reduced recruitment (FIGURE 16). 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 fifth consecutive year, no Peamouth were captured in Cabinet Gorge Reservoir. It appears that Peamouth have been functionally extirpated from Cabinet Gorge Reservoir.

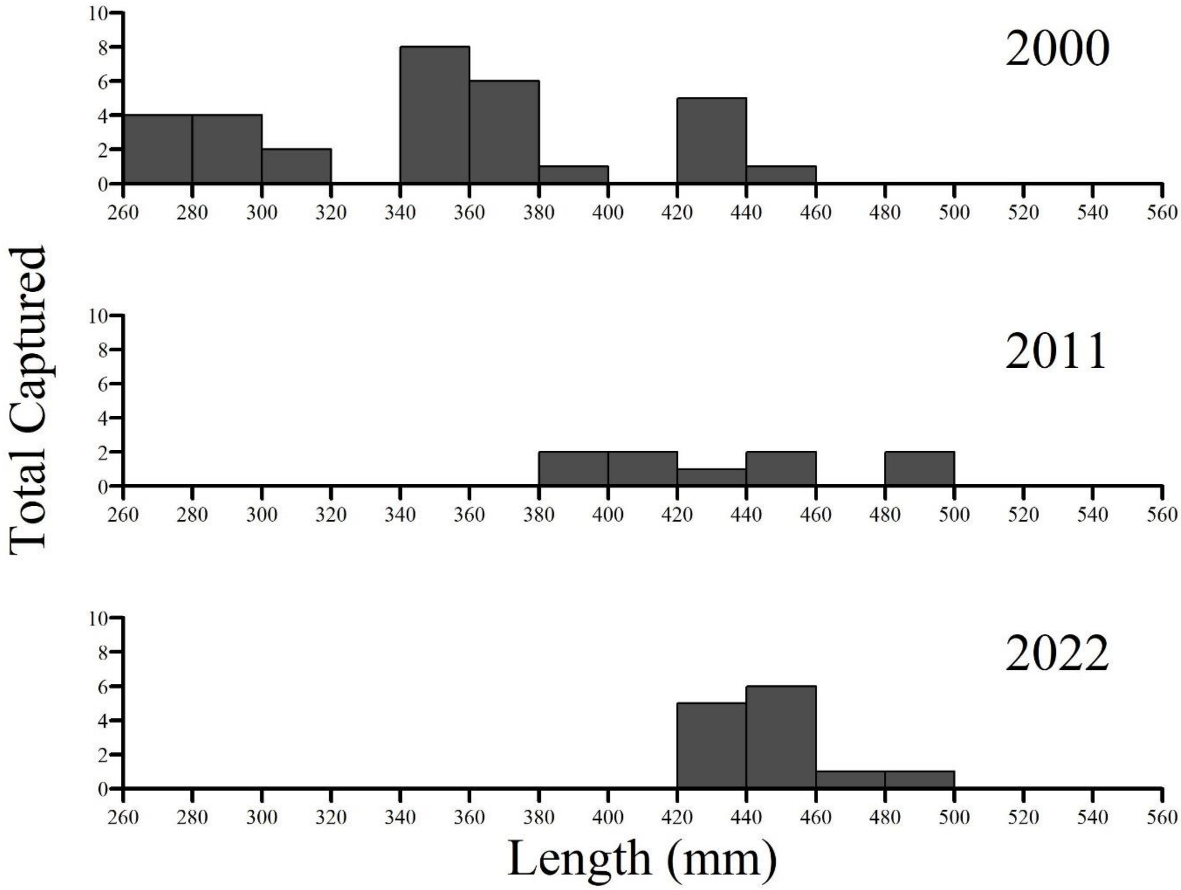

FIGURE 16. Length Frequency distribution of fall caught Largescale Sucker during annual gillnet monitoring in Cabinet Gorge Reservoir in 2000 (n = 31), 2011 (n = 9), and 2022 (n = 13).

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 eight separate occasions in spring, 2022. Sampling effort and dates were affected by boat ramp accessibility due to low reservoir levels in spring. Sampling time was split between the area above the Highway 200 bridge (71%) and the area adjacent to the River's Bend Golf Course (29%; FIGURE 4). A total of 267 sexually mature fish were captured, of which 96 (25%) were females and 161 (75%) were males (FIGURE 17). Of the 267, fish captured 62 (23%) of them were sacrificed for age analysis. The remaining 205 fish were released alive. The majority of Walleye (221) were captured upstream of the Highway 200 Bridge while catch adjacent to the River's Bend Golf Course (46) was low. These discrepancies in catch-rates between sampling location are likely due to capture efficiencies differences between the two locations.

