WISCONSIN DEPARTMENT OF NATURAL RESOURCES

LAKE SUPERIOR WI-2 SUMMER SURVEY REPORT 2024

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INTRODUCTION

The fish community of Lake Superior has gone through a series of dramatic changes over the last 100 years. Agencies responsible for the management of Lake Superior's fishery resources have established a series of fish community objectives, with the overarching goal to "rehabilitate and maintain a diverse, healthy and self-regulating fish community, dominated by native species while supporting sustainable fisheries" (Horns et al. 2003). Information from this survey is used to monitor population dynamics of recreational and commercially important fisheries and to assess progress toward fish community objectives in Wisconsin waters of Lake Superior. The nets in this survey include a wide range of mesh sizes and are fished at a wide range of depths to incorporate as much of the Lake Superior fish community and the life stages of individual species as possible.

There are three primary objectives for this assessment. First, the survey is used to track changes in the Lake Superior fish community (e.g., predators, prey, benthivores, etc.). Second, the survey is used to assess population dynamics (e.g., abundance, age, size) in coregonine species (i.e., lake whitefish, cisco and deepwater chub species) in Wisconsin waters of Lake Superior. Third, the small meshes in the survey are used to monitor lake trout recruitment or the number of lake trout entering the "fishable" population each year. This aspect of the survey is part of a larger, lake-wide, small-mesh juvenile lake trout monitoring effort.

METHODS

The Wisconsin Department of Natural Resources (DNR) Summer Community Survey rotates between sampling the Western Arm region (WI-1) during odd-numbered years and the Apostle Islands region (WI-2) during even-numbered years. In 2024, we sampled 39 stations in the Apostle Islands region (Figure 1) with 1,097-meter monofilament gill net gangs. Each gang was composed of a series of 91.4-meter nets constructed with 38 to 178 mm mesh (stretch measure) by 13-mm increments. We measured a temperature profile at each site after deploying the net. We recorded temperatures at the surface, bottom and 3, 6, 9, 12, 15, 18, 30, 45, 60, 75 and 90 meter depths (Figure 2). We set all nets on the bottom for one night (24 hours) using the R/V Hack Noyes. Ultimately, we collected biological information (e.g., length, weight, sex, etc.) from fish using standardized protocols.

The modern stations used in this survey have been consistently sampled since 1980 in even years, so we calculated a time-series of mean catch-per-unit-effort (CPE) using only catch data from 1980 to 2024. We calculated mean CPE using stations as replicates (fish per km of net per night). Wild (non-hatchery origin) lean lake trout CPE was assessed using trout captured in all mesh sizes but excluded trout with hatchery fin clips. Juvenile wild lean lake trout CPE was assessed using only trout captured in the 51- and 64-mm mesh sizes, excluding trout greater than 450 mm. Subadult and older lean lake trout CPE was the opposite, assessed using only trout captured in meshes greater than 64 mm, excluding trout less than 450 mm. Juvenile cisco CPE was assessed using only fish captured in the 38-mm mesh panel. CPE for all ciscoes was assessed by combining all *C. artedi, C. hoyi, C. kiyi C. zenithicus*, and respective crosses. Juvenile lake whitefish CPE was assessed using only the 38-, 51- and 64-mm mesh sizes. CPE for all other species (and total wild lean lake trout, hatchery lean lake trout, total cisco and total lake whitefish) was assessed using all mesh sizes.

The "juvenile" and "adult" nomenclature does not necessarily refer to the sexual maturity of individual fish in this case. It refers to the size-selective nature of graded-mesh gill net sampling, which allows separation of fish by size with known effort for each subset. Therefore, the examination of CPE trends from small mesh sizes may allow insight into recruitment patterns or a relative "year-class strength." All analyses were conducted using Program R.

