



**NAVAJO LAKE**  
**2020 TREND NET SURVEY**  
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**BACKGROUND:** Navajo Lake is a shallow natural lake situated in an isolated, enclosed basin in the Dixie National Forest. Water draining the basin through fractured basalt and lava tubes has been shown to emerge in both Duck Creek Spring (Sevier River drainage) and Cascade Falls (Virgin River drainage). A dike helps stabilize the water level by isolating the majority of the lake from large lava tubes on the east end of the basin (Figure 1). UDWR is responsible for the maintenance and upkeep of the dike. Winter survival is a chronic problem for stocked trout due to the lake's shallow basin, high volume of aquatic vegetation, and long period of ice cover. Winterkill of trout has historically been common after low water years. A pipeline constructed during the mid 1990s delivers oxygenated spring water to the middle of the lake during the winter and has slightly improved winter survival. Natural springs in the lake basin also provide winter refuge. Competition with Utah chubs has contributed to limited growth and survival of trout and the lake has periodically been treated with rotenone, most recently in 1997. Rainbow trout (RBT) have been stocked in the lake for decades and an annual stocking quota of 25,000 catchable RBT (Table 1) has been maintained in recent years. RBT growth and overwinter survival has been almost negligible in the past decade. In spite of the challenges faced by the fishery, Navajo Lake helps sustain a private lodge and three Forest Service campgrounds. During summer months the lake receives heavy fishing pressure from non-resident anglers.

Hybrid splake were added to Navajo Lake in the mid 1990s in hopes that this sterile predator would utilize chubs as forage and help reduce their numbers. From 2007 to 2008, splake showed much higher overwinter survival than what was anticipated and the annual stocking quota of 10,000 fingerling fish was reduced to 5,000 in 2009 to reduce competition pressure among all trout (Table 1). By 2011, the average size of splake had increased dramatically and trophy fish – up to 27 inches and 11 pounds – were commonly caught. The splake stocking request was increased to 6,000 in 2019 in response to increases in Utah chub density, though the quota was not stocked that year due to shortages in hatchery production. The success of splake in Navajo Lake also prompted the conversion of the previous brook trout quota to tiger trout to provide more predatory pressure on chubs. Tiger trout showed little return to population surveys and anglers after that change, however.

Due to nearly annual inundation, the earthen Navajo Lake dike has experienced periodic breaches throughout its history. Water seeping under the dike causes sites of localized sinking, which act as alternate pour-over points because the spillway is not sufficiently wide to accommodate the water flowing from west to east when the east basin level drops below the dike. If sufficiently weakened, the dike will breach at that point, with the most recent breaches occurring in 2009 and 2010. Both required repairs, with the 2010 breach not being repaired until 2012. Geologic surveys completed after the 2010 breach indicated that the entire dike was unstable and that eventual replacement with a new design would be necessary to prevent further failure.

The fishery in Navajo Lake is regularly monitored through trend net surveys, most recently conducted every three years. In 2011, a new net design recommended by the American Fisheries Society (AFS) was introduced in trend net surveys at most Southern Region waters, including Navajo Lake. This design was intended to reduce catch bias generated by graduated mesh nets, which “lead” fish into the net. In most waters where they have been employed, the AFS-style nets have yielded about 50% of the trout and chub catch rates of the older style nets that were used by UDWR for many years. A new regional sampling strategy developed in 2014 recommended that traditional trend net surveys be conducted at Navajo Lake every third year. In order to more closely monitor the Utah chub population a separate annual survey was designed

and implemented, utilizing fyke nets to collect chubs in the summer. This report summarizes results of the 2020 spring trend net survey, as well as summer fyke net surveys in 2018 and 2019.

**METHODS:** Four experimental gill nets (two floating and two diving) were set in Navajo Lake on May 19, 2020, and were allowed to fish overnight. Nets measured 6 ft x 80 ft, with eight panels of randomly-arranged mesh size (1.5", 2.25", 1", 0.75", 2.5", 1.25", 2") (AFS-recommended design). Net locations have been consistent for many years (Fig. 1). Fish caught were removed from nets on the morning of May 20 and all sport fish were measured to the nearest mm (total length) and weighed to the nearest gram. Body condition of trout was measured by the calculation of Fulton's  $K_{TL}$  (generated from total length [TL]):

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

Total weight of Utah chubs was measured for each net catch and a representative subsample of lengths was measured.

