



Ashurst Lake and Coconino Reservoir Fisheries Management Plan 2019-2029

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Approved [] by Chris Cantrell


Aquatic Wildlife Branch Chief

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Location

Ashurst Lake is located on Anderson Mesa about 20 miles southeast of Flagstaff Arizona at an elevation of 7,110 feet (2,164 m). UTM Zone 12-NAD83 463239, 3875496 (Figure 1). Coconino Reservoir is located approximately ½ mile southeast of Ashurst Lake at UTM Zone 12-NAD83 463485, 3873444.

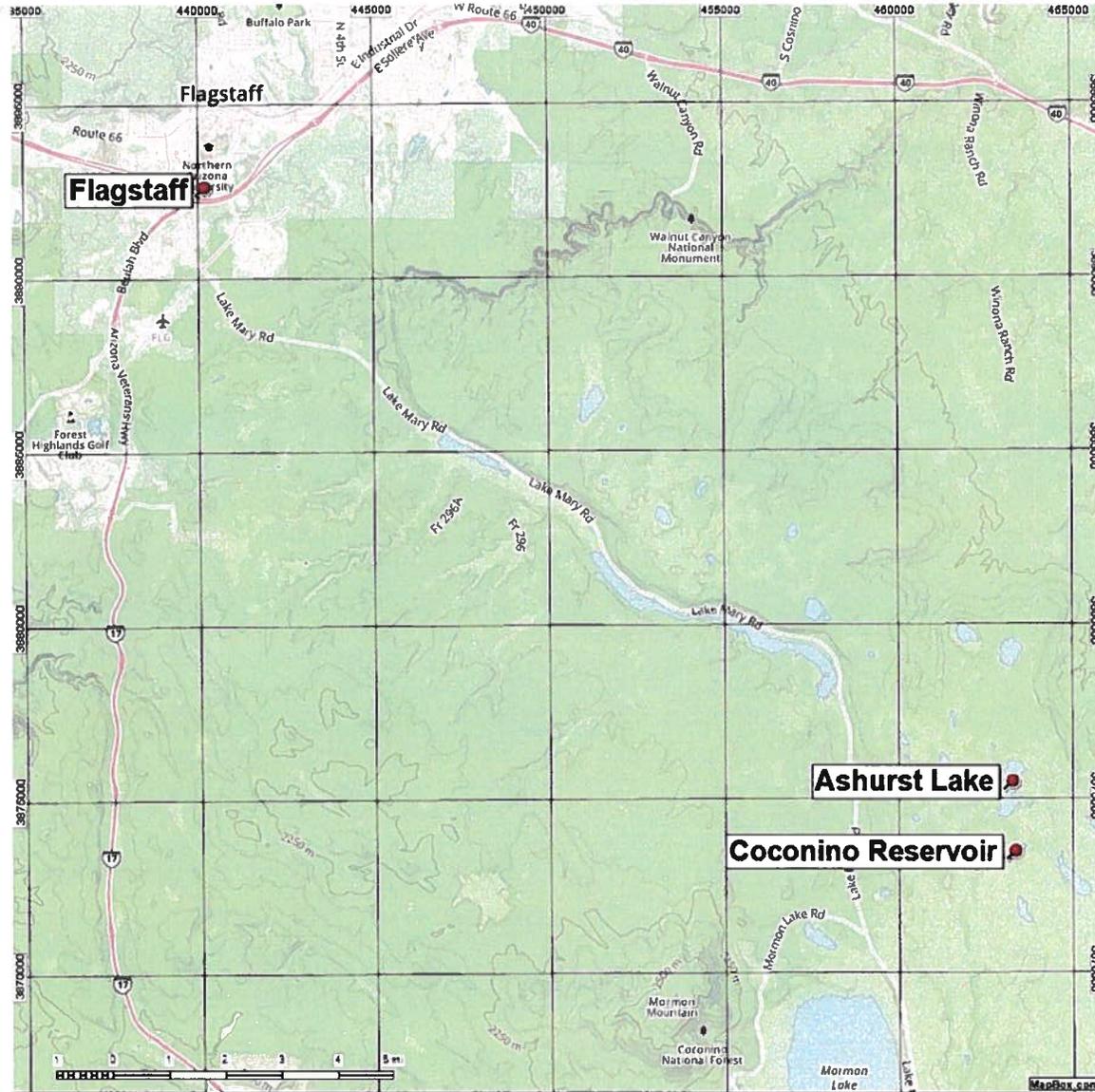


Figure 1. Vicinity Map of Ashurst Lake and Coconino Reservoir

Management Prescription

The Arizona Game and Fish Department (Department) has developed concepts under a Coldwater Strategic Vision Document (AGFD 2019) to help guide coldwater fisheries management in Arizona. Using these concepts, Ashurst Lake will be managed as an Intensive Use Rainbow Trout fishery where catchable sized Rainbow Trout are stocked bi-weekly to provide fish for anglers to catch. If the Northern Pike *Esox lucius* numbers are reduced, large holdover (quality) Rainbow Trout *Oncorhynchus mykiss* are more readily caught each spring.

If the turbidity of the lake is reduced and Northern Pike are completely removed, then Ashurst Lake has the potential to be managed as a Basic Yield Rainbow Trout fishery where fingerling and subcatchable trout are stocked and allowed to grow to catchable size. Management strategies for meeting Objectives for Ashurst Lake are listed in Table 1.

Coconino Reservoir is not currently managed as a fishery because of the illegal introduction of Northern Pike in 1996. If pike are removed from the lake it will be managed as a Featured Species trout fishery with either Tiger Trout or Rainbow Trout.

Management strategies for meeting Objectives for Coconino Reservoir are listed in Table 2.

Objectives for Ashurst Lake:

Objective 1. Maintain angler catch rates at or above .5 trout per hour.

Objective 2. Maintain a level of at least 80% of the anglers interviewed on Ashurst Lake during creel census rate the fishing as fair, good or excellent.

Objectives for Coconino Reservoir:

Objective 1. Establish a fishable trout population.

Objective 2. Maintain angler catch rates at or above .5 trout per hour.

Table 1. Ashurst Lake Objectives and Adaptive Management Strategies:

Objective 1. Maintain angler catch rates at or above .5 trout per hour.			
Parameters	Objective Guideline	Trigger point to address unmet Objectives	Strategies if Objectives are Unmet
Angler Catch Rates	Stocked, catchable sized Rainbow Trout overwinter and are caught in spring gillnet surveys.	Numbers of holdover Rainbow Trout caught during spring gillnet survey is less than 20% of the fish caught and 90% of Northern Pike sampled are greater than 400 mm in length. In addition the road access to lake must be closed by the Coconino National Forest at the time of the removal project.	<ul style="list-style-type: none"> • Develop plan to renovate Coconino Reservoir and Ashurst Lake. • Complete necessary clearances and documentation to stock all year long. • Renovate Coconino Reservoir and Ashurst Lake. • Conduct mechanical removal project to reduce Northern Pike numbers. • Increase stocking rates of Rainbow Trout. • Increase size of Rainbow Trout stocked. • Conduct education campaign to show novice anglers how to catch trout.
		Catch rates are below .5 trout per hour as measured by creel survey.	
	Establish a Basic Yield fishery where survivability and growth are demonstrated by stocked fingerling and subcatchable Rainbow Trout through being angled or by sampling in spring	10% or less of the Rainbow Trout sampled in spring surveys measure 254 mm (10 inches) or less.	
Low growth rates of stocked fingerling or subcatchable Rainbow Trout.			

	gillnet surveys.	Presence of Northern Pike or other illegally stocked predatory fish.	Reservoir and Ashurst Lake.
Objective 2. At least 80% of the anglers interviewed during creel census rate the fishing as fair, good or excellent.			
Parameters	Objective Guideline	Trigger point to address unmet Objectives	Strategies if Objectives are Unmet
Angler Satisfaction	A minimum of 80% of anglers rate fishing as fair, good or excellent.	Creel Census shows less than 80% of the anglers rate fishing as fair, good or excellent.	<ul style="list-style-type: none"> • Increase stocking rates. • Increase size of trout stocked. • Work with Coconino National Forest to improve watershed health to reduce inflow of sediment from the watershed. • Increase or modify efforts for angler education, preferably at the lake. • Creel Census conducted a minimum of once every 5 years. • Increase production of “how too” video’s to improve angling methods to catch more fish.
		Continued complaints about boating angler access.	<ul style="list-style-type: none"> • Convert the existing primitive dirt boat ramp to a concrete ramp. • Install geo-fabric or similar material to improve traction and reduce erosion.
		No boat launching access due to low water levels.	
		Continued complaints about difficulty in reaching the water from parking areas	<ul style="list-style-type: none"> • Work with the Coconino National Forest to build trail network. • Work with local volunteers

		to fish.	to secure labor for trail construction and maintenance.
		Reduced angling participation due to rough shoreline.	
		Reduced angling participation due to rough shoreline.	<ul style="list-style-type: none"> • Build an ADA accessible fishing dock on the east side of the lake to provide access for shore anglers.
		Compliance rate below 95% as recorded by officers during patrol efforts.	<ul style="list-style-type: none"> • Work with Department Law Enforcement personnel for consistent patrol effort and to place regulation signs on Ashurst Lake.

Table 2. Coconino Reservoir Objectives and Adaptive Management Strategies:

<i>Objective 1. Establish a fishable trout population in Coconino Reservoir.</i>			
Parameters	Objective Guideline	Trigger point to address unmet Objectives	Strategies if Objectives are Unmet
Stock Trout	Stock catchable Rainbow trout if numbers of Northern Pike can be eliminated.	Catch rates for Rainbow Trout are below .5 fish per hour.	<ul style="list-style-type: none"> • Stock sufficient numbers of catchable Tiger Trout or Rainbow Trout the first Spring after Pike removal to establish a fishery • Stock sufficient numbers of subcatchable Tiger Trout or Rainbow Trout annually each spring after flow into Ashurst Lake has subsided.
	Stock Tiger Trout under the Featured Species concept.	Catch rates for Tiger Trout are below .5 fish per hour.	
<i>Objective 2. Maintain angler catch rates at or above .5 trout per hour.</i>			
Parameters	Objective Guideline	Trigger point to address unmet Objectives	Strategies if Objectives are Unmet

<p>Angler Catch Rates</p>	<p>Stocked, catchable sized Rainbow Trout overwinter and are caught in spring gillnet surveys.</p>	<p>Numbers of holdover Rainbow Trout caught during spring gillnet survey is less than 20% of the fish caught and 90% of Northern Pike sampled are greater than 400 mm in length. In addition the road access to lake must be closed by the Coconino National Forest at the time of the removal project.</p> <p>Catch rates are below .5 trout per hour as measured by creel survey.</p>	<ul style="list-style-type: none"> • Develop plan to renovate Coconino Reservoir and Ashurst Lake. • Complete necessary clearances and documentation to stock all year long. • Renovate Coconino Reservoir and Ashurst Lake. • Conduct mechanical removal project to reduce Northern Pike numbers. • Increase stocking rates of Rainbow Trout. • Increase size of Rainbow Trout stocked. Conduct education campaign to show novice anglers how to catch trout. • Block the road to Coconino Reservoir to reduce the chance of anyone illegally stocking Coconino Reservoir.
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Background

Ashurst Lake

Ashurst Lake is located on the Coconino National Forest (Forest) on Anderson Mesa at an elevation of 7,110 feet (2,164 m). On average, the lake covers 161 surface acres with a maximum of 229 surface acres. The average depth is 10 feet (3.05 m) with a maximum depth of 25 feet (7.62 m). Ashurst Lake was a shallow, weedy lake that was deepened by the construction of 2 dikes by the Arizona Game and Fish Department (Department) in 1954 (Figure 1, Figure 2).