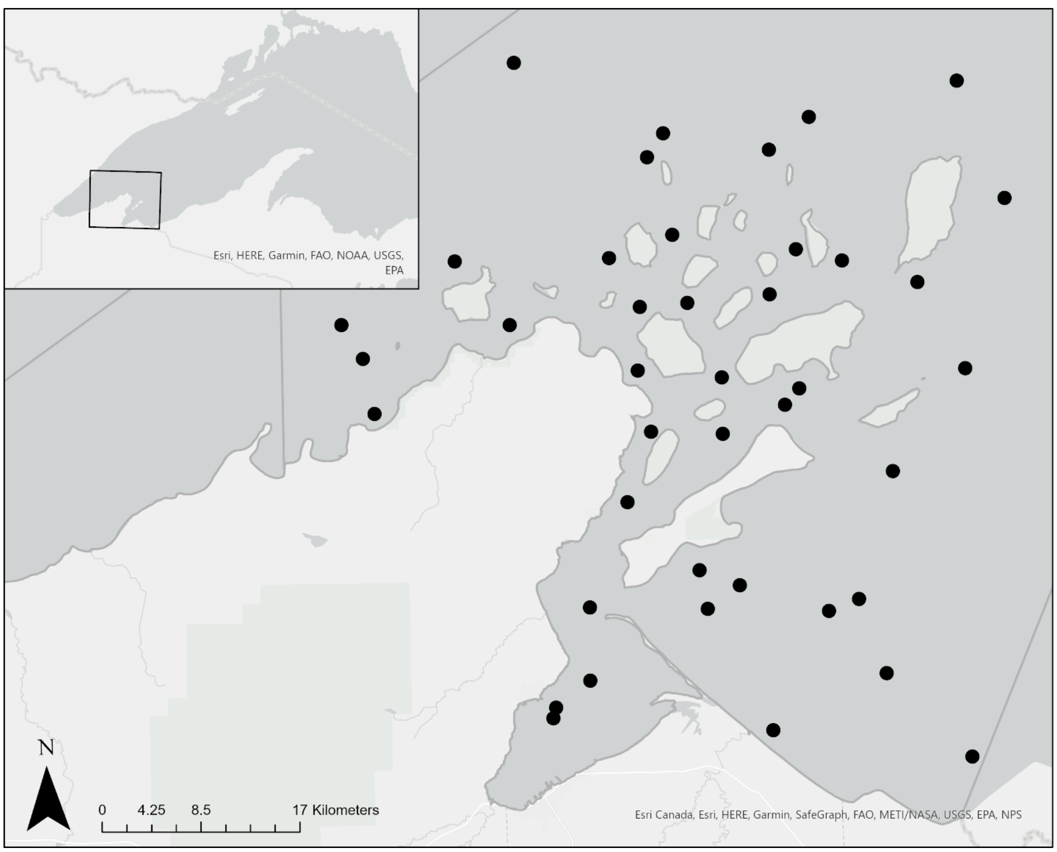

Figure 1. Map of the Apostle Islands region (WI-2) of Lake Superior and the sampling stations for the DNR Summer Survey.

RESULTS AND DISCUSSION

The mean water temperature profile measured during sampling in 2024 was on the warmer side of the ranges observed in the summer survey since 1998 for near-surface temperatures, but the thermocline appeared to form a little higher in the water column compared to most years (Figure 2).

LAKE TROUT

The relative abundance of wild lean lake trout in 2024 was similar to the prior survey in 2022, as a lower abundance of larger fish was offset by an increase in smaller, juvenile wild lean lake trout (Figure 3). However, total relative abundance of wild lean lake trout was still low compared to all surveys in the past couple decades. While we did observe an increase in juvenile lake trout abundance from the previous survey, it was still lower than all surveys from 2006 to 2020. Hatchery lean lake trout relative abundance was much lower than 1980s and 1990s after the lake trout stocking program in ended in WI-2 in 1995. The relative abundance of subadult and older wild trout decreased to the second-lowest observed value since 1998. Without a large recruitment spike, we do not expect the abundance of subadult and older fish to increase in the next survey in 2026.