Summer chub surveys were conducted in July 2018 and September 2019. (Other work priorities left no time for the survey in 2020.) In 2018, two fyke nets were set at the sites of the north shore trend nets (Fig. 1), while the 2019 survey also added two fyke nets set in tandem in the middle of the lake. Nets were pulled after fishing overnight and all Utah chubs were counted. Subsamples of chub lengths were also recorded.

## RESULTS

### *Spring Gill Nets*

The 2020 trend net trout catch consisted of only two small (182-205 mm) tiger trout (Table 2). This produced the lowest catch rate observed since 2004 (Table 3) and completed a declining trend observed since 2011 (Fig. 2). While splake have dominated the trout catch and fish biomass (Fig. 3) since 2007, none were observed in 2020. The remainder of the net catch (99%) was made up by 329 Utah chubs, for a catch rate of 82 fish per net-night. This rate continued an overall trend of high chub catch since 2008 (Fig. 4). As has been the case throughout that time, the chub catch was dominated by small fish measuring under 200 mm (Fig. 5).

### *Summer Fyke Nets*

Summer fyke net surveys have been employed as intermediate monitoring in years when gill nets are not set. Catch rate has fluctuated with no apparent pattern (Fig. 6), but has exceeded 300 fish per net-night most years (Table 4). While summer nets were also intended to sample larger chubs, these catches have also been dominated by fish less than 200 mm. Mean TL has consistently measured between 140 and 160 mm.

**DISCUSSION:** A declining trend in trout survival at Navajo Lake culminated in a complete crash of the trout fishery between 2017 and 2020. While trout catch declined from 2011 to 2017, large average splake size kept relative trout biomass high, even while Utah chub density also remained elevated. The lack of intermediate-size splake in the 2017 survey, however, signaled potential reduced survival of fish stocked in recent years and was corroborated by fishing reports. By 2020, the older cohorts of splake finally died out while younger cohorts appeared to have also completely failed to recruit. Whether this failure occurred annually or can be attributed to a singular event is unknown, though the winter of 2018-19 followed a particularly dry year. Ultimately, it appears that persistent high chub density negatively impacted survival of small splake, to the point where recruitment failed to replace natural mortality of older fish. In addition, predation by those large fish was insufficient to affect chub density.

The loss of the trout fishery in Navajo Lake demonstrated that previous stocking quotas were not sufficient to maintain a large enough predator base to reduce chub density to a level where competition could be mitigated. In response, regional staff began to alter management in 2020 to increase the predation pressure on Utah chubs. Excess triploid (sterile) lake trout were available from hatchery production, so 17,000 fingerlings were stocked in June. In addition, approval was secured to introduce tiger muskies and a quota of 3,000 6-inch fish will be stocked beginning in 2021. In response to necessary cuts in hatchery requests, as well as poor overwinter survival, the RBT quota is being cut to 15,000 fish in 2021.

Fishery management at Navajo Lake will focus on attempting to increase predation pressure on Utah chubs for the next several years. Tiger muskie, splake, and tiger trout quotas will continue, while excess of any of these should also be stocked when available. If this continued stocking does not result in reduced chub density and recovery of the sport fishery, then a rotenone treatment should be conducted. Regional staff will develop a formal management plan, including targets and deadlines, in spring 2021.

The Navajo Lake dike continues to be threatened by erosion. At least three low spots with varying levels of downslope erosion were observed in May 2020 (Fig. 7). Coordination between UDWR, Dixie National Forest, county commission, and legislative partners will need to continue so that reconstruction of the dike can be approved and funded in the coming years.