Ashurst has been managed as a fishery since 1935 with Bluegill *Lepomis macrochirus* being the first species stocked. Other warm water fish such as Largemouth Bass *Micropterus salmoides*, Smallmouth Bass *Micropterus dolomieu*, Black Crappie *Pomoxis nigromaculatus* and “Unknown Sunfish” (Bream) were stocked into Ashurst Lake between 1935 and 1947. The only warm water fish species stocked since the lake was deepened in 1954 is Channel Catfish *Ictalurus punctatus* which were stocked in 1987-88.

The first trout stocking occurred in 1943 with a stocking of Cutthroat Trout *Oncorhynchus clarkii*. Other coldwater species stocked into Ashurst include Rainbow Trout *Oncorhynchus mykiss*, Kokanee *Oncorhynchus nerka*, Brook Trout *Salvelinus fontinalis*, Brown Trout *Salmo trutta*, and Arctic Grayling *Thymallus arcticus*. Rainbow Trout were first stocked in 1944 and have been stocked in the lake most years since the lake was deepened in 1954.

In the 1950's and 1960's, Ashurst Lake was stocked primarily with fingerling Rainbow Trout along with fingerling Kokanee and Brook Trout. The lake was managed as a basic yield or put, grow and take fishery. It was during the 1960's that the fishing at Ashurst Lake reached its peak with the estimated number of Rainbow Trout harvested exceeding 40,000 from 1962-1968, with a high of 65,800 in 1965 (Table 3). These harvest numbers of Rainbow Trout in the 1960's approach or exceed the number of catchable trout currently stocked in the lake (46,000 stocked in 2015 and 31,000 stocked in 2016). Kokanee were first stocked in 1960 but did not return to creel at a high rate. The last stocking of Kokanee was in 1964. Brook Trout were stocked in 1964 and 1967.

During the 1970's Rainbow Trout fingerlings were the primary fish stocked with occasional stockings of Brook Trout. In 1977, Ashurst Lake was treated with rotenone to remove Golden Shiners *Notemigonus crysoleucas* and Green Sunfish *Lepomis cyanellus*.

Reduced growth rates of trout related to increased turbidity and reduced primary productivity in the early 1980's led to a change in management from stocking small trout to stocking catchable trout (> 8 inch) and managing the lake as an intensive use or put and take fishery.

Coconino Reservoir

Coconino Reservoir is a small 31 acre impoundment located just upstream of Ashurst Lake. The dam for Coconino Reservoir was constructed in 1954 to provide water for Ashurst Lake by diverting spring runoff from Ashurst Run through a diversion canal connecting the two reservoirs. Flow from Coconino Reservoir is controlled by a head gate that is opened to allow runoff to fill Ashurst Lake. The Department holds all of the water rights on Coconino Reservoir and Ashurst Lake, except for a total of 4.41 acre feet (1,440,000 gallons) of water combined that are allocated for livestock watering.

Coconino has not been managed as a fishery since the discovery of illegally introduced Northern Pike in 2003. Prior to then the lake was managed as a coldwater fishery with the first stocking of Rainbow Trout occurring in 1955. In addition to Rainbow Trout, Cutthroat Trout were stocked in 1991 and 1992, and Brown Trout were stocked in 1992.

Productivity/Water Quality

Ashurst Lake

Prior to 1981, Ashurst Lake had relatively low turbidity (<50NTU) and satisfactory water quality (pH<9.0) during the spring and early summer months. It did however, occasionally suffer from elevated pH levels (pH> 9.8) in the late summer and fall caused by large cyanobacteria (bluegreen algae) blooms. The elevated pH levels caused partial to total fish kills in 1974 and 1979.

After 1981, turbidity increased in Ashurst Lake, possibly caused by extremely high runoff years in 1980 and 1983. Increased turbidity and suspended solids has been shown to be detrimental to trout growth (Bash et al. 2001).

Ashurst Lake has been chemically treated at least three times to reduce the amount of cyanobacteria. The first treatment occurred in 1962 using copper sulfate, a second in 1975 with Aquazine and a third in 1981 using Simazine.

The only water quality data that has been collected in recent years has been the pH and temperature checks done prior to trout stockings. During years when the lake fills, more comprehensive water quality survey need to be conducted that includes turbidity, and productivity.

Coconino Reservoir

Water quality or productivity has not been measured on Coconino in many years. When a trout fishery is re-established, periodic water quality surveys will be performed to monitor conditions.

Forage/Prey

Ashurst Lake

The majority of the forage for Rainbow Trout in Ashurst Lake consists of zooplankton and Chironomids (midge larvae). Northern Pike primarily feed on Fathead Minnows and stocked Rainbow Trout. Both species will also forage on Northern Crayfish *Orconectes virils* when other prey items are not available.

Prior to 1981, Ashurst Lake had abundant zooplankton numbers and fish growth was excellent. Diet studies on the trout indicated that they were consuming primarily zooplankton in the genus *Daphnia* and midges of the family Chironomidae (Citation). Trout growth decreased in the early 1980s as the turbidity of the lake increased.

A Masters study was conducted by J. R. Simms between May 1985 and October 1986 to look at the reduction of trout growth and possible causes (Simms 1987). The study evaluated water quality, turbidity, zooplankton numbers, trout diet, growth and condition. During 1985, the turbidity ranged between 32 and 58 Nephelometric Turbidity Units (NTU) while in 1986 it ranged from 75 to 122 NTU. Zooplankton abundance was high in 1985, ranging from 5.8 to 12.7 ml/m³. In 1986, the zooplankton abundance was lower ranging from .9 to 8.3 ml/m³ with the zooplankton numbers falling when the turbidity exceeded 85 NTU. Benthic organisms, which were dominated by Chironomidae, followed the same pattern as the zooplankton. During 1985 and March-June of 1986 *Daphnia* was the primary food item detected in trout stomachs by volume. *Daphnia* also occurred in more than 50% of the stomachs with food items during that time frame. Chironomids were the second most common prey item found in the stomachs by frequency of occurrence. During July – October of 1986, when the turbidity exceeded 85 NTU, *Daphnia* found in stomachs dropped as the zooplankton abundance dropped to below 4 ml/m³. The primary food items after July of 1986 were Fathead Minnow *Pimephales promelas* and crayfish. When Rainbow Trout switched from *Daphnia* to other food items, their average condition factor (KTL) dropped from .92 in June to .69 in October.

In 2014 and 2015, the water level in Ashurst Lake was extremely low with very little runoff to fill the lake. Turbidity was low and Rainbow Trout grew well over the winter with holdover fish over 14 inches being regularly caught in the spring and early summer months. Turbidity should be monitored routinely to act as a reasonable predictor of zooplankton abundance for any given month.

Turbidity remained low after the lake filled in 2017. While turbidity was not measured directly, sechi disk depth was measured during of plankton sampling. On July 12, the sechi depth was 1.2 meters and it was 2.5 meters on August 22, 2017.

Turbidity Reduction

There are three actions that may reduce turbidity in Ashurst Lake. A reduction in turbidity would increase the amount of zooplankton available for trout forage.

1. Watershed rehabilitation

Work with the Coconino National Forest to improve the conditions of Ashurst Run. Reduction of the amount of silt flowing into the lakes would improve the conditions for fish by increasing the amount of aquatic vegetation in the lake. Reduced turbidity would increase zooplankton production.

2. Seeding of the lake bottom to reduce erosion during filling

Explore the possibility of seeding the lake bottoms in Coconino Reservoir and Ashurst Lake with grass during low water years. Grass would tie up some of the sediment during years when the lake refills to reduce the erosion of the lake bottom, reducing the amount of suspended sediment in the lake.

3. Alum treatment

Alum can be used to reduce the turbidity in the lake. Alum (Potassium Aluminum Sulfate) causes suspended sediment to flocculate (stick together) and settle out of the water. Reducing the turbidity would increase the amount of zooplankton available for trout forage. Alum treatments would also reduce the amount of available phosphorus for cyanobacteria which could reduce the possibility of blooms that cause fish kills.

Coconino Reservoir

Similar to Ashurst Lake, Coconino is a very turbid lake when it has water in it. Forage in Coconino is limited to zooplankton, crayfish and smaller Northern Pike. If Northern Pike were removed, turbidity reduction would be necessary to improve forage in Coconino.

Habitat

Ashurst Lake

Aquatic macrophytes are the primary fish habitat found in Ashurst Lake. The macrophytes are only present during low water years and years when the lake is clear enough for light penetration to promote plant growth. Crayfish and suspended sediment are the main threats to the existing fish habitat in Ashurst Lake through their reduction of aquatic vegetation.

The primary habitat improvements needed on Ashurst Lake to improve forage for trout is to reduce the turbidity of the lake. The lake may also require occasional use of herbicides to control cyanobacteria (blue-green algae) blooms.

Coconino Reservoir

The primary habitat improvements needed on Coconino Reservoir to improve forage for trout is to reduce the turbidity of the lake. The lake may also require occasional use of herbicides to control cyanobacteria blooms.

Species

Ashurst Lake

The primary species currently found in Ashurst Lake are stocked Rainbow Trout and the illegally introduced Northern Pike. One Black Crappie was caught during gillnet surveys in 2010 and anglers reported catching a few Green Sunfish *Lepomis cyanellus* and Black Crappie during the 2009 and 2011 creel census. Fathead Minnows (*Pimephales promelas*) were observed in 2018.