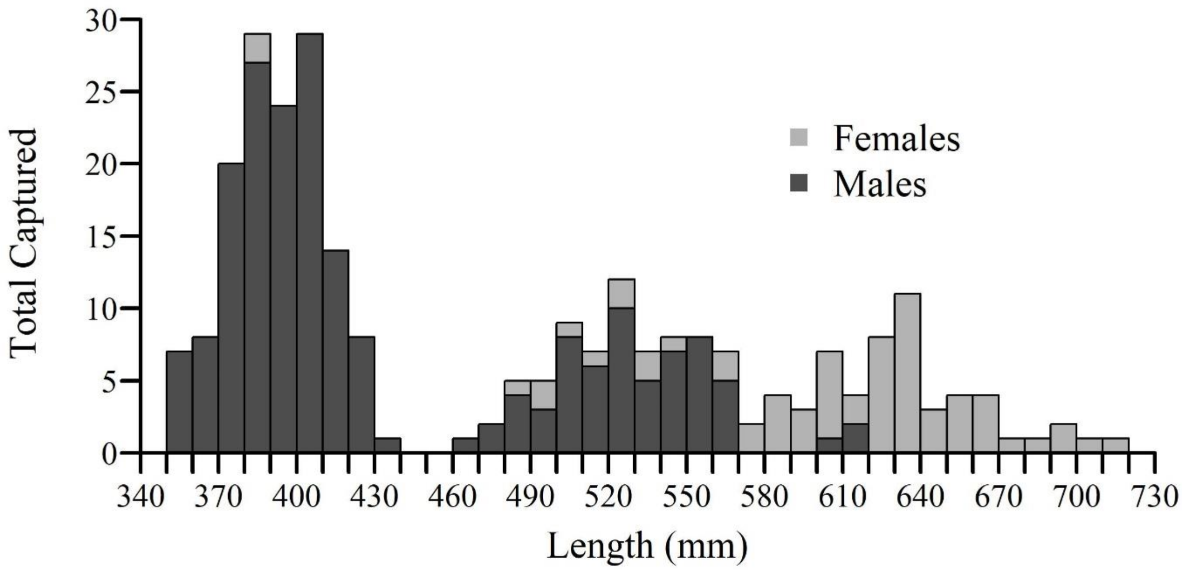

FIGURE 17. Length frequency distribution of spring caught walleye from Noxon Reservoir in 2022.

A strong 2019 year-class was first detected during 2021 fall gill netting efforts (Rehm et al. 2022). As predicted, males of the 2019 year-class have recruited to the spawning population at age 3. Males were represented primarily by the 2019 year-class (70%) followed by the 2015 year-class (23%; FIGURE 18). Females' most abundant year-class continues to be 2015 (76%) followed next by the 2016 year-class (12%; FIGURE 18). Mature males were captured from six different year-classes and mature females from five different year-classes (TABLE 5). Spring Walleye sampling in 2022 showed a spawning population dominated by the 2015 and 2019 year-classes (age 7 and 3; FIGURE 17). 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 relatively strong year-classes were produced in 2020 and 2021. We expect males of the 2020 and 2021 year-class to begin showing up in spring sampling in 2023 and 2024, respectively. Females of those year classes should recruit to the spawning population during 2024-2025 and 2025-2026, respectively.

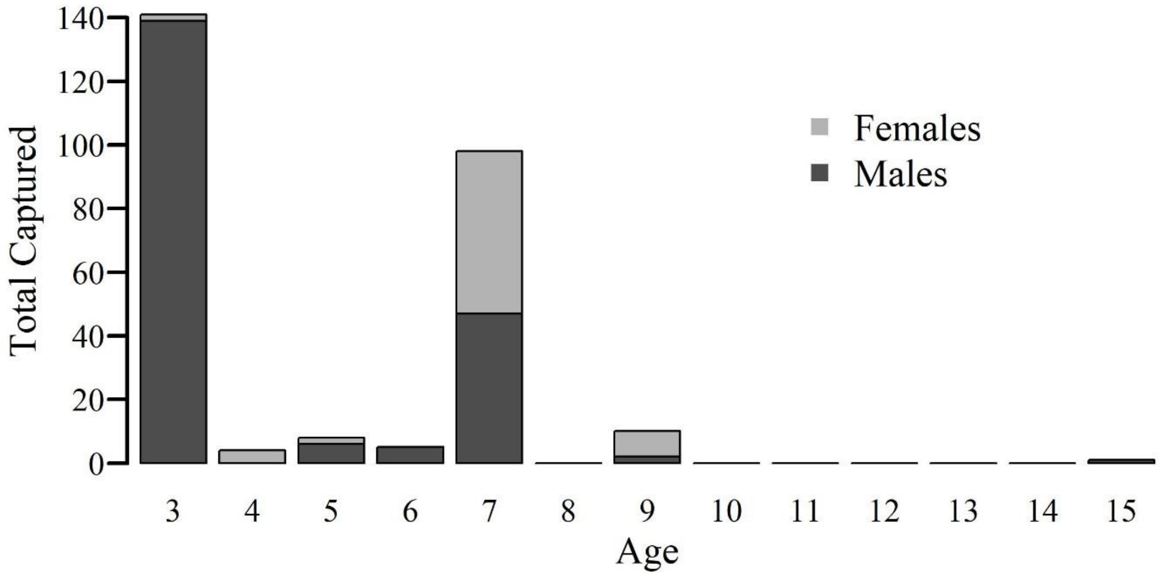

FIGURE 18. Age frequency distribution of spring caught Walleye from Noxon Reservoir in 2022.

Mean length of males captured was 436 mm (range = 351–620; TABLE 5). Of these fish, 114 (57%) exceeded 400 mm in length, this smaller structure compared to recent years comes from the strong influence of the young 2019 year-class. In contrast, mean length of females captured was 605 mm (range = 381–719; TABLE 5). All except for two females (97%), 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 2022.

Age	Males			Females		
	n	Mean Length (mm)	SD	n	Mean Length (mm)	SD
3	139	394	19.4	2	381	0.7
4	-	-	-	4	496	6.9
5	7	497	10.3	2	524	1.5
6	5	502	4.24	-	-	-
7	46	537	27.9	51	614	35.3
8	-	-	-	-	-	-
9	2	562	2.8	8	686	23
10	-	-	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	1	620	-	-	-	-

Overall catch rate was 30.2 fish per hour and ranged 10.4–83.5 fish per hour. Total catch peaked at 83.5 fish per hour on April 26 when water temperature was 9.3°C and flow was 18,600 cfs (FIGURE 19). Female catch remained relatively low until April 20th and peaked on May 5th at 17.2 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.