#### **RECOMMENDATIONS:**

1. Develop a formal plan in spring 2021 to address Utah chub density and sport fishery recovery at Navajo Lake.
2. Maintain current annual stocking quotas of 15,000 catchable RBT, 6,000 fingerling splake, 2,000 fingerling tiger trout, 3,000 6-inch tiger muskies. Stock excess predators when available.
3. Conduct gill net surveys to monitor sport fish every other year while a new management plan is implemented and evaluated. Monitor Utah chubs annually with summer fyke net surveys. Two fyke nets, either on shore or as one tandem set in the middle of the lake, should be sufficient.

# Navajo Lake Sampling Locations

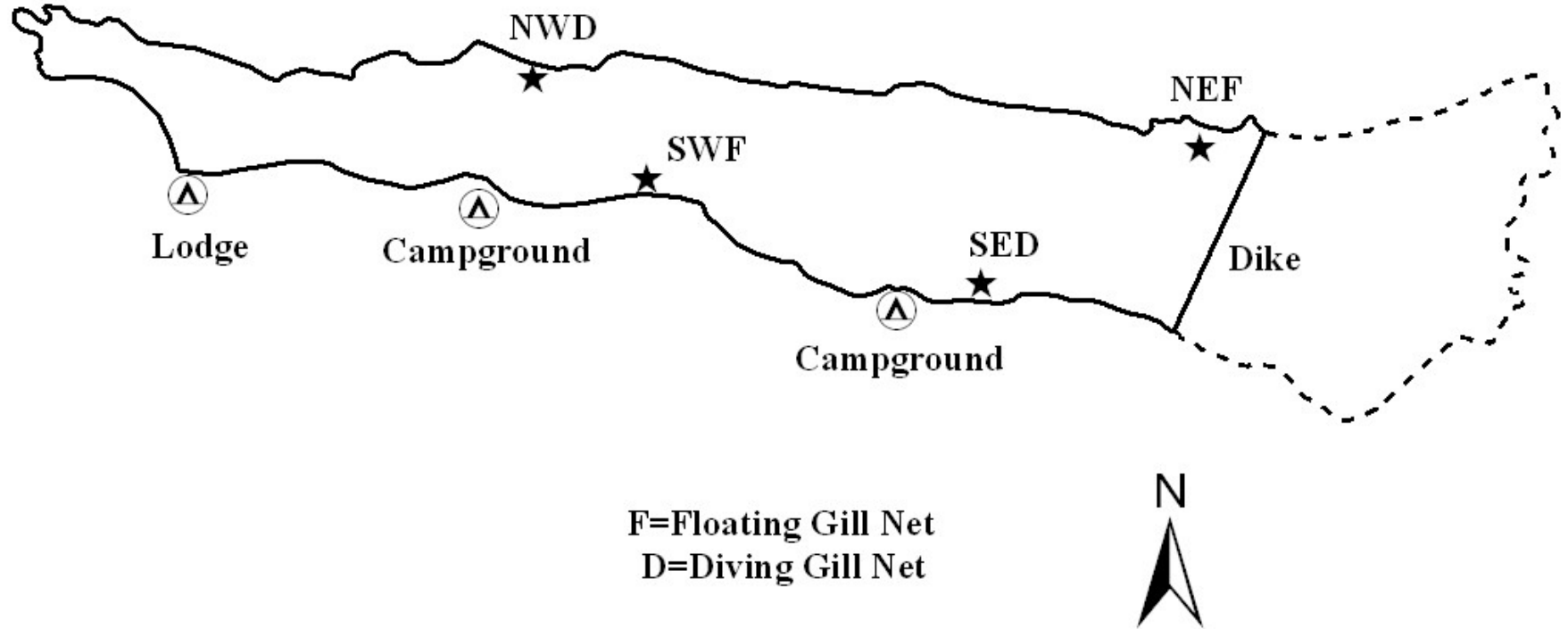


Figure 1. Locations of gill nets set at Navajo Lake during the 2020 trend net survey.