Illegal introductions of fish species into Ashurst by the public has occurred since at least the 1960's. The lake was treated with rotenone in 1970 and 1977 to remove illegally stocked Golden Shiners, Green Sunfish and bullhead catfish. Northern Pike were illegally introduced into the lake in about 1996 and established a population. The current state record Northern Pike, 32 pounds 5.6 ounces, was caught in Ashurst Lake in 2004 by a trout angler using a marshmallow for bait.

In early April 2011, a mechanical removal of Northern Pike was attempted on Ashurst Lake using 30 gillnets set over a one week period. A total of 201 Northern Pike were removed (estimated 98% of Northern Pike vulnerable to 2 inch gill nets).

Based on creel surveys done after the removal, catch rates for trout increased substantially. Therefore, each spring, prior to the Forest opening the road to the public, gillnets are set in the lake to determine if another mechanical pike removal is needed. A removal is needed when very few or no holdover Rainbow Trout are caught and the number of large Northern Pike caught is relatively high. The nets are set prior to the opening of the road to allow a mechanical removal to take place, if needed, without the large number of nets and boats interfering with angling opportunity.

Gillnets were set in the spring of 2012, 2014, 2015, 2016 and 2018 to determine if another intensive Northern Pike removal was needed. Prior to 2018, relatively large numbers of holdover Rainbow Trout were caught during each of the surveys, when compared to the number of Northern Pike caught, indicating a removal was not needed that year. The 2013 spring gillnet survey was not conducted because the road to the lake was opened to the public prior to the scheduled sampling date. In addition, anglers had reported they were catching Rainbow Trout which indicated that the Northern Pike population was not at a level where most of the stocked trout were being eaten.

In 2012, eight 150 foot gill nets with 1.5 inch mesh were set overnight in Ashurst Lake. A total of 58 Northern Pike and 298 Rainbow Trout were caught during the survey gillnet surveys. During

the spring 2014 gillnet survey 12 nets were set and 42 Northern Pike and 191 Rainbow Trout were caught. In 2015 2 Northern Pike and 151 Rainbow Trout were caught in 4 gillnets. Sampling was conducted in 2016 even though water levels were extremely low making launching the boat difficult. A total of 41 Rainbow Trout and 16 Northern Pike were caught in 4 gillnets. The large number of holdover Rainbow Trout caught during spring gillnet sampling in both years indicated that Northern Pike removals were not needed (Figure 8).

Sampling was not conducted in 2017 because the lake filled to spilling after a record low lake level in 2016.

On March 8, 2018, four 150 foot long gill nets with 1.5 inch mesh were set in Ashurst Lake to determine if a pike removal might be needed. A total of 58 Northern Pike, 85 Rainbow Trout and 10 Brown Trout were captured during the sampling (Table 4). Of the trout caught 24 Rainbow Trout and 8 Brown Trout were released back into the lake. The Northern Pike caught averaged 650.8 mm in length and 2,301.3 grams in weight with a maximum length of 814mm and a minimum length of 414 mm (Table 5, Figure 5). The Rainbow Trout measured averaged 357.1 mm in length and 525 grams in weight with a maximum length of 406mm and a minimum length of 314mm (Table 5, Figure 6). The 2 Brown Trout measured were 329 mm and 314 mm in length. The relative weights for the Northern Pike captured were all over 100 indicating fat healthy fish (Figure 7). The relative weights for the rainbow trout measured were all above 80 (Figure 12).

The relatively high number of Northern Pike caught during the 2018 sampling along with the relatively few trout caught, especially when compared to past spring surveys, may indicate that another Northern Pike removal is needed (Figure 8). The size of the Northern Pike and their relative weights are similar to past year's sampled fish (Figure 9 and Figure 10). The size and relative weights of the Rainbow Trout measured in 2018 were also similar to past year's sampled fish (Figure 11, Figure 12).

The primary forage source for the illegally stocked Northern Pike in the lake is stocked Rainbow Trout. According to a study done by Nilsson, and Brönmark (2000) a 400mm (15.7 inches) Northern Pike can consume prey over 50mm (2 inches) in body depth. A 500mm (19.5 inches) pike can consume prey about 65mm (2.55 inches) in body depth and a 600mm (23.6 inches) pike prey over 75mm (3 inches) in depth. This means that most stocked catchable Rainbow Trout are vulnerable to predation by pike over 500mm and some are vulnerable to Pike over 400mm. In 2018, 96.6% of the Northern Pike captured were over 500mm and all of the Pike were over 400mm.

There are two general activities that need to occur to meet the fish population objectives for Ashurst Lake: Northern Pike control and trout stocking.

For Northern Pike control there are 2 alternatives: Complete removal and mechanical population management of the Northern Pike.

Alternative 1. Complete removal of Northern Pike from Ashurst Lake and Coconino Reservoir.

To have the best chance of meeting the goals of having 80% of the anglers' rate the fishing as fair,

good or excellent, and of maintaining catch rates at or above .5 trout per hour, the Northern Pike would be removed from both Ashurst Lake and Coconino Reservoir. During the 2003, 2009, and 2011 creel census anglers were asked if they would support the removal of Northern Pike from Ashurst Lake and Coconino Reservoir, even if it meant these waters would remain fishless for a year. The majority of the anglers surveyed during 2003(55%), 2009(63%), and 2011(93%) supported Northern Pike removal (Table 11).

Step 1. Remove Pike from Coconino Reservoir

The Department should drain Coconino Reservoir (via the outlet pipe if it is still operational) to remove pike from the lake. If draining is not possible, chemically treat the reservoir at the same time as Ashurst Lake.

Step 2. Treat Ashurst Lake

Ashurst Lake would be treated with rotenone or pumped dry during a low water year to remove Northern Pike.

Alternative 2. Complete removal of Northern Pike is not possible.

Northern Pike Population Management

Northern Pike would be “controlled” using mechanical removal as needed. Major removal projects should only take place in years where holdover trout are in low numbers.

Step 1. Determining if a Northern Pike removal is needed

To determine if a removal project is needed, 4-6 gill nets should be set in the lake prior to the road to the lake opening in the spring. A control effort will be conducted based on catch rates of large Northern Pike and holdover Rainbow Trout.

Step 2. Conduct Northern Pike removal project

If a major removal project is needed, Northern Pike will be removed using 20-40 1.5 inch mesh gill nets. The majority of the nets are set in shallow areas near where the ditch from Coconino Reservoir flows into Ashurst prior to the headgates being opened on Coconino. Northern Pike seem to be attracted to the inflowing water so nets set near the inflow appear to be more effective at catching pike. Nets should also be set in other parts of the reservoir since they also catch pike.

Trout Stocking

There are 3 different possible stocking regimes for Ashurst Lake depending on whether Northern Pike are completely removed from the system or if the population is just controlled. All of the regimes involve stocking enough trout to achieve a catch rate of at least .5 trout per hour and a fishing satisfaction of at least 80% of respondents reporting the fishing as fair, good or excellent. There are 2 potential stocking regimes that could meet these goals if all of the Northern Pike are removed and one if the Northern Pike population is just managed.

Complete Removal of Northern Pike

Complete removal of pike allows smaller fish to be stocked which reduces cost for stocking. Alternative 1 is the Basic Yield Management approach and Alternative 2 is the Intensive Use Management Approach

Alternative #1 (Basic Yield Management).

The most cost effective and efficient way to achieve the stocking rates necessary to achieve this goal would be to stock fingerling Rainbow Trout in the spring (100,000) and fall (50,000) or subcatchables in the fall (75,000) and allow the lake to grow them to a catchable size. To grow trout in Ashurst Lake, zooplankton, especially *Daphnia*, have to be available in sufficient amounts and the turbidity of the water must be low enough that the trout can successfully feed on the *Daphnia*. In 1986, zooplankton numbers were greatly reduced when the turbidity exceeded 85 NTU (Sims 1987). Stock 5,000 subcatchable Rainbow Trout in Coconino Reservoir each year

Alternative #2 (Intensive Use Management).

The Departments Standard Fish Sampling Protocol allows for stocking trout in an Intensive Use concept fishery at 100-400 trout per acre annually. Therefore, begin the stocking regime at 55,000 catchable (2.5 fish/pound) Rainbow Trout annually. Stock 5,000 subcatchable Rainbow Trout in Coconino Reservoir annually and evaluate survival and growth.

Northern Pike Population is managed (not removed)

If Northern Pike are still in the lake, the trout stocked need to be larger to reduce the loss to predation. The larger the stocked fish the fewer Northern Pike that are large enough to prey on them. Currently Ashurst Lake is food limited for smaller Northern Pike that can't prey on stocked Trout.

Alternative #1 (Intensive Use Management).

Begin the stocking regime at 55,000 catchable Rainbow Trout each year with a minimum size of 2 fish per pound as per the Departments Standard Fish Sampling Protocol (SFSP).

Regardless of which alternative is implemented, law enforcement will be critical to management of both Ashurst and Coconino Reservoirs. Movement of species among water bodies continues and is not expected to come to a complete stop. Therefore, the regional aquatics program is committed to work with Department Law Enforcement personnel for a consistent patrol effort and to place regulation signs on both Ashurst and Coconino. A goal of 95% compliance with rules and regulations as recorded by officers during patrol efforts will be our target.

Coconino Reservoir

From spot check net surveys, Northern Pike are the only fish that are in Coconino Reservoir are Northern Pike.

Prior to the establishment of Northern Pike, Rainbow Trout were stocked in Coconino Reservoir. Anglers who fished the lake reported catching larger Rainbow Trout than they caught at Ashurst. Management of Coconino Reservoir would be as a featured species fishery with either Tiger Trout or Rainbow Trout.

As with Ashurst, to be successful with the goals of managing Coconino Reservoir for trout, and maintaining a catch rate of .5 trout per hour, Northern Pike should be completely eliminated from the reservoir.

Draining of Coconino Reservoir should be considered during one summer to remove it as a source of Northern Pike. The presence of a valve in the dam may allow the reservoir to be drained into Breezy Lake to provide water for the cattle that usually water at Coconino Reservoir. If draining is not possible the lake should be chemically treated to remove Northern Pike.

After complete removal of Northern Pike from the reservoir, 3,000 catchable Tiger Trout or Rainbow Trout should be stocked to establish the fishery as per SFSP.

Access

Ashurst Lake

Access to Ashurst Lake is by a Forest maintained gravel road. Two Forest campgrounds are found along the lakeshore; Ashurst Campground on the west side of the lake and Forked Pine Campground on the east side of the lake. A dirt boat ramp is located on the northwest side of the lake near the Ashurst Campground. There are numerous parking spots for shore access around the lake.