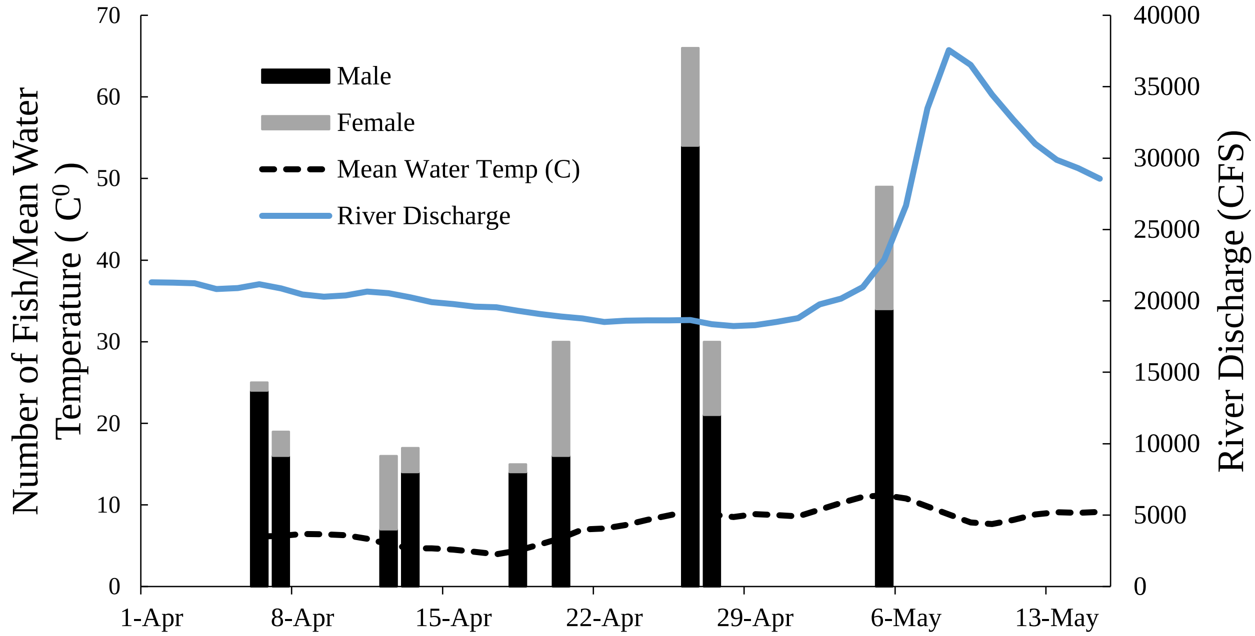

FIGURE 19. Catch per unit effort of Walleye during spring 2022, with river discharge and mean water temperature.

Of the 205 fish PIT tagged and released alive, four were subsequently captured during a later sampling date in 2022 (within year recaptures), and 27 additional fish captured in 2022 had been captured and tagged in prior years (previous year recaptures). The initial capture event for one recaptured individual could not be identified. Most of the Walleye tagged in previous years were recaptured after only one (27%) or two (46%) growing seasons. The remaining fish were captured after three (23%) and four (4%) growing seasons (TABLE 6). Fish tagged during 2019 sampling are still commonly being captured, this is likely due to the high number fish tagged during 2019 spring Walleye sampling. Recapture rates for fish PIT tagged in 2018 through 2021 were <1%, 1%, 6%, and 4% 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 541 mm. Recaptured fish grew between 16 and 108 mm per year with a mean value of 45 mm (TABLE 6).

TABLE 6. Mean yearly growth of recaptured walleye sampled during spring 2022.

PIT Tag Number	Initial Capture Date	Initial Capture Length (mm)	Recapture Date	Recapture Length (mm)	Sex	Mean Yearly Growth (mm)
982000363519216	4/23/2018	332	4/27/2022	501	Male	42
982000363517960	4/9/2019	364	4/27/2022	505	Male	46
982000362691466	4/10/2019	407	4/26/2022	557	Male	49
982000362691467	4/10/2019	391	4/26/2022	500	Male	36
982000363519302	4/18/2019	443	4/18/2022	560	Male	39
982000362691544	4/22/2019	399	4/13/2022	511	Male	38
982000362691559	4/22/2019	393	4/26/2022	530	Male	45
989001026318184	4/13/2020	430	4/27/2022	524	Male	46
989001026318142	4/20/2020	519	4/12/2022	612	Female	47
982000362929427	4/28/2020	435	4/26/2022	535	Male	50
982000362929527	4/30/2020	394	4/18/2022	495	Male	51
982000362929489	4/30/2020	458	4/26/2022	561	Female	52
982000362929428	4/30/2020	460	4/26/2022	539	Male	40
982000362929461	4/30/2020	402	4/27/2022	486	Male	42
982000362691619	4/30/2020	430	5/5/2022	504	Male	37
982000362929522	5/5/2020	454	4/7/2022	537	Male	43
982000362929478	5/5/2020	556	4/20/2022	658	Female	52
982000362929466	5/5/2020	434	4/26/2022	511	Male	39
982000362929510	5/5/2020	426	5/5/2022	509	Male	42
982000362929484	4/5/2021	515	4/13/2022	531	Male	16
982000362929523	4/7/2021	523	4/12/2022	582	Female	58
982000362929467	4/12/2021	561	4/26/2022	584	Female	22
982000362929520	4/12/2021	556	4/27/2022	621	Female	62
982000357016262	4/19/2021	500	4/27/2022	540	Female	39
982000357016322	5/3/2021	619	4/7/2022	650	Female	33
982000365414983	5/3/2021	310	4/7/2022	410	Male	108