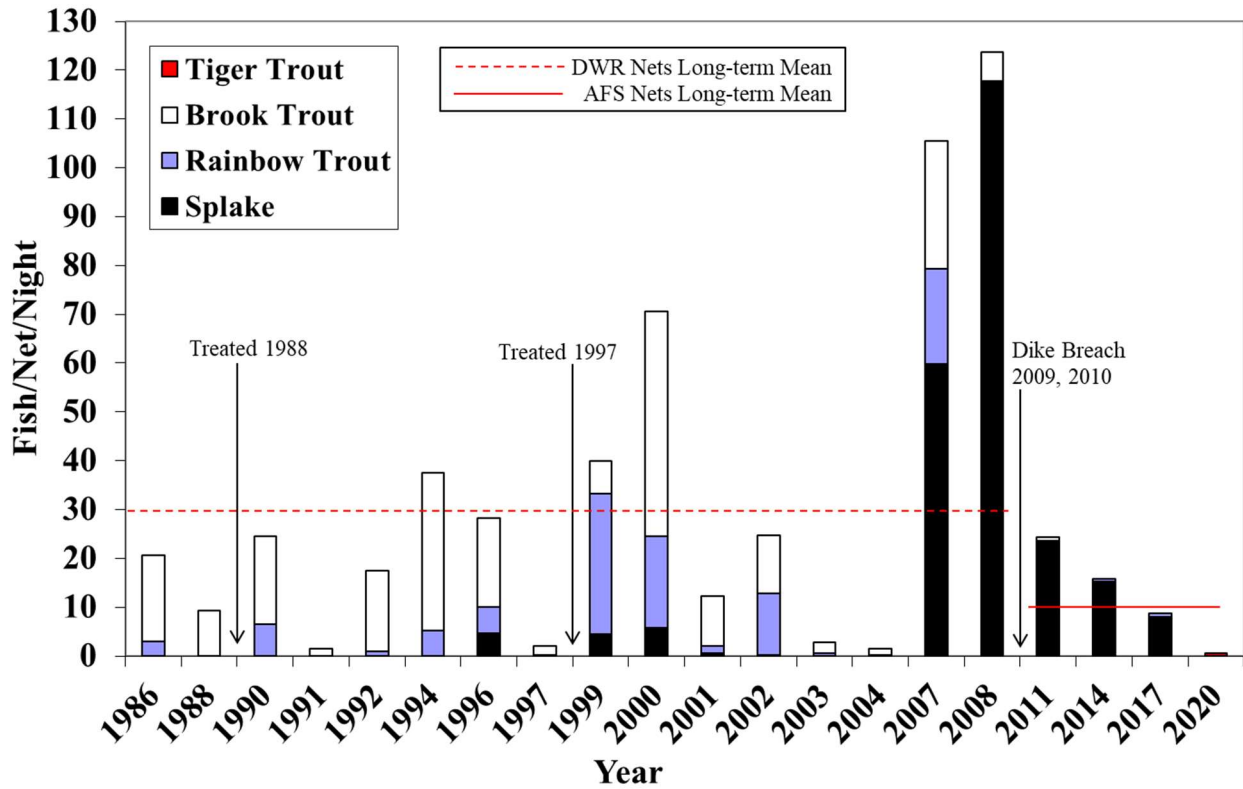


Figure 2. Trout catch rate during trend net surveys at Navajo Lake 1986-2020.