Steps need to be taken to insure safe access is maintained for anglers at Ashurst Lake. Periodic road maintenance needs to be conducted by the Forest to insure safe road access.

The current primitive dirt boat ramp is unusable at many water levels. It needs to be replaced with a concrete ramp.

Development of an “official trail network” around the lake would improve shore angler access. The placement of a fishing pier on the east side of the lake that is ADA accessible would improve shore access to the lake.

Coconino Reservoir

Access to Coconino Reservoir is on a rough dirt road from Ashurst Lake. This road would be easy to block off with a gate (Figure 2) or by other methods to reduce the ability of individuals to move Northern Pike back into Coconino if renovations are completed. It is not anticipated that Coconino Reservoir would receive the angling pressure that Ashurst Lake receives. Therefore, it would be beneficial to create a walk-in type fishery. Other walk in type fisheries have been established in the Region and around the state. It would require an approximate quarter of a mile walk to get from a parking area that would need to be created, to the water at Coconino.

Catch

Ashurst Lake

Creel census surveys were conducted on Ashurst Lake in 2009 (Table 4) and 2011 (Table 5). Angler use was low when compared to that in 1995 and 1996 (Table 6). The low return of stocked

Rainbow Trout to the creel in 2009 (Table 7) triggered the mechanical removal project for Northern Pike in 2010.

The 2011 creel census was post pike removal to determine if return to creel of stocked Rainbow Trout would increase from the 2009 survey. Angler days in 2011 were estimated at 17,711 angler days. Catch rates were .15 fish per hour in 2009 and .29 fish per hour in 2011. The return to creel in 2011 improved from that observed in 2009 (Table 8).

A number of things need to happen to achieve a consistent catch rate of .5 fish per hour at Ashurst. This lake has shown that when it receives sufficient water from snowmelt, and is stocked at sufficient levels, angler catch rates can approach 1 fish per hour. Control of the Northern Pike population and reducing turbidity will also greatly contribute to increasing angler catch rates. Creel census is the only means of determining angler use, harvest and satisfaction on Ashurst Lake and Coconino Reservoir. Creel Census can also alert the Department to illegal species introductions. Since angler satisfaction and catch rate are one of the metrics used to determine if the objectives for Ashurst Lake and Coconino Reservoir are met, creel census needs to be conducted on the lakes at least once every 5 years.

Coconino Reservoir

Creel census could be done in conjunction with Ashurst Lake. Creel has not been done at Coconino since the 1990's.

Satisfaction

Ashurst Lake

Satisfaction on any lake is difficult to judge as satisfaction is often not clearly defined. During the 2009 and 2011 creel, angler satisfaction was measured two ways. The first was fishing satisfaction; anglers were asked how they would rate the fishing (number of fish caught, catch rates, size and quality of fish) independent from any other factors that might influence their overall experience. The second was overall satisfaction. This included all of the factors (weather, scenery, number or people at the lake, quality of facilities, etc.) that effect their enjoyment or lake experience. In 2009, 27% of the anglers rated fishing as good or excellent while in 2011 35% rated fishing as good or excellent. Most of the anglers rated the overall experience of fishing the lake as good or excellent in both 2009 and 2011 (Table 9 and 10). These results show the importance of defining or separating the various different definitions of what satisfaction could mean to an angler.

To meet the objective of 80% of the anglers on Ashurst Lake rating the fishing as fair, good or excellent, the Department must increase catch rates and/or the quality of fish being stocked as well as caught. The Department's goal is to manage the lake in such a manner to return to the glory days of Ashurst Lake in the 1960's.

Coconino Reservoir

Satisfaction questions will be asked during any future creel efforts at Coconino.

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Tables and Figures

Table 3. Rainbow Trout Harvested Annually from Ashurst Lake, 1959-1967 Estimated Number Harvested is from Creel Census Data.

Year ¹	Estimated ² Number Harvested	# Fingerlings Stocked Previous Year All Species
1959	31,915	115,000
1960	28,913	116,220
1962	57,399	189,900 ³
1963	42,925	200,615
1964	65,897	159,930
1965	43,342	240,748 ⁴
1966	50,857	170,075
1967	35,648	166,900

¹ The years 1964 through 1967 are from a period beginning March 1 through November 31. The previous years are for a full 12 months.

² Data from the 1967 Sport Fish Investigations Completion Report

³ Includes 9,600 Kokanee

⁴ Includes 99,940 Kokanee and 10,140 Brook Trout

Table 4. Percent of Catch and Catch per Net Night for Fish Species Caught During Gillnet Surveys on Ashurst Lake March 8-9, 2018.

Species	Number	% of Catch	Fish per Net Night
Rainbow Trout	85	55.6%	21.25
Brown Trout	10	6.5%	2.5
Northern Pike	58	37.9%	14.5

Table 5. Ashurst Lake Length and Weights for Fish Measured March 8-9, 2018.

Species	Average Length mm	Length Range mm	Average Weight Grams
Rainbow Trout	357.1	314-406	525.1
Brown Trout	320	311-329	324.3
Northern Pike	650.8	414-814	2,301.3

Table 6. 2009 Ashurst Lake Monthly Creel Census Expanded Totals Catch and harvest rates were calculated using reported catch, harvest, and angler hours and may not match expanded totals. October data was only collected on one weekend because of a change in priorities. *No boat anglers were interviewed during one or more strata (week day or weekend/holiday day) during the month.

Month	Angler Days Using 3.8 Hours Ashurst Mean Length of Angler Day	Angler Hours	Catch (Catch Rate in Fish/Hour)	Harvest (Harvest Rate in Fish/Hour)	% Anglers who Caught Fish
April	709	2,690.67	725(0.188)	441 (0.127)	19.6%
May	3,152	11,974	1,916* (0.193)	1,729* (0.163)	32.8%
June	2,234	8,488	1,943* (0.173)	1,611* (0.148)	36.6%
July	2,346	8,913.33	820* (0.117)	491* (0.087)	25.5%
August	1,270	4,824	620 (0.099)	443 (0.084)	22.8%
September	780	2,961	815* (0.173)	765* (0.150)	29.3%
October	137	520	56* (0.155)	37* (0.077)	20%
Total	10,624	40,371	6,895 (0.154)	5,517 (0.127)	29%

Table 7. 2011 Ashurst Lake Monthly Creel Census Expanded Totals. Catch and harvest rates were calculated using reported catch, harvest, and angler hours and may not match expanded totals. October data was only collected on three weekend days because of a change in priorities.

Month	Angler Days Using 2.4 Hours Ashurst Mean Length of Angler Day	Angler Hours	Catch (Catch Rate in Fish/Hour)	Harvest (Harvest Rate in Fish/Hour)	% Anglers who Caught Fish
April	917	2,200	572 (.26)	440 (.20)	29.1%
May	2,108	5,059.33	1,500 (.30)	1,120 (.22)	29.1%
June	4,137	9,929.6	2,972 (.30)	2,335 (.24)	36.3%
July	5,478	13,148	3,462 (.26)	3,353 (.25)	35.8%
August	2,930	7,032	1,746 (.25)	1,048 (.15)	28.8%
September	1,664	3,993.6	1,197 (.30)	1,137 (.28)	26%
October	477	1,144	306 (.27)	306 (.27)	31.8%
Total	17,711	42,506.53	12,125(.29)	10,023 (.24)	32.3%

Table 8. 1995 and 1996 Ashurst Lake Expanded Creel Numbers.

Year	Angler Days	Angler Hours	Catch (Catch Rate Fish/Hour)	Harvest (Harvest Rate Fish/Hour)	% of Stocked Trout Caught	% of Stocked Trout Harvested	% Successful
1995	25,941	79,117.7	35,176 (0.445)	26,496 (0.334)	58.6%	44.2%	52%
1996	24,940	59,107.9	20,452 (0.346)	17,048 (0.288)	40.5%	33.7%	37.9%

Table 9. 2009 Ashurst Lake Creel Census Species Caught and Harvested.

Species	Number Caught (Percent of Catch)	Number Harvested (Percent of Harvest)	Expanded Number Caught (Percent return of stocked trout)	Expanded Number Harvested (Percent return of stocked trout)
Rainbow Trout	772 (97.4%)	641 (98.5%)	6,716 (15.3%)	5,434 (12.4%)
Northern Pike	17 (2.1%)	10 (1.5%)		
Green Sunfish	3 (0.4%)			
Black Crappie	1 (0.1%)			

Table 10. 2011 Ashurst Lake Creel Census Species Caught and Harvested.

Species	Number Caught (Percent of Catch)	Number Harvested (Percent of Harvest)	Expanded Number Caught (Percent return of stocked trout)	Expanded Number Harvested (Percent return of stocked trout)
Rainbow Trout	487 (97.2%)	439 (99.3%)	11,763 (32%)	9,955 (27%)
Northern Pike	4 (0.8%)	3 (0.7%)		
Green Sunfish	9 (1.8%)			
Black Crappie	1 (0.2%)			

Table 11. 2009 Ashurst Creel Census Angler Satisfaction Questions.

Question	Very Poor	Poor	Fair	Good	Excellent
How Would You Rate Today's Fishing?	140 (25%)	117 (21%)	156 (27%)	96 (17%)	59 (10%)
How Would You Rate Today's Visit?	7 (1%)	17 (3%)	77 (14%)	165 (29%)	302 (53%)

Table 12. 2011 Ashurst Lake Creel Census Angler Satisfaction Questions.

Question	Very Poor	Poor	Fair	Good	Excellent
How Would You Rate Today's Fishing?	81 (23%)	72 (21%)	73 (21%)	89 (25%)	34 (10%)
How Would You Rate Today's Visit?	1 (0.3%)	4 (1.2%)	20 (5.7%)	131 (37.4%)	194 (55.4%)

Table 13. 2011 Ashurst Lake Pike Removal Question from 2011 and 2009 Creel Census and 2003 Angler Questionnaire.