Growth curves and parameters (Appendix E) were calculated for all Walleye and both sexes from otoliths of 38 males and 24 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

Two Bass tournaments, both spanning two days, were monitored to help assess the overall status of the bass fishery in Noxon Reservoir. The first being The Bass Federation (TBF) and American Bass Association (ABA) Buddy Series #3 (May 21st and 22nd) and the second Tri-State Buddy Tournament (July 30th and 31st). Three other Bass tournaments occurred but were not monitored in 2022. Similar to recent years, mean length and proportion of quality fish were high for both species (TABLE 7, FIGURES 20 and 21). The TBF Buddy Series Qualifier #3 weighed bass consisted of 69% Largemouth Bass and 31% Smallmouth Bass. Tri-State Buddy Tournament weighed bass consisted of 82% Largemouth Bass and 18% Smallmouth Bass. A total of 494 Bass were measured during the two tournaments with a mean length of 410 mm for Largemouth Bass and 399 mm for Smallmouth Bass. Of checked-in bass, 4% of Largemouth Bass and 8% 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 2022.Numbers DO NOT include culled fish.

Statistic	Species	5/21-5/22	7/30-7/31	Combined
% of Catch	LMB	69	82	79
	SMB	31	18	21
% $\geq$ 380 mm	LMB	81	88	87
	SMB	79	60	67
	Both	80	83	82
% $\geq$ 460 mm	LMB	5	4	4
	SMB	11	6	8
	Both	7	4	5
Total Caught	LMB	83	306	389
	SMB	38	67	105
	Both	121	373	494
Mean Length (mm)	LMB	406	411	410
	SMB	410	393	399

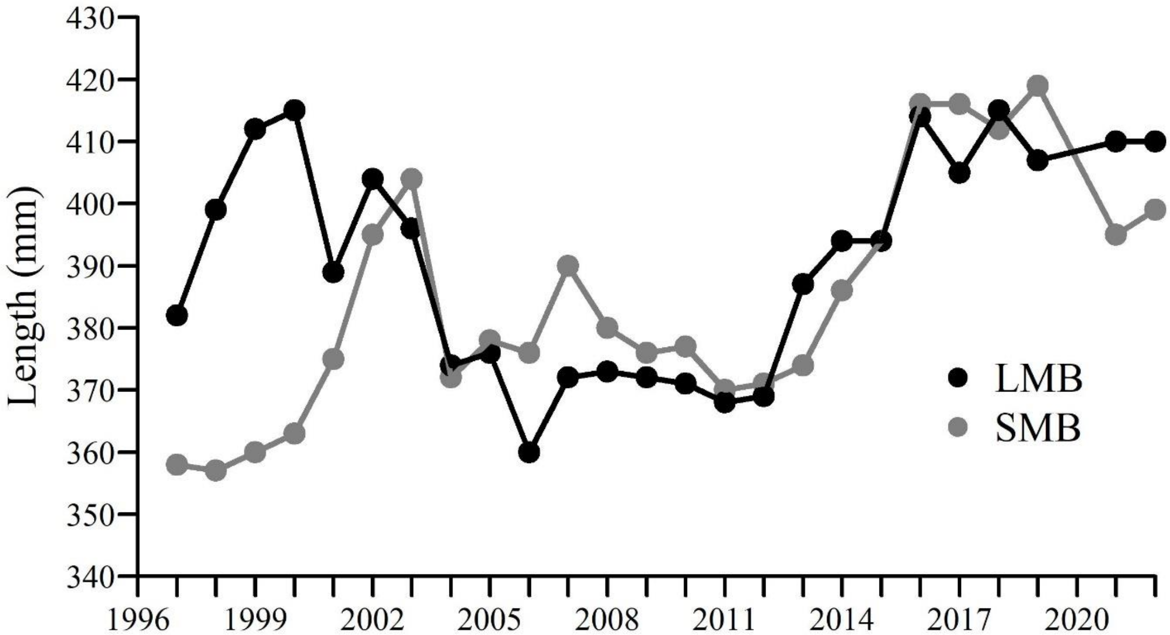

FIGURE 20. Mean length of both bass species checked in at monitored bass tournaments over time.