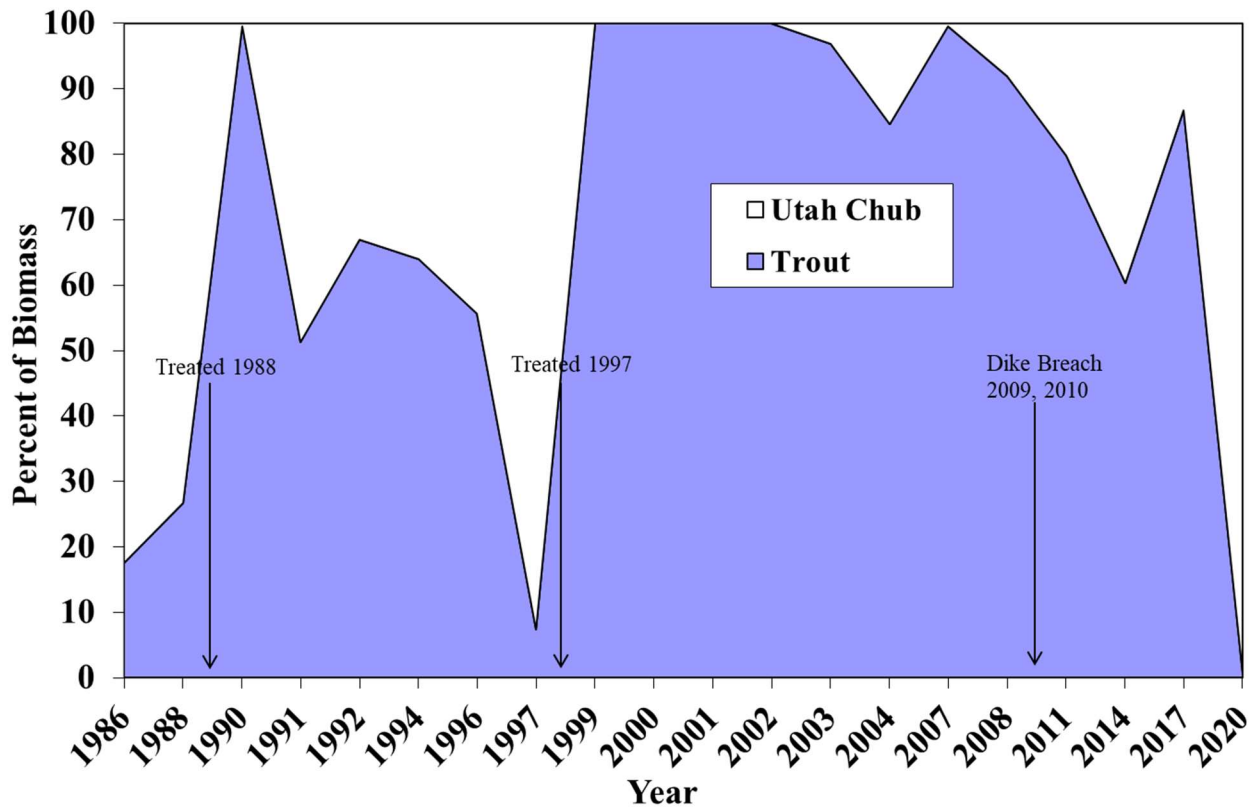


Figure 3. Relative biomass of trout and Utah chubs collected during trend net surveys at Navajo Lake 1986-2020.