We observed several wild lean lake trout between 250 and 375 mm total length but a general lack of fish between 375 and 600 mm (Figure 4), indicating a recruitment gap. Median length of wild lean lake trout was similar to the previous survey (Figure 5).

Siscowet lake trout relative abundance remained relatively high in the summer community survey (Figure 3), but juvenile-sized fish were underrepresented in the 2024 length distribution (Figure 4).

CISCOES

We observed an increase in total cisco *Coregonus artedi* relative abundance from the previous two surveys, but total cisco abundance was still lower than the late 1980's and 1990's. The juvenile cisco index indicated an increase in recruitment complimentary of the 2022 cohort (Figure 6). However, the magnitude of the juvenile cisco index was not as high as anticipated (Vinson et al. 2024), possibly due to slower growth of the very abundant 2022 cohort. The median length of cisco substantially decreased in the 2024 survey (Figures 8 and 9). The current cisco population is dependent on infrequent, large year-classes to maintain the stock. It is primarily maintained by diminishing large cohorts from 2003, 2009 and 2015, which make up most of the fishery.

The relative abundance of bloater *Coregonus hoyi* was higher in the 2024 survey compared to 2022 (Figure 6). Relative abundance of bloater has been variable throughout the time series but is currently at moderate levels. The relative abundance of all ciscoes combined *C. artedi, C. hoyi, C. kiyi C. zenithicus,* and respective crosses was greater than 2022, around average for the past two decades, but lower than the late 1980's and 1990's (Figure 6).

The USGS (United States Geological Survey) R/V Kiyi lake-wide spring bottom-trawling survey in spring 2023 detected a large 2022 cohort of cisco (Vinson et al. 2024). We expect this cohort to significantly contribute to this survey and the fishery in the coming years.

Vinson, M.R., Evrard, L., Gorman, O.T., Phillips, S.B., Yule, D.L. 2024. Status and Trends of the Lake Superior Fish Community, 2023. Great Lakes Fishery Commission, Ann Arbor, Michigan.

LAKE WHITEFISH

Total lake whitefish relative abundance in 2024 was similar to recent years (Figure 7). The relative abundance of mature lake whitefish decreased slightly from the previous two surveys but ultimately remained high, and high catches were observed in multiple fisheries. The juvenile lake whitefish index was higher than the previous survey, which was relatively low. Median length was similar to the previous survey (Figure 9), but the survey was fairly lacking in lake whitefish between 325 and 400 mm (Figures 8 and 9).

OTHER SPECIES

Burbot, longnose sucker and white sucker relative abundance has generally decreased over the time series (Figure 10). The relative abundance of rainbow smelt (gill netting survey only efficiently captures larger adults age 2+) has been stable over the past couple of decades and much lower than in the 1980s. Round whitefish relative abundance has been up and down throughout the time series and was higher in 2024 than the previous three surveys. Eurasian ruffe relative abundance increased substantially from 1998 to 2010 but has somewhat decreased since. Brown trout relative abundance was relatively high. Splake relative abundance was higher than 2022 but lower than 2020. We observed the highest walleye and yellow perch relative abundance of the entire time series in 2024. Figure 11 shows the length distributions of these other ten species captured during the 2024 summer community survey.