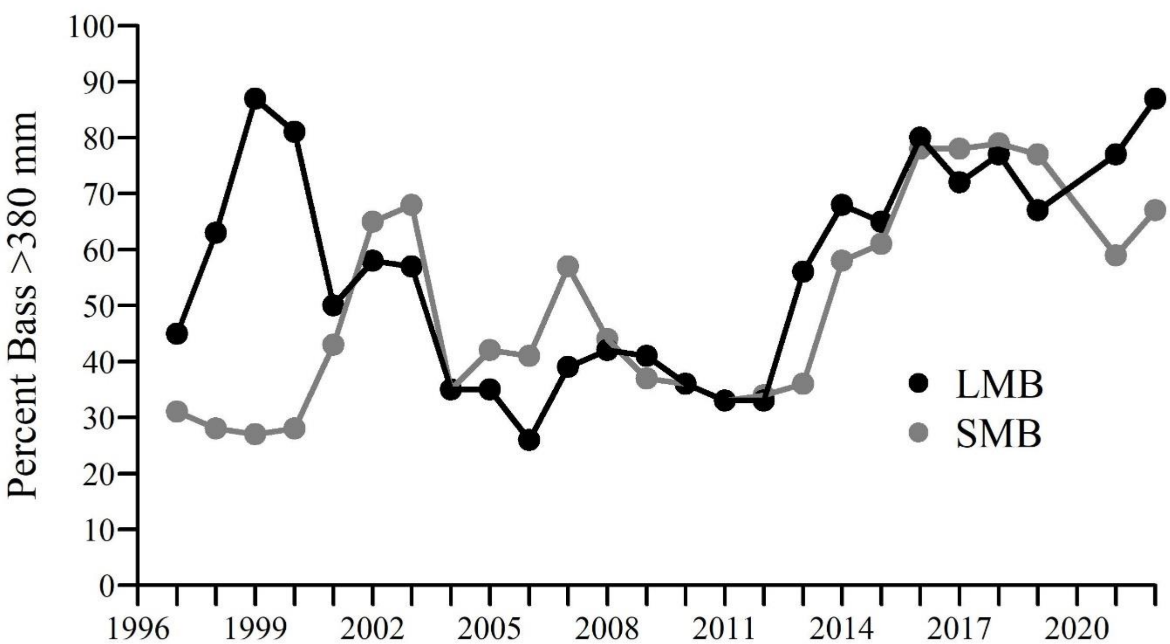

FIGURE 21. Percent ‘quality’ fish (≥380 mm) checked in at bass tournaments over time.

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 as abundance of other predators (i.e., Walleye and Northern Pike) within Noxon Reservoir increases.