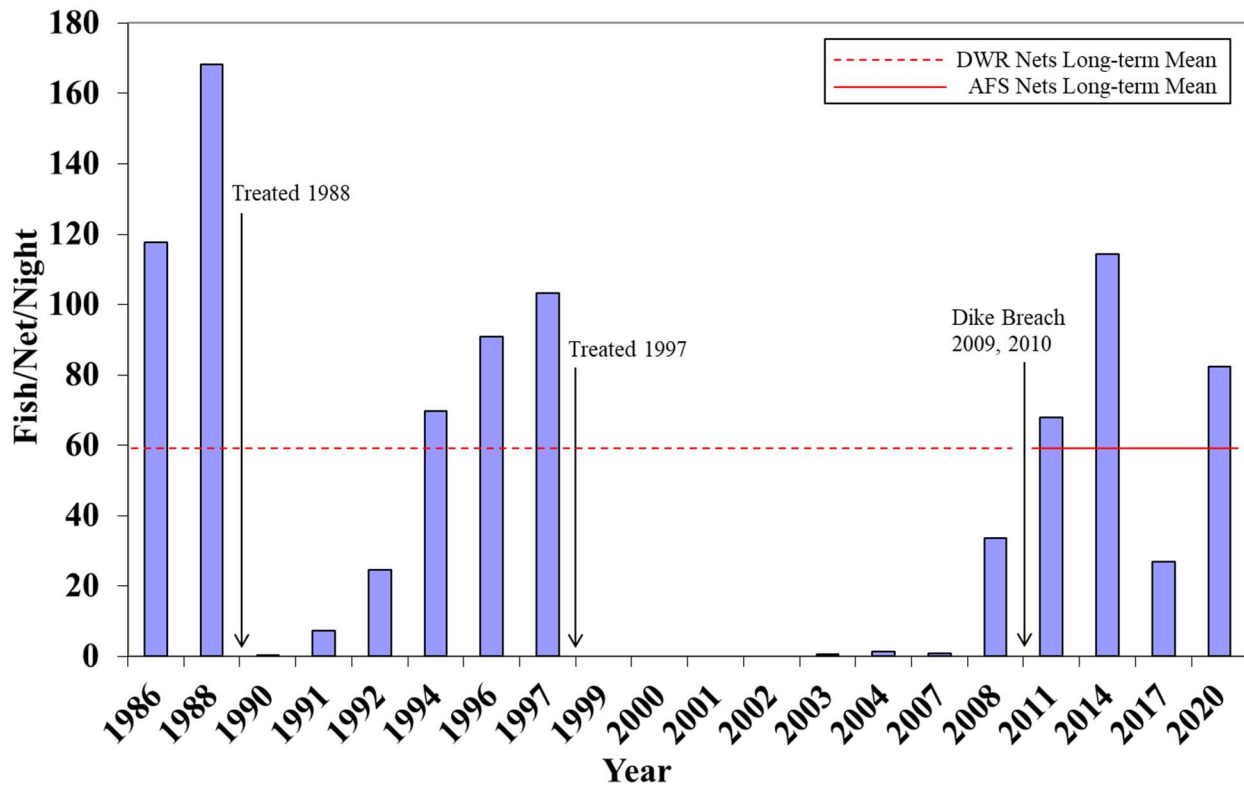


Figure 4. Utah chub catch rate during trend net surveys at Navajo Lake, 1986-2020.