Question	Yes	No	No Opinion
2011- Would you support the removal of illegally introduced fish species (Northern Pike) from Ashurst Lake and Coconino Reservoir, understanding that any removal program could result in the lake being fishless for the winter?	325 (93%)	10 (3%)	16 (4%)
2009- Would you support the removal of illegally introduced fish species (Northern Pike) from Ashurst Lake and Coconino Reservoir, understanding that any removal program could result in the lake being fishless for the winter?	355 (63%)	107 (19%)	103 (18%)
2003 - Would you support the removal of illegally introduced fish species (Northern Pike) from Ashurst Lake and Coconino Reservoir, understanding that any removal program could result in the lake being fishless for a couple of years?	372 (55%)	229 (34%)	77 (11%)

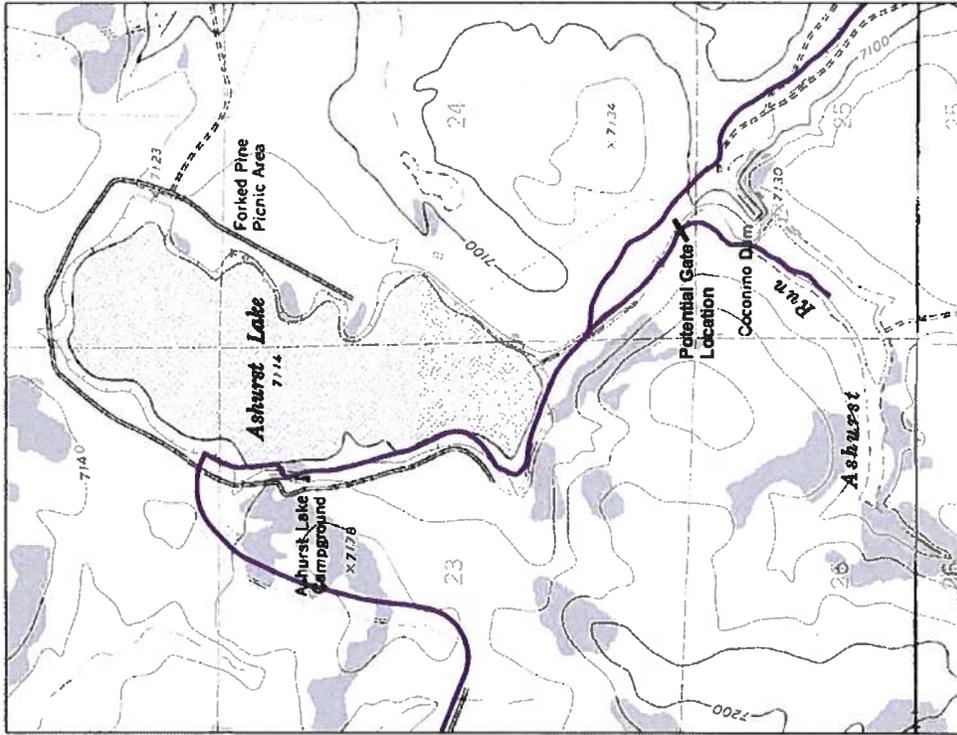
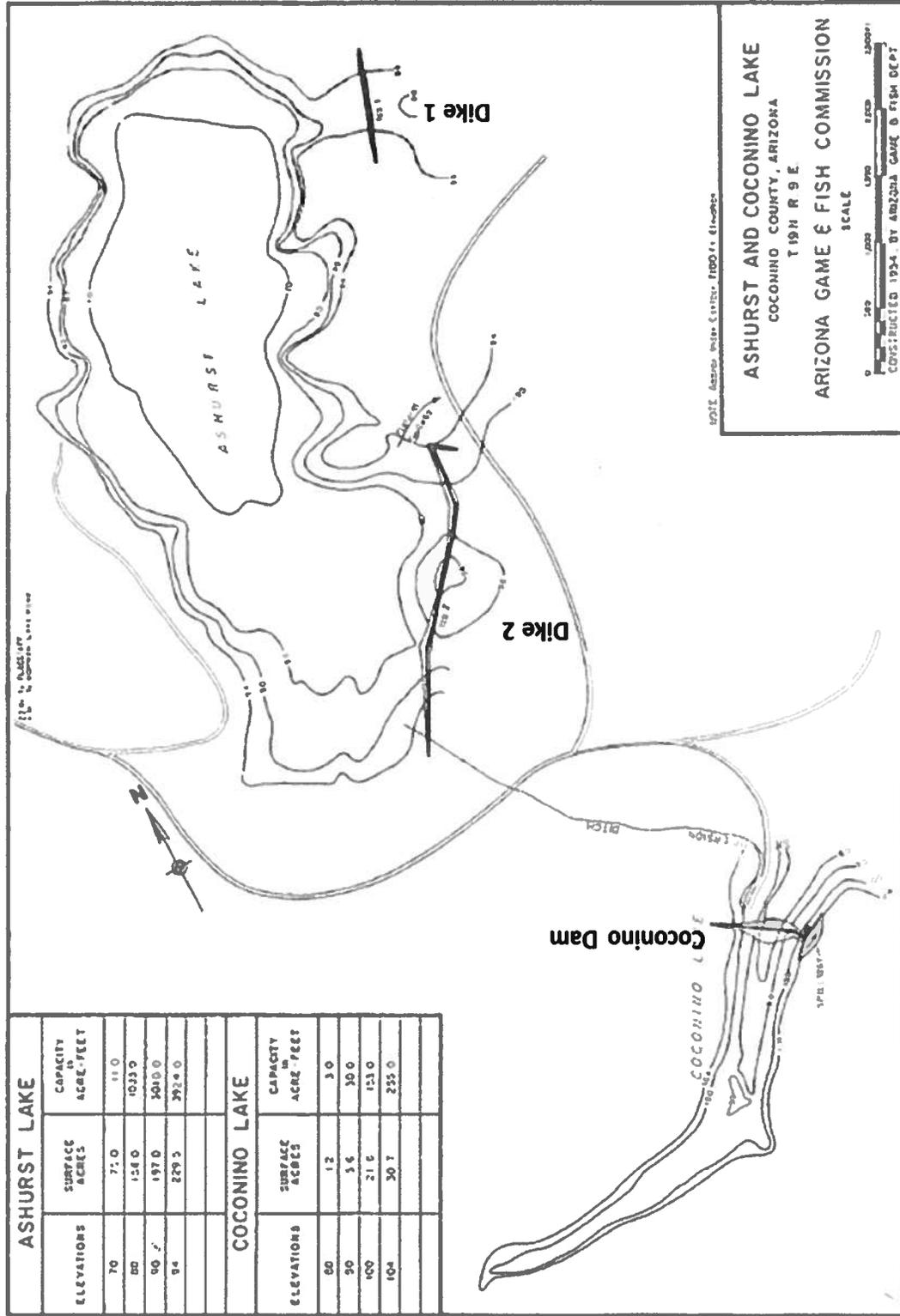


Figure 2. Map of Potential Gate Placement Site on Road to Coconino Reservoir.



ASHURST LAKE		
ELEVATIONS	SURFACE ACRES	CAPACITY IN ACRES-FEET
70	71.0	11.0
80	154.0	1033.0
90	197.0	3000.0
94	229.5	3974.0
COCONINO LAKE		
ELEVATIONS	SURFACE ACRES	CAPACITY IN ACRES-FEET
80	12	3.0
90	5.6	30.0
100	21.6	153.0
104	30.7	255.0

Figure 3. Original Drawing of Ashurst Lake and Coconino Reservoir Showing Locations of Dikes.

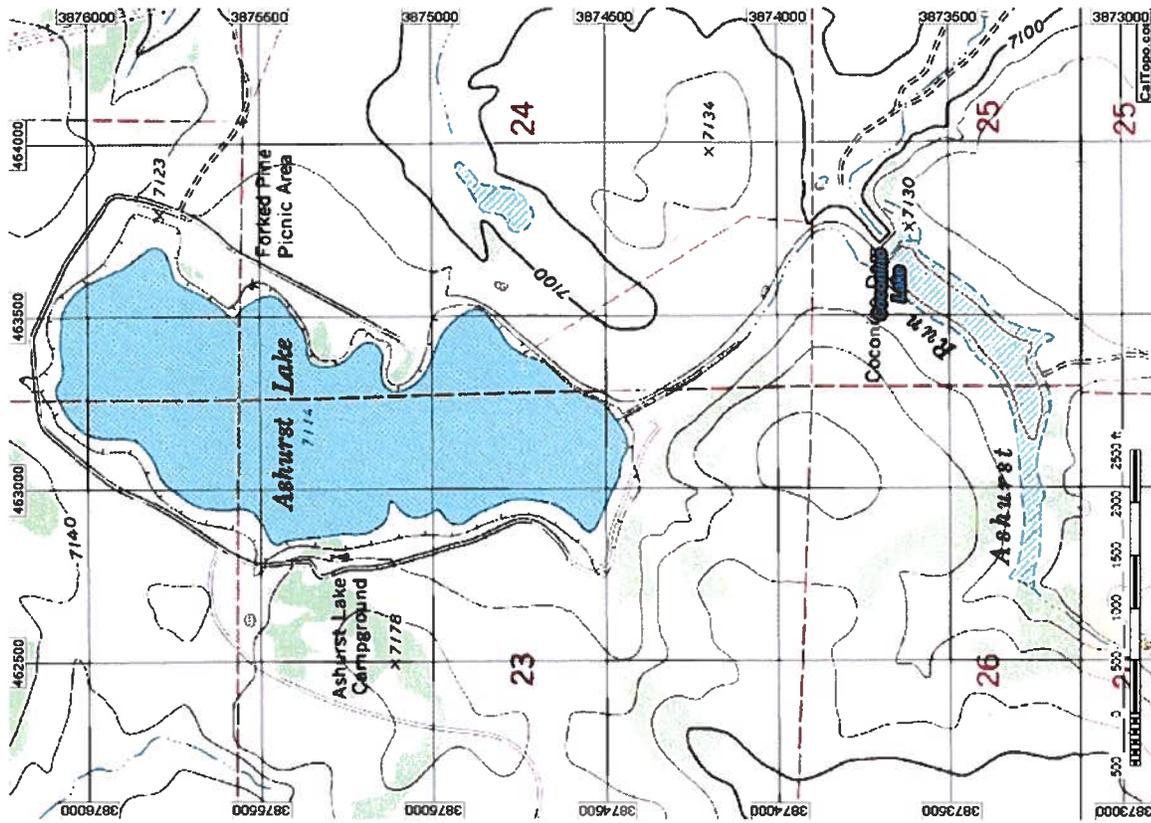


Figure 4. Map of Ashurst.