Acknowledgements

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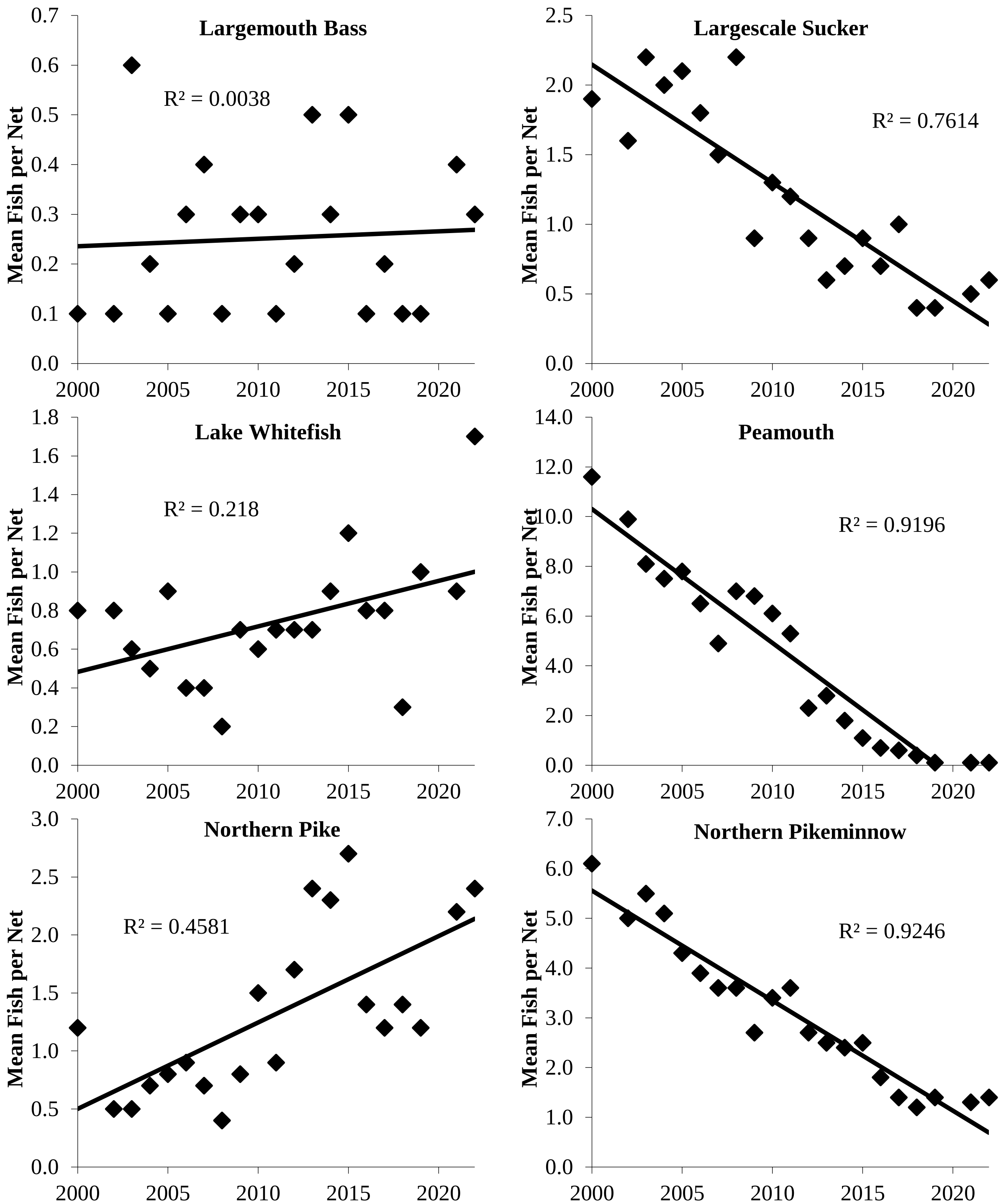
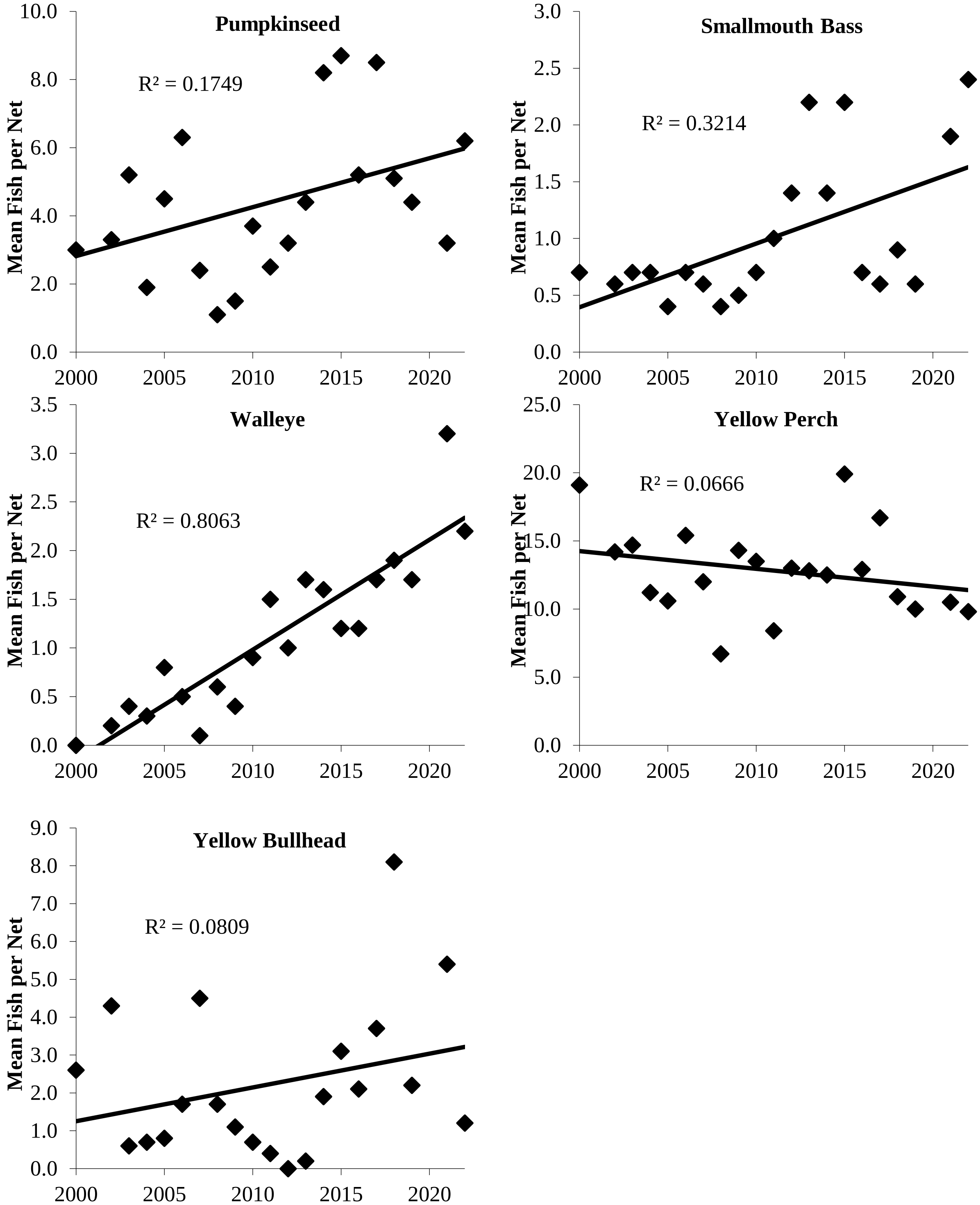
Appendix A. Species abbreviations and scientific names of fish in Noxon and Cabinet Gorge reservoirs