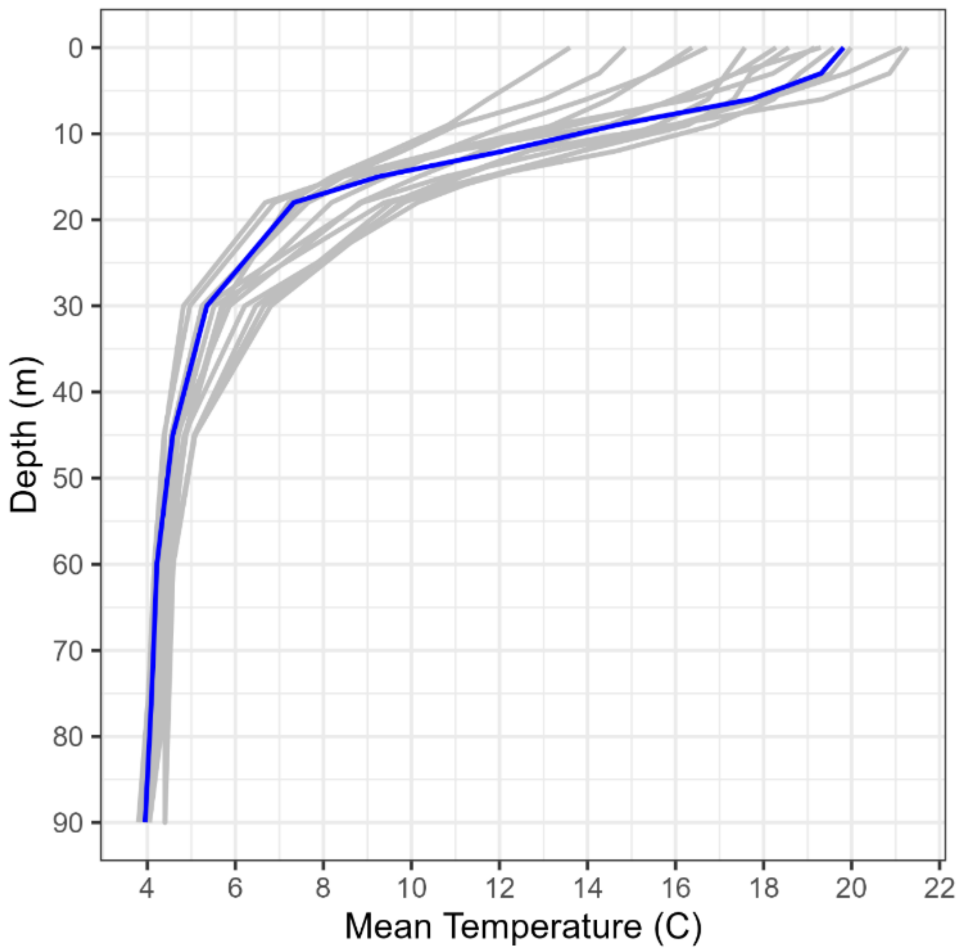

Figure 2. Mean temperature profiles measured from the 39 stations sampled during the summer survey in WI-2 waters of Lake Superior. The blue line represents the mean temperature profile measured in 2024, and the grey lines represent mean temperature profiles measured in even years from 1998 to 2022.