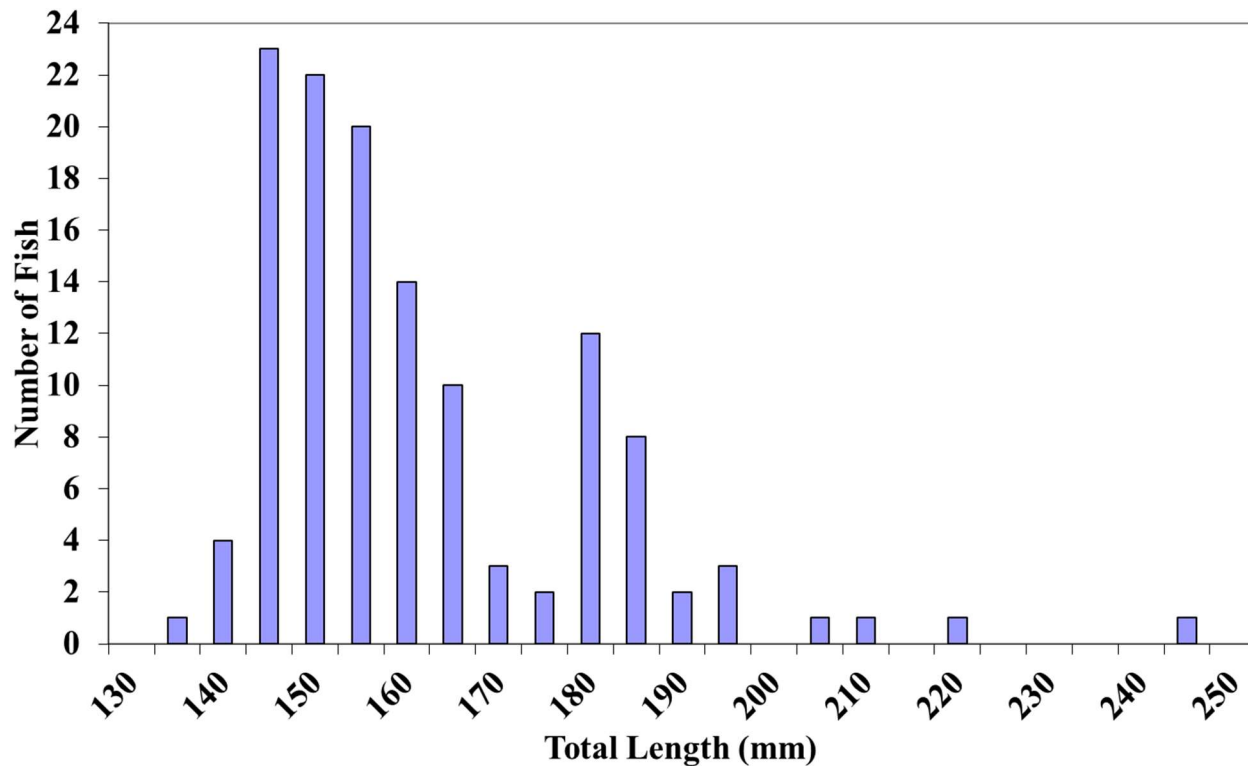


Figure 5. Length distribution of Utah chubs collected at Navajo Lake on May 20, 2020.

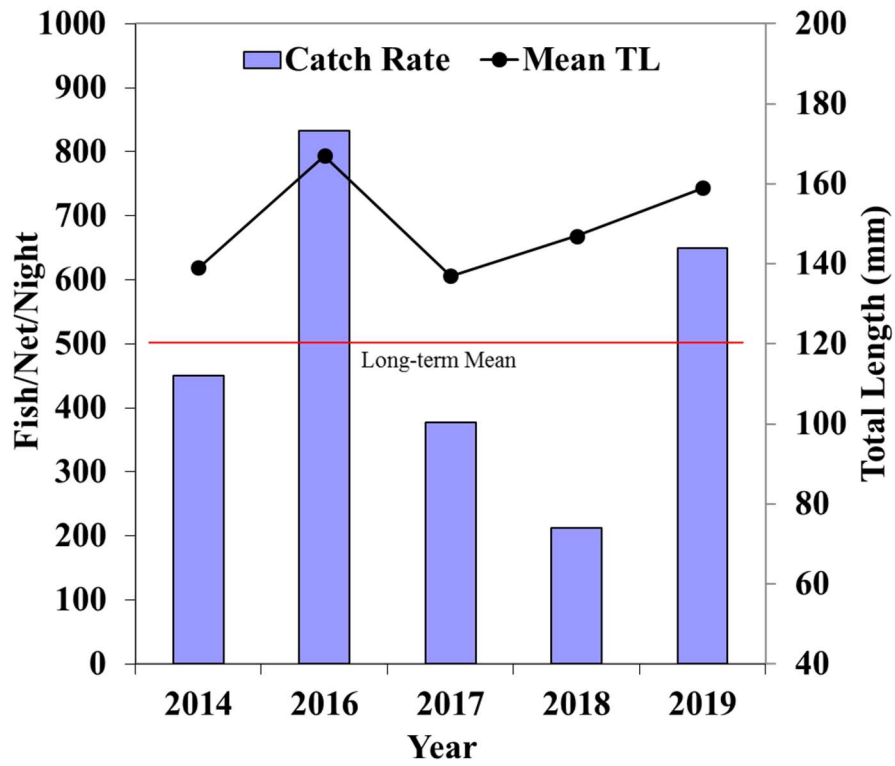


Figure 6. Catch rate and mean total length of Utah chubs during summer fyke nets surveys at Navajo Lake, 2014-2019.





Figure 7. Erosion of the Navajo Lake dike observed in May 2020.





Table 4. Summer fyke net survey results at Navajo Lake, 2014-2019.

	<b>Fyke</b>		<b>Chubs</b>		
	<b>Nets</b>	<b>Total</b>	<b>per Net-</b>	<b>MeanTL</b>	
<b>Date</b>	<b>Set</b>	<b>Chubs</b>	<b>Night</b>	<b>(mm)</b>	<b>Comments</b>
30-Jul-14	2	902	451	139	
4-Aug-16	2	1665	833	167	
11-Jul-17	2	755	378	137	
11-Jul-18	2	424	212	147	
13-Sep-19	4	2600	650	159	
	Long term mean		505	155	