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*

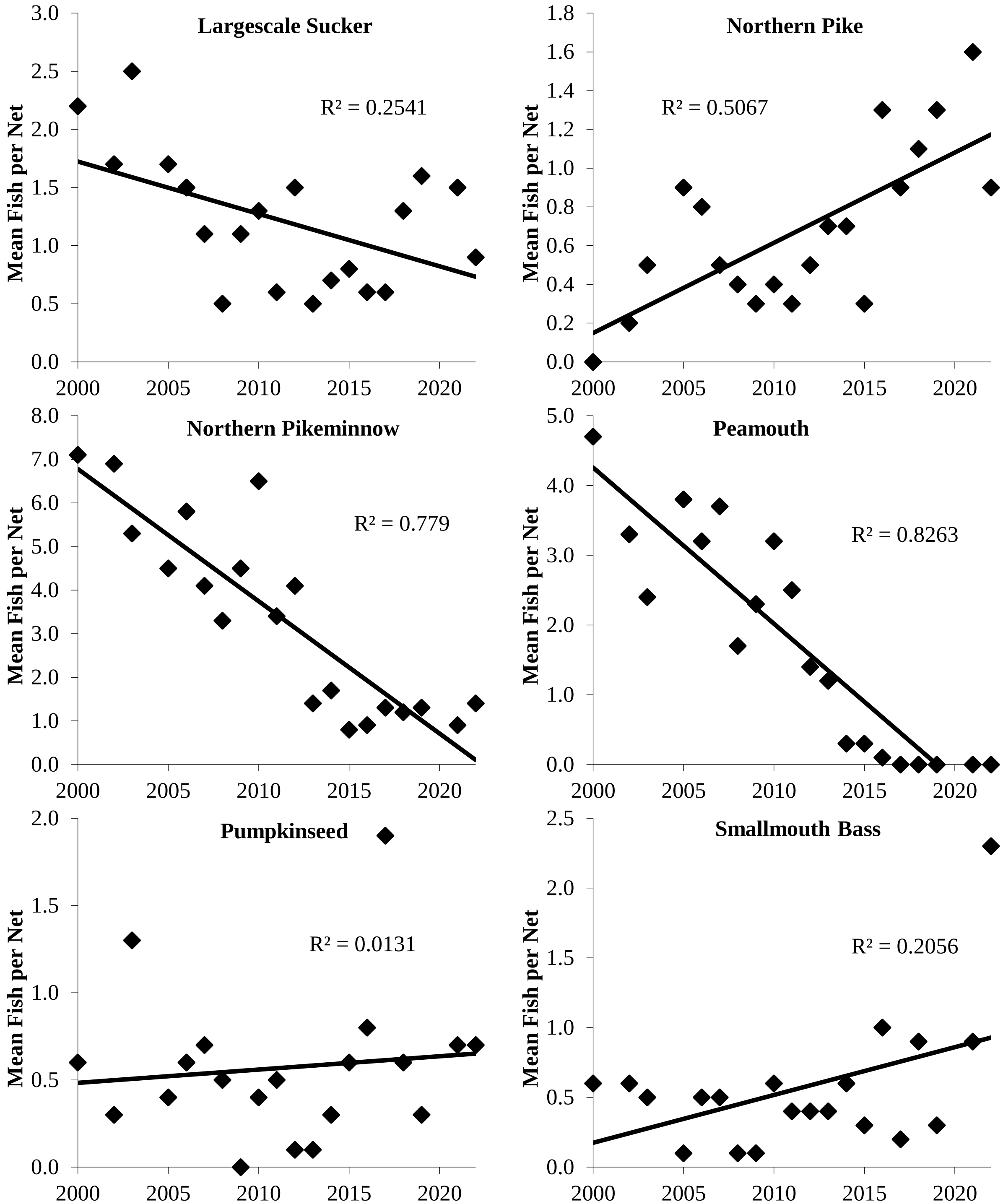
Appendix B. Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Noxon Reservoir, 2000-2022.



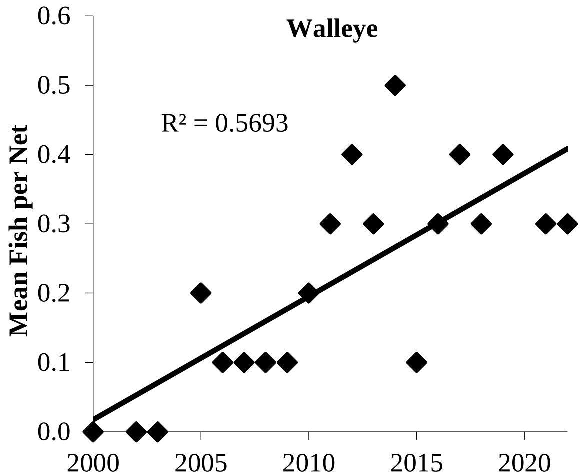
Appendix B (continued). Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Noxon Reservoir, 2000-2022.

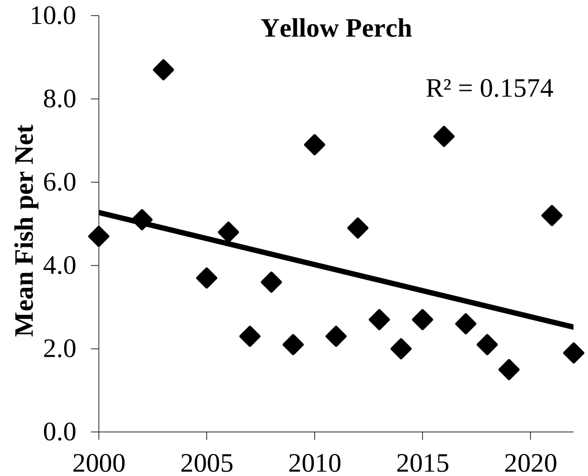


Appendix C. Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Cabinet Gore Reservoir, 2000–2022.



Appendix C (continued). Catch per Unit Effort (CPUE) trends of selected fish from annual gill net surveys in Cabinet Gore Reservoir, 2000–2022.