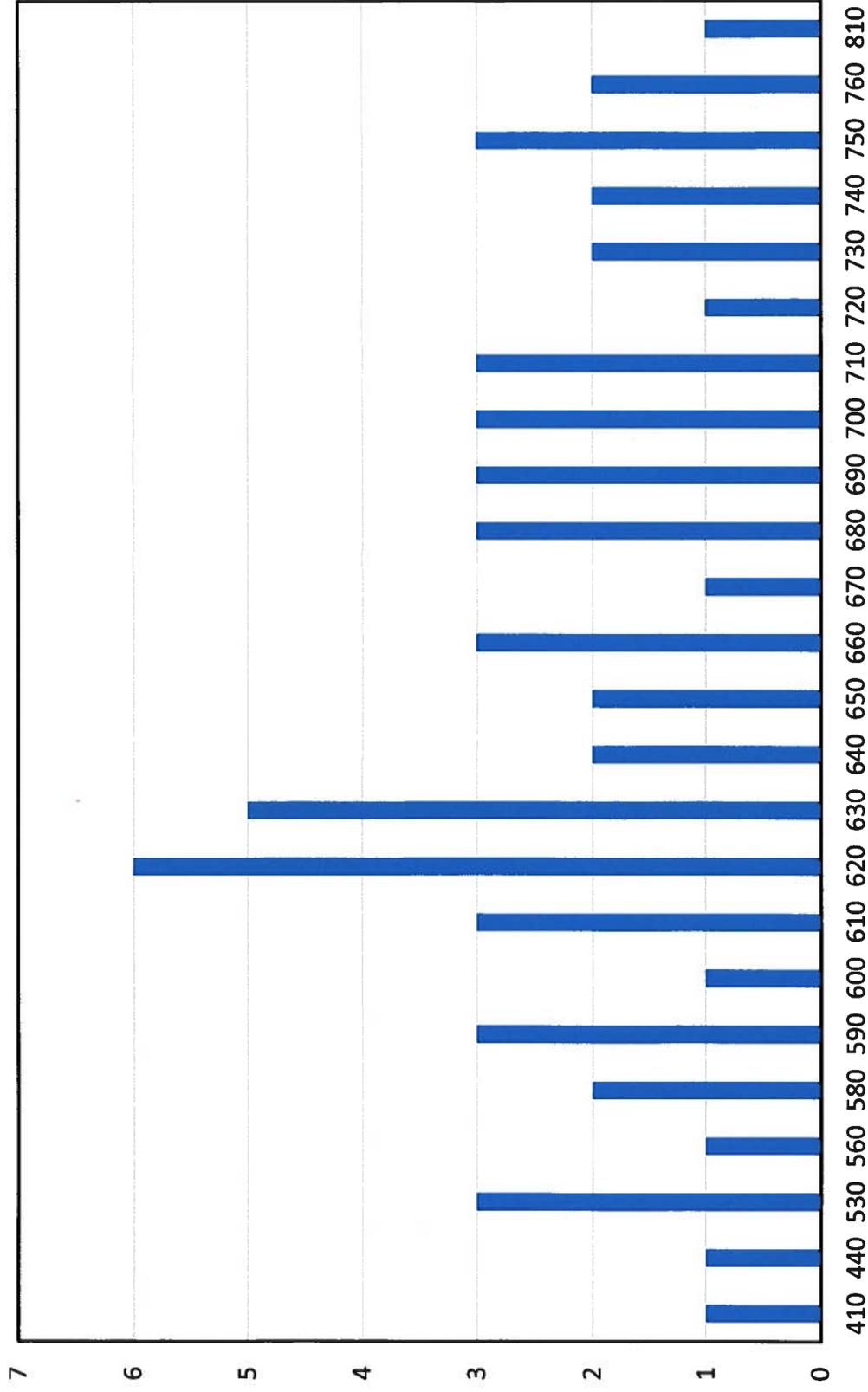


Figure 5. 10mm Length Frequency for Northern Pike Captured by Gillnet from Ashurst Lake March 8-9, 2018.

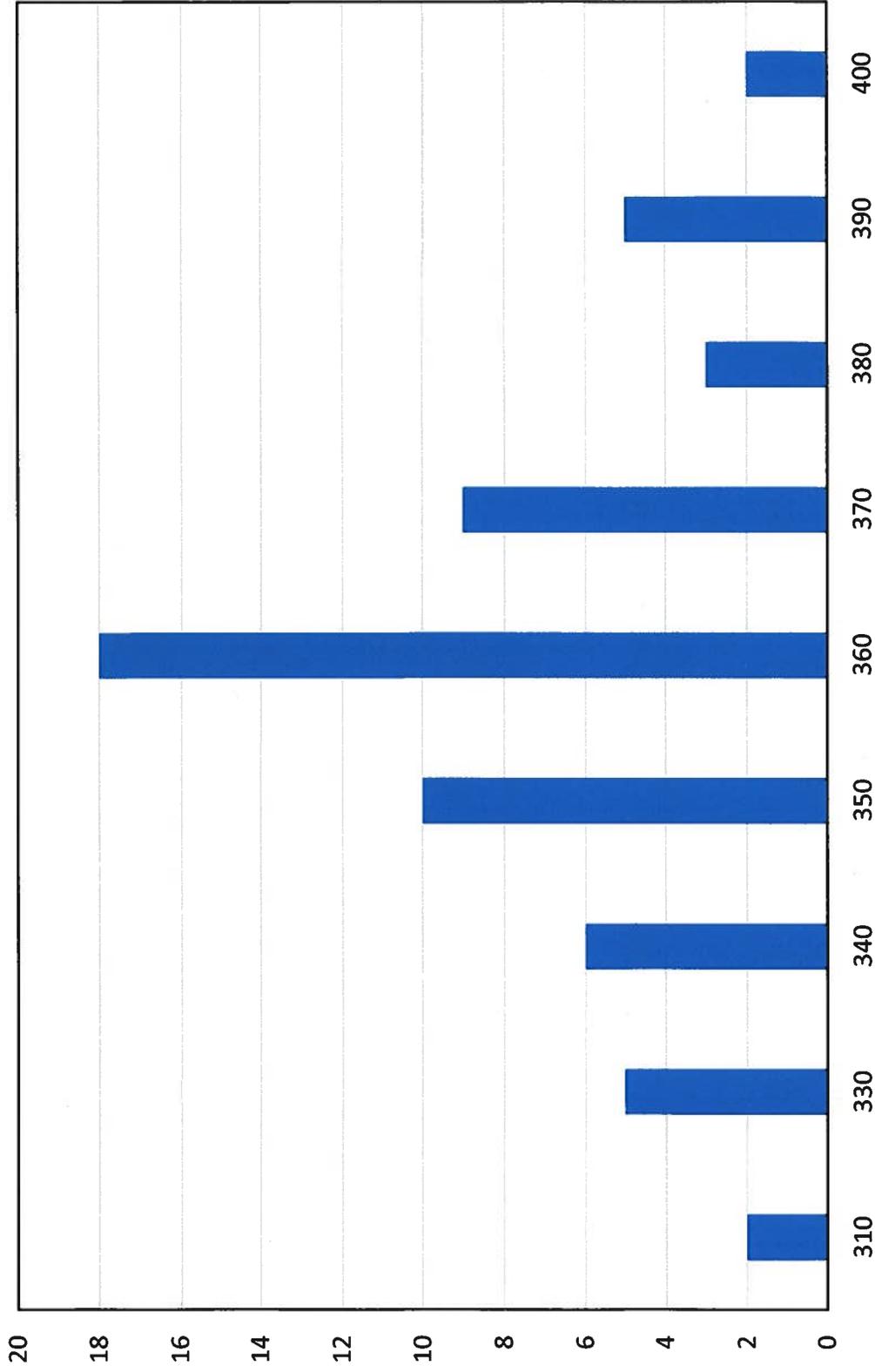


Figure 6. 10mm Length Frequency for measured Rainbow Trout Captured by Gillnet from Ashurst Lake March 8-9, 2018.

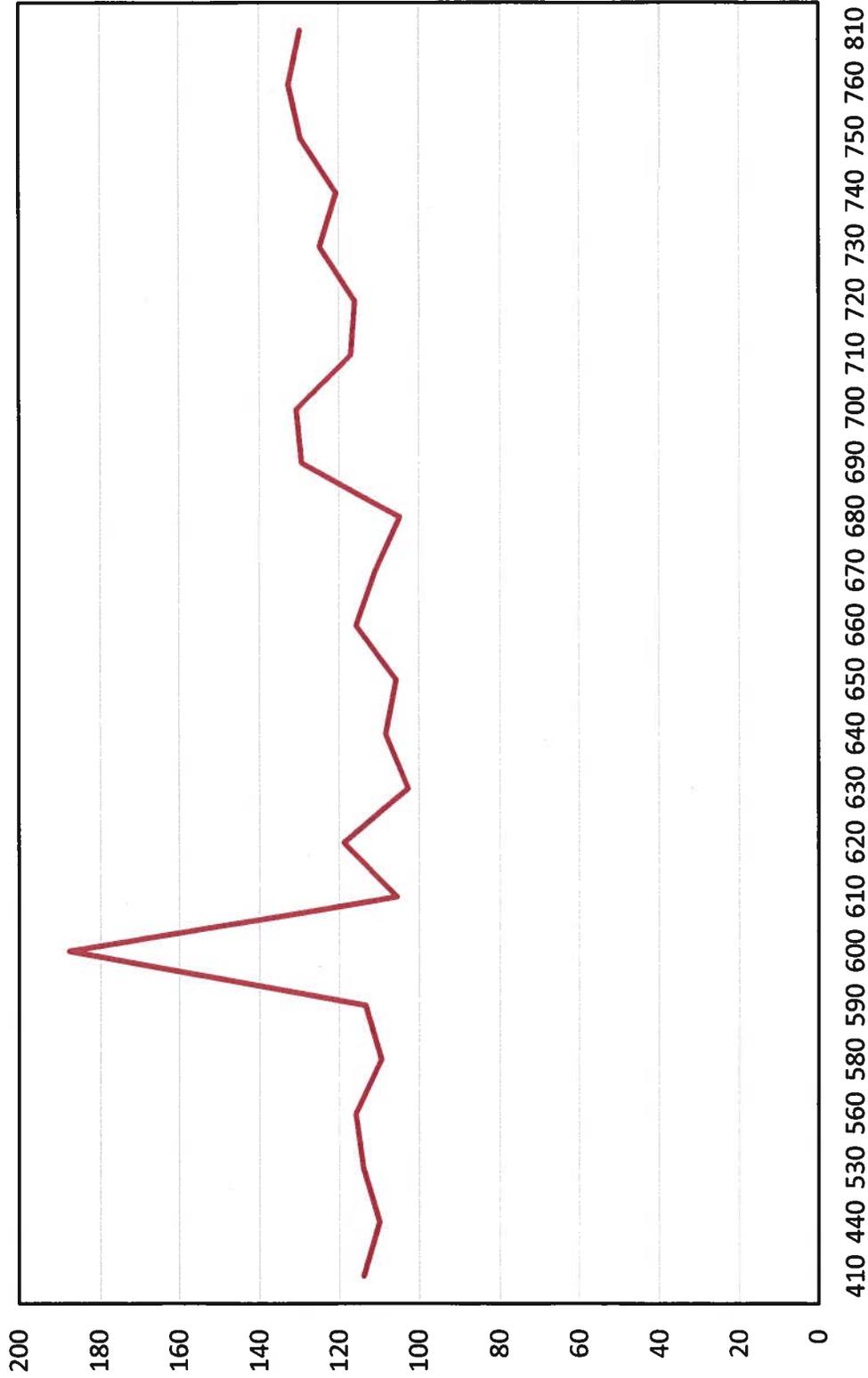


Figure 7. Average Relative Weight by 10mm Length Frequency for Northern Pike Captured by Gillnet from Ashurst Lake March 8-9, 2018.