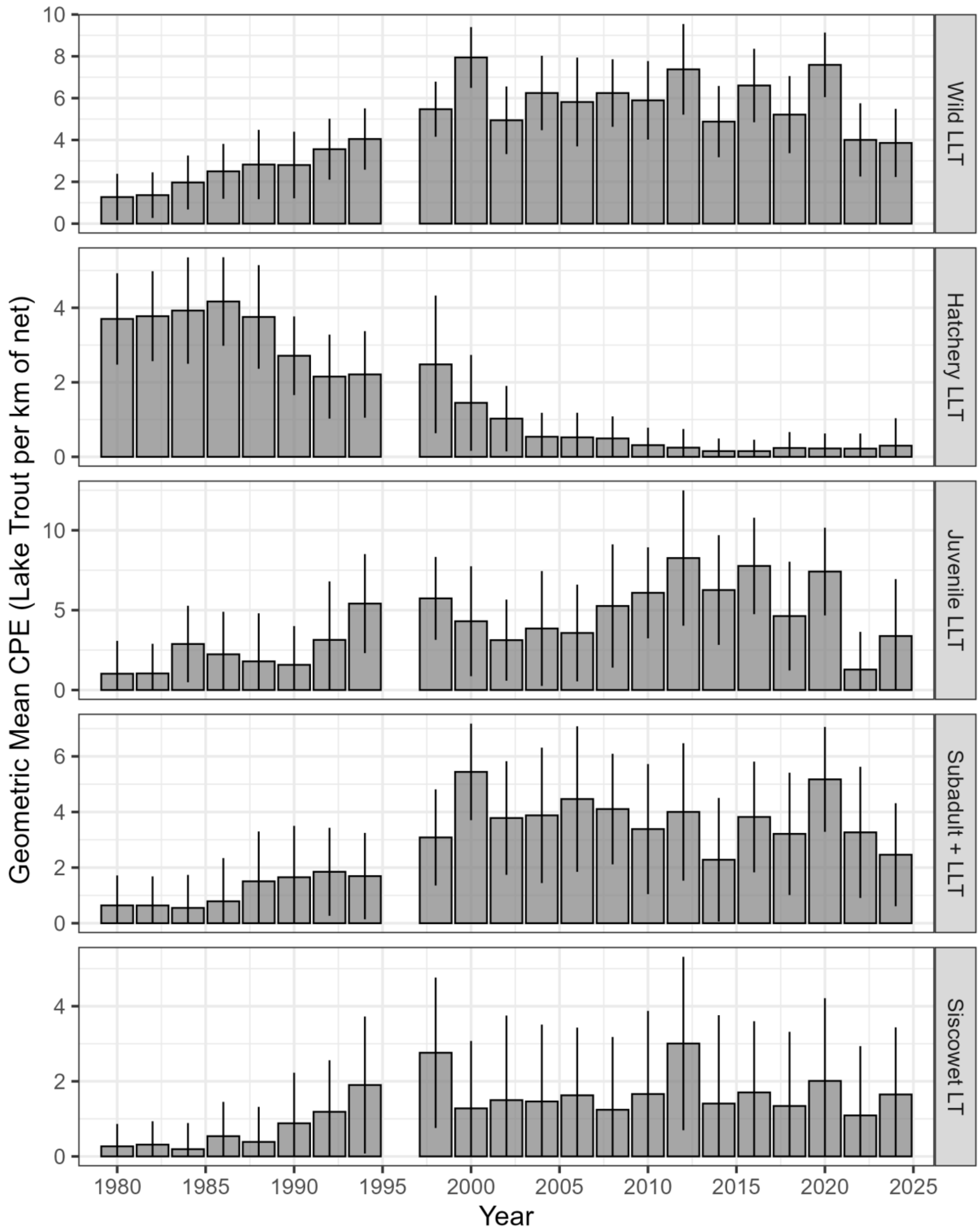

Figure 3. Time series of geometric mean catch-per-unit-effort (CPE) for all wild lean lake trout (all meshes), all hatchery-origin lean lake trout (all meshes), wild juvenile lean lake trout (51 and 64 mm meshes, < 450 mm total length), subadult and older wild lean lake trout (> 64 mm meshes, > 450 mm total length) and siscowet lake trout (all meshes) in the summer survey of the Apostle Islands region of Lake Superior, 1980-2024. Sampling did not occur in 1996. Error bars represent one standard deviation.