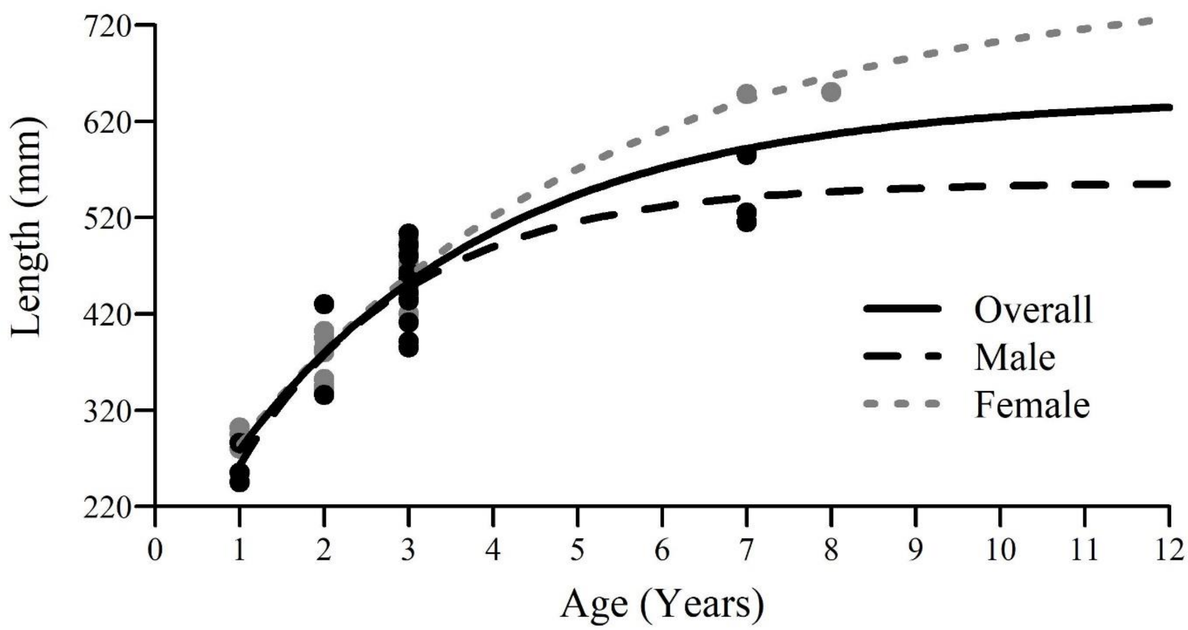




Appendix D. Von Bertalanffy growth curves and parameters for both male and female Walleye using estimates derived from Walleye collected from Noxon Reservoir in Fall 2022.

Von Bertalanffy parameter estimates derived from Walleye collected from Noxon Reservoir in Fall 2022.

von Bertalanffy parameter	Data Source					
	Female		Male		All Walleye	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
L_{inf}	767	665–869	556	498–614	645	588–702
K	0.22	0.14–0.3	0.49	0.27–0.71	0.32	0.23–0.41
T_0	-1.07	-1.69– -0.45	-0.3	-0.9– 0.3	-0.77	-0.51– 0.35

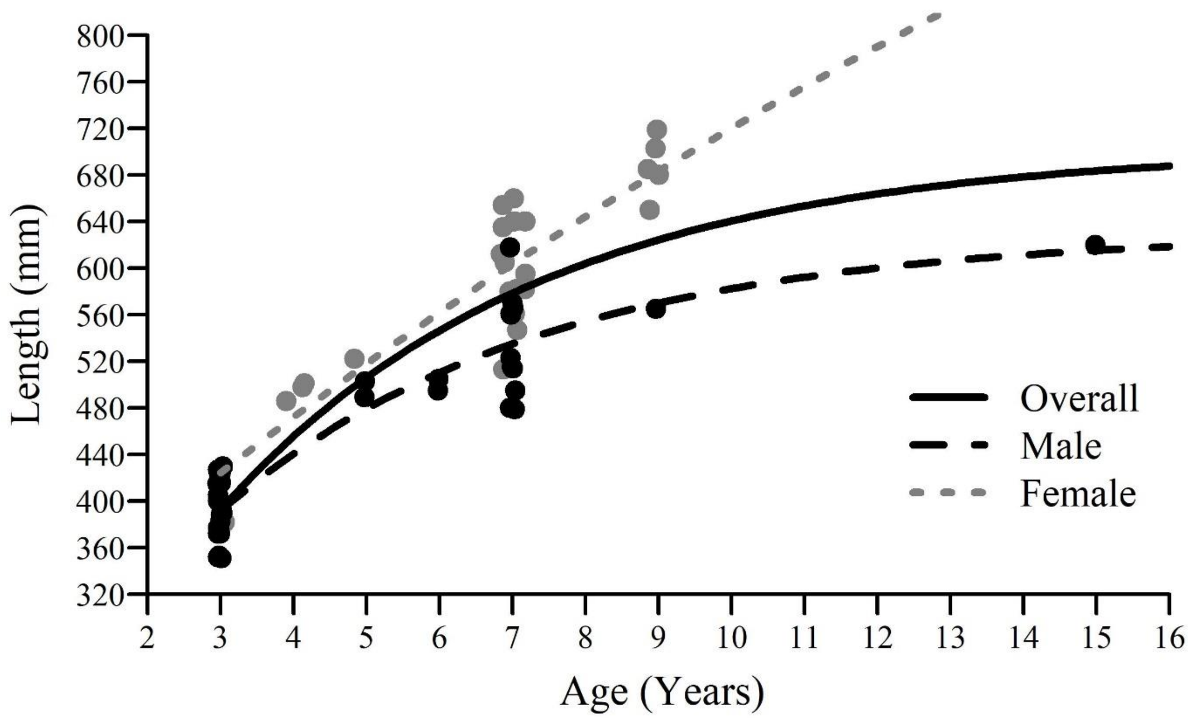


Von Bertalanffy growth curves for Walleye using estimates derived from Walleye collected from Noxon Reservoir in fall 2022.

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 2022.

Von Bertalanffy parameter estimates derived from Walleye collected from Noxon Reservoir in spring 2022.

von Bertalanffy parameter	Data Source					
	Female		Male		All Walleye	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
L_{inf}	1,602	0–7,138	630	543–717	704	592–816
K	0.04	-0.18–0.26	0.23	0.08–0.38	0.23	0.09–0.37
T_0	-4.45	-15.15–6.25	-1.25	-3.11– 0.61	-0.58	-1.54– 0.96



Von Bertalanffy growth curves for Walleye using estimates derived from Walleye collected from Noxon Rapids Reservoir in spring 2022.