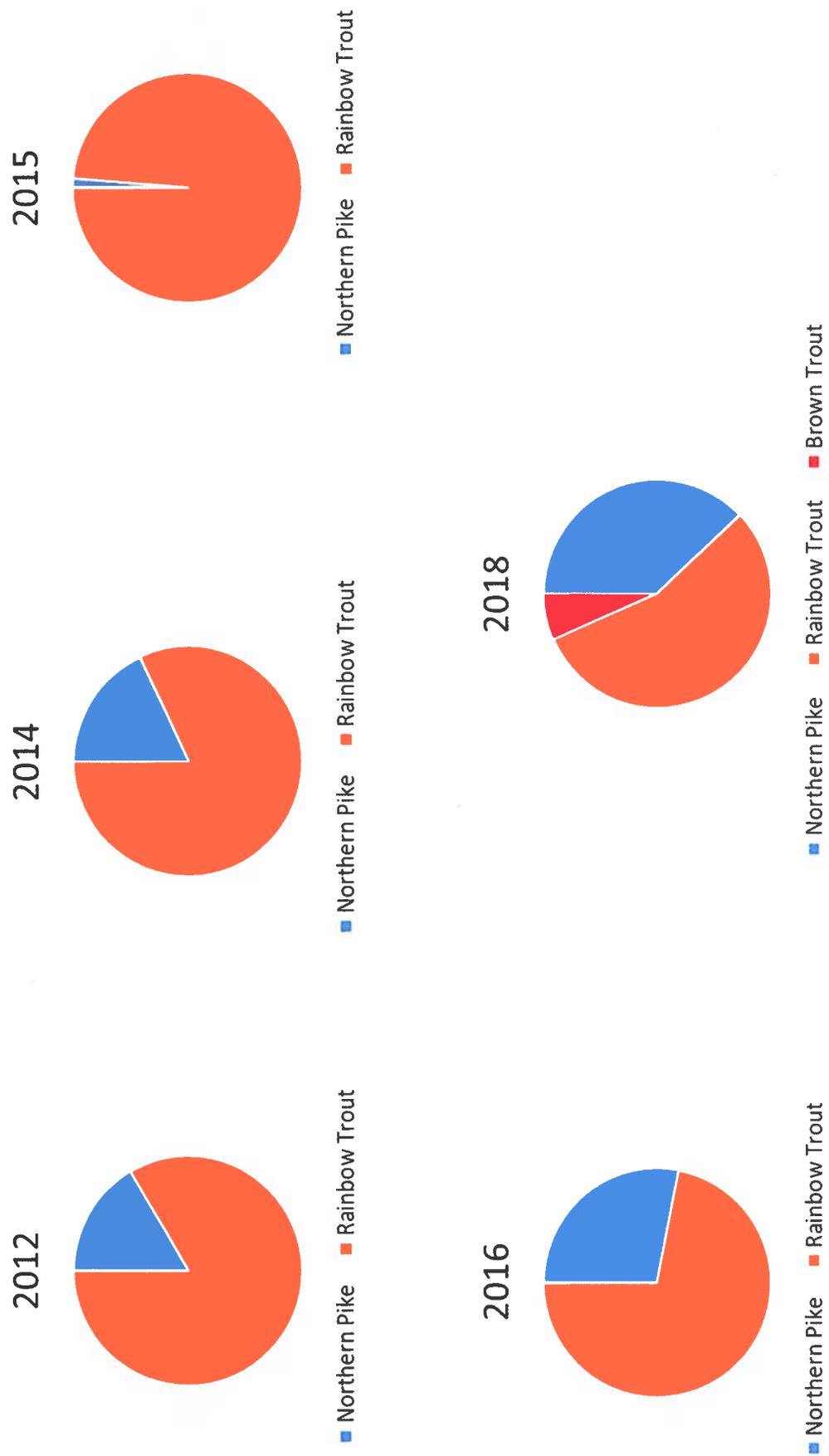


Figure 8. Number of Fish Captured During Early Spring Gill Net Sampling on Ashurst Lake 2012 – 2018.

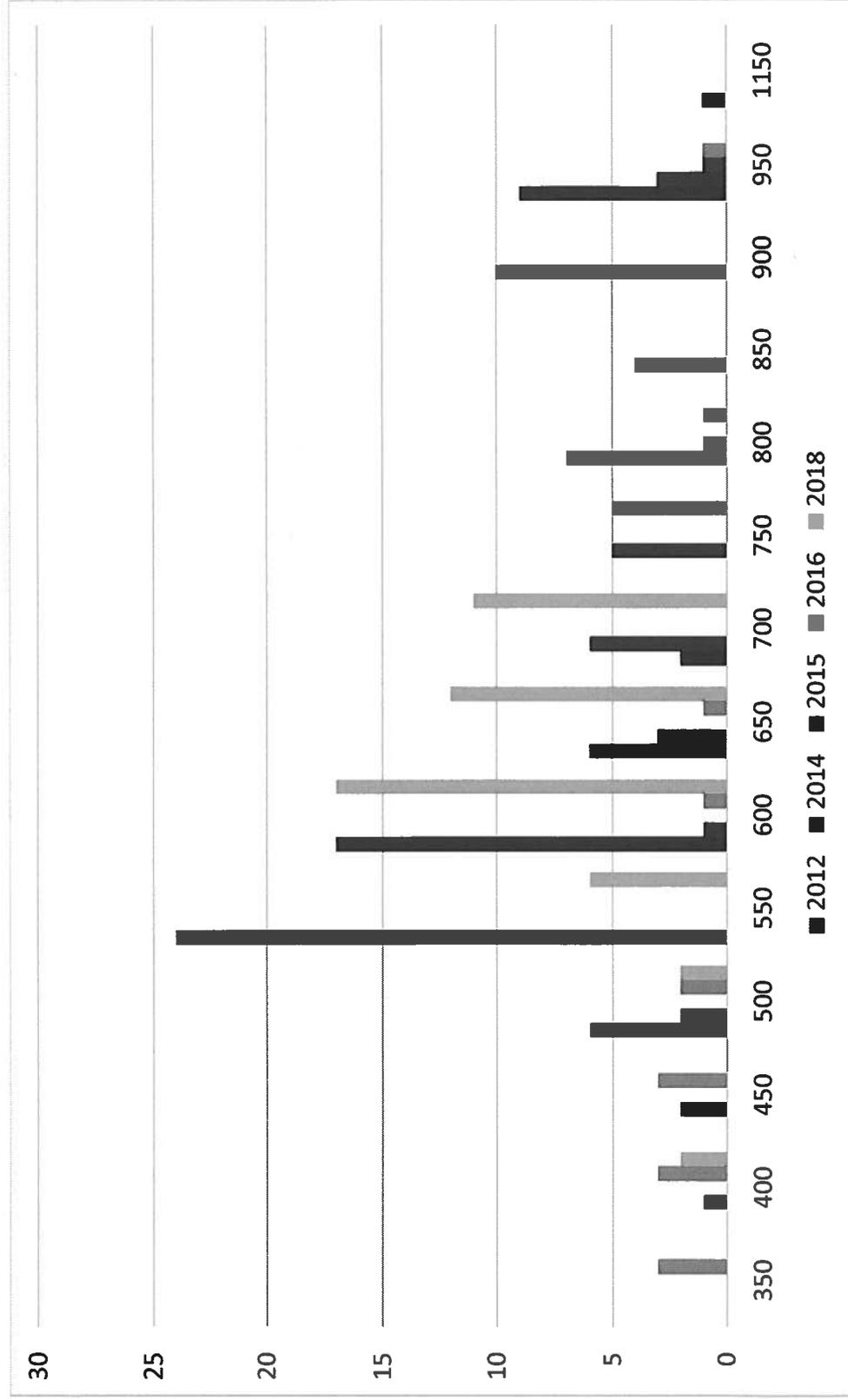


Figure 9. Northern Pike 50 mm Length Frequency for Fish Measured During Spring Gillnet Surveys on Ashurst Lake 2012-2018.