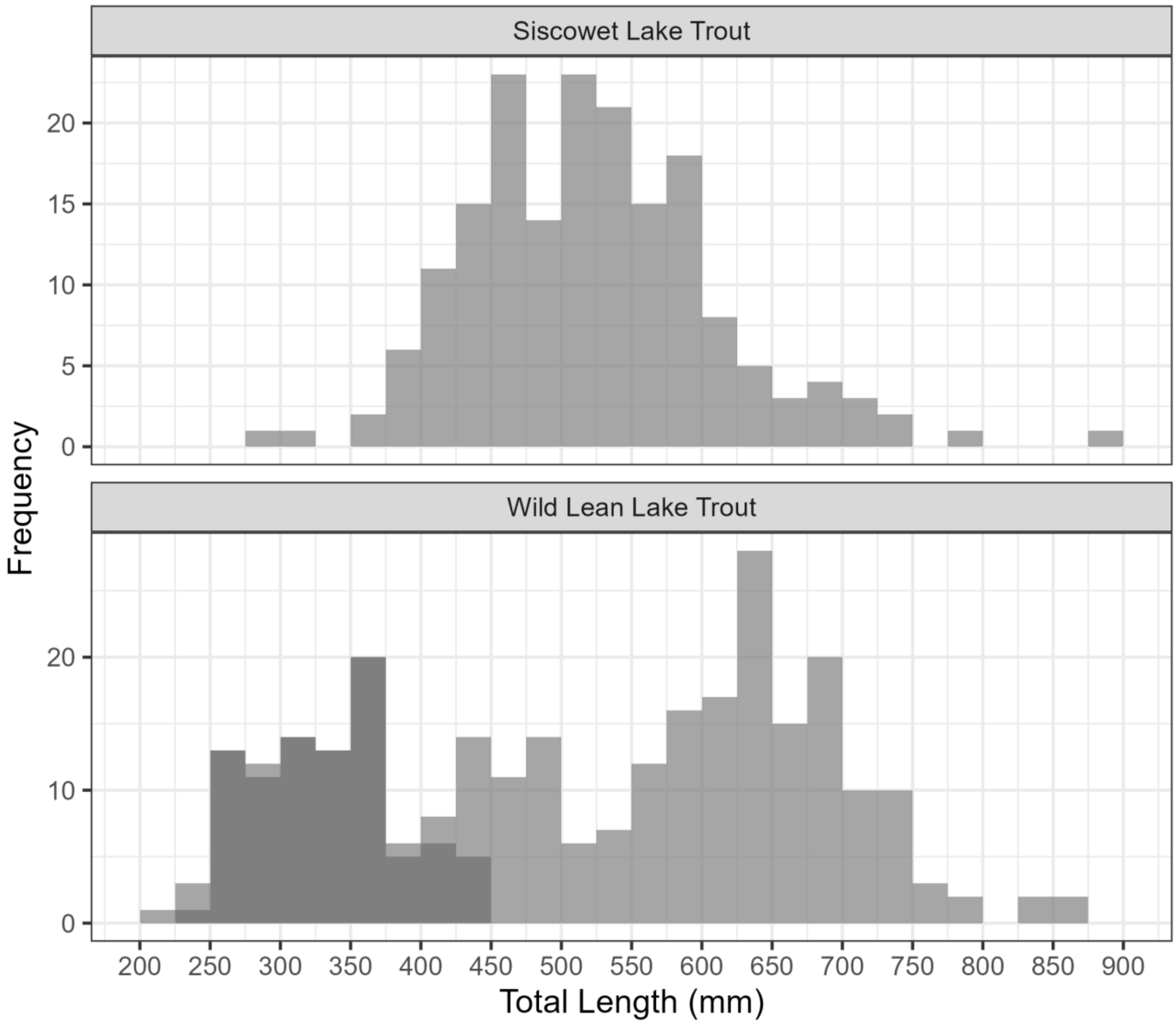

Figure 4. Length frequency histograms of siscowet lake trout (top) and wild lean lake trout (bottom) caught in the Apostle Islands region of Lake Superior during the 2024 summer survey. Darker grey bars represent fish that were counted in the juvenile lean lake trout CPE index (i.e., non-hatchery origin, caught in 51 or 64 mm mesh, < 450 mm total length).