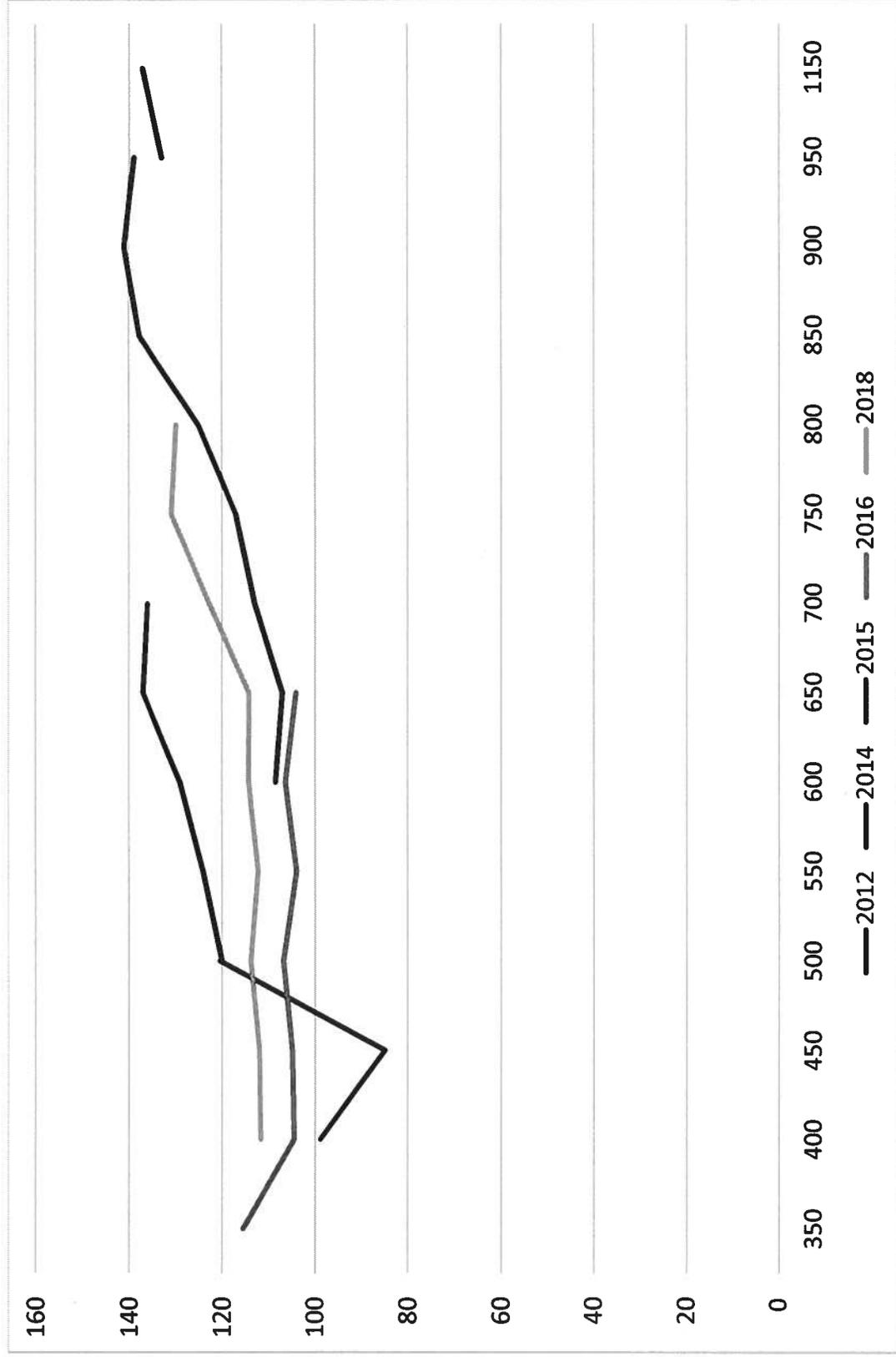


Figure 10. Northern Pike Average Relative Weights by 50 mm Length Class for Fish Measured During Spring Gillnet Surveys on Ashurst Lake 2012-2018.

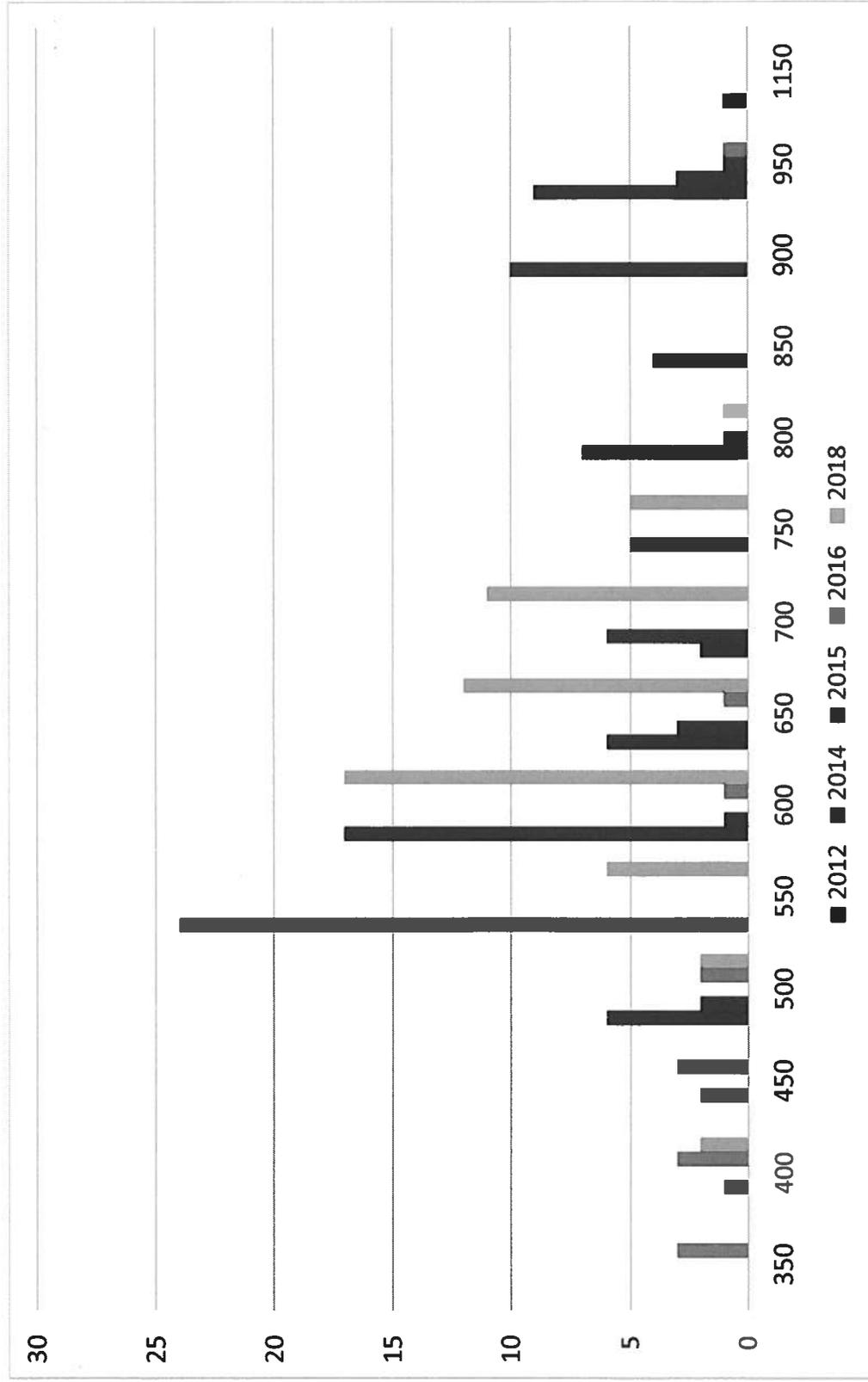


Figure 11. Rainbow Trout 10 mm Length Frequency for Fish Measured During Spring Gillnet Surveys on Ashurst Lake 2012-2018.

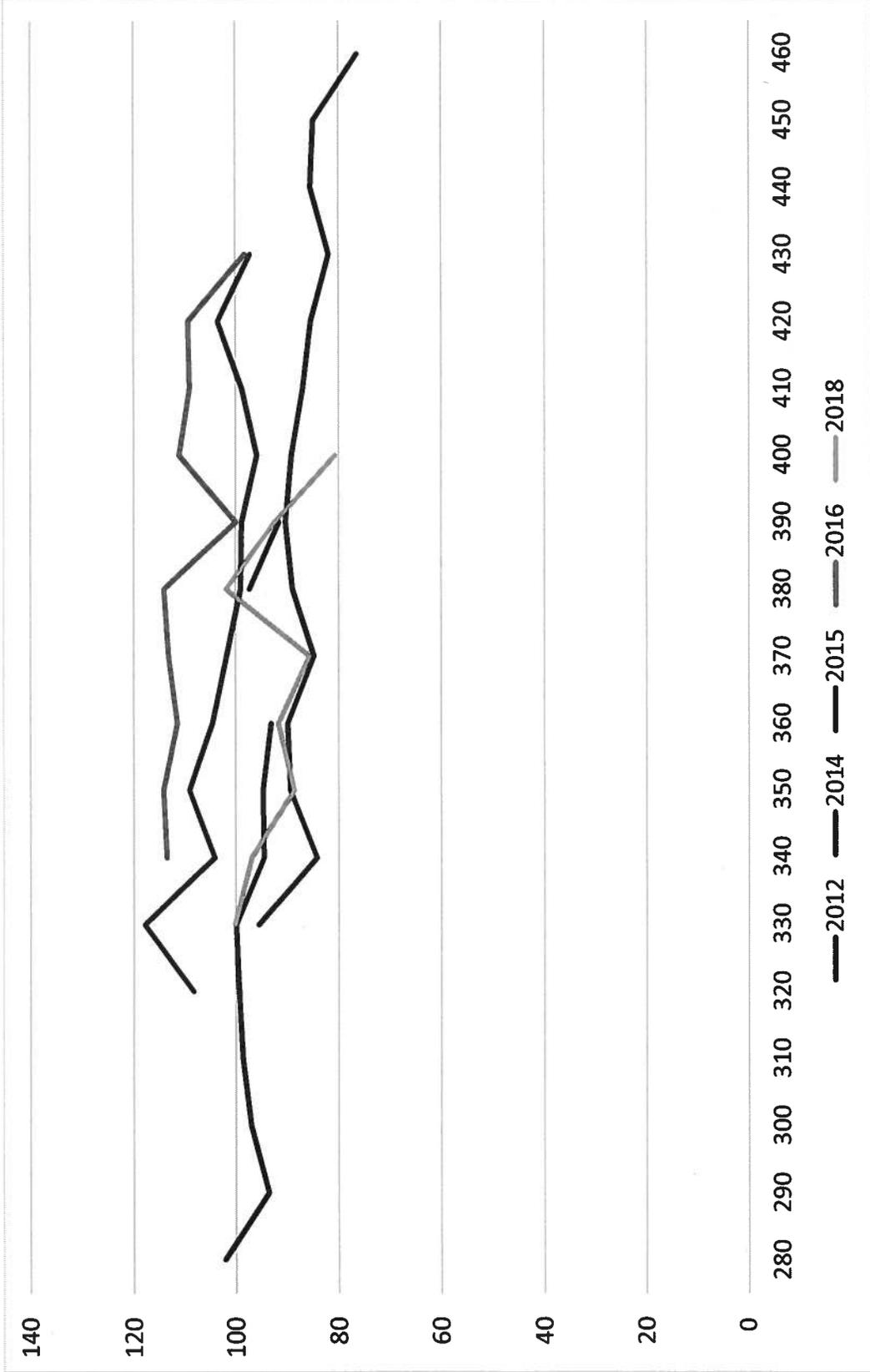


Figure 12. Rainbow Trout Average Relative Weights by 10 mm Length Class for Fish Measured During Spring Gillnet Surveys on Ashurst Lake 2012-2018.



Figure 13. Ashurst holdover Rainbow Trout angled in 2015.



Figure 14. A 46 inch (1,167mm), 31 pound (14,125g) Northern Pike Netted From Ashurst Lake February 2012.