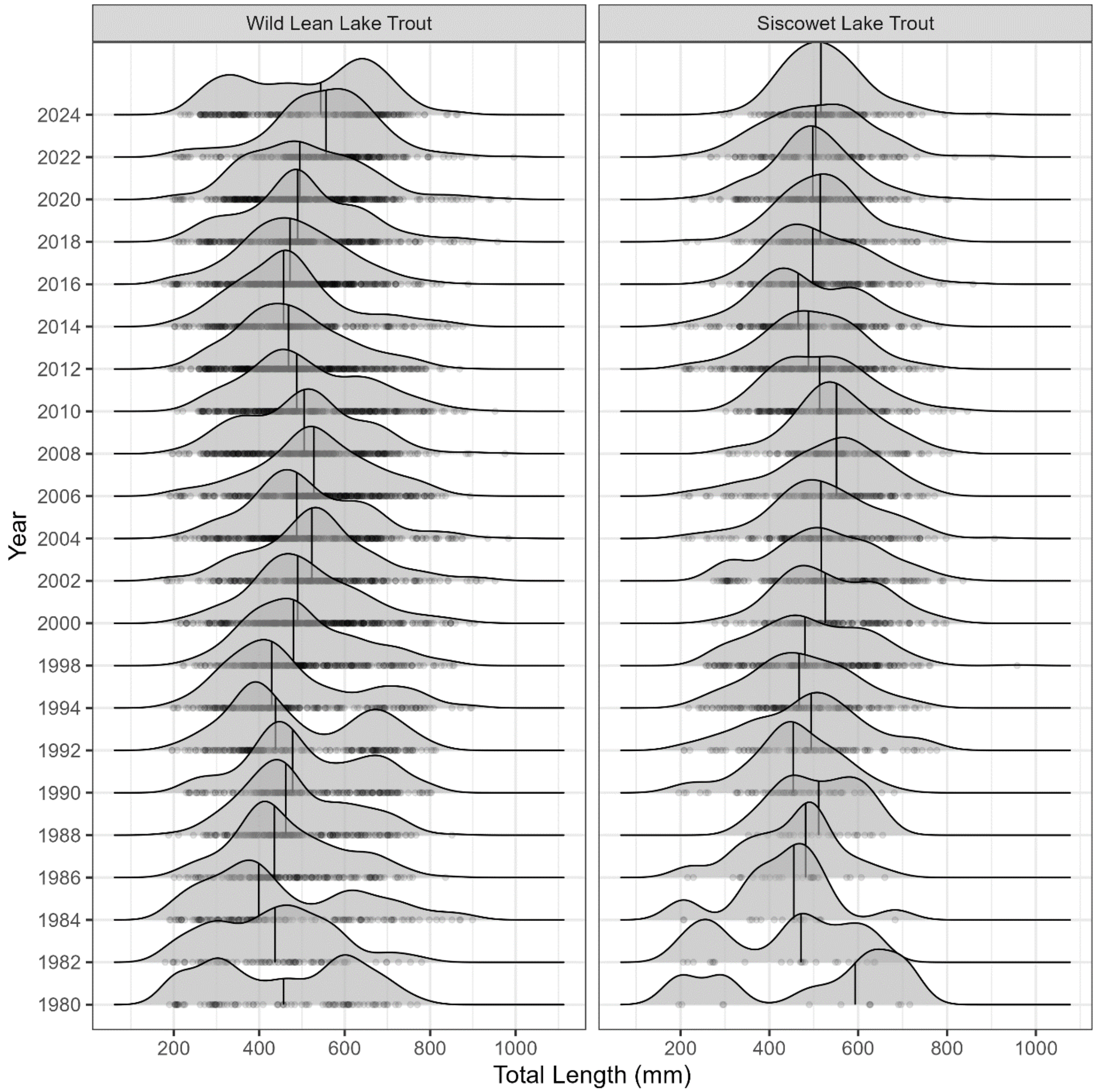

Figure 5. Time series of wild lean lake trout and siscowet lake trout length distributions from 1980 to 2024 captured during the summer survey in the Apostle Islands region of Lake Superior. Vertical lines represent the median total length sampled each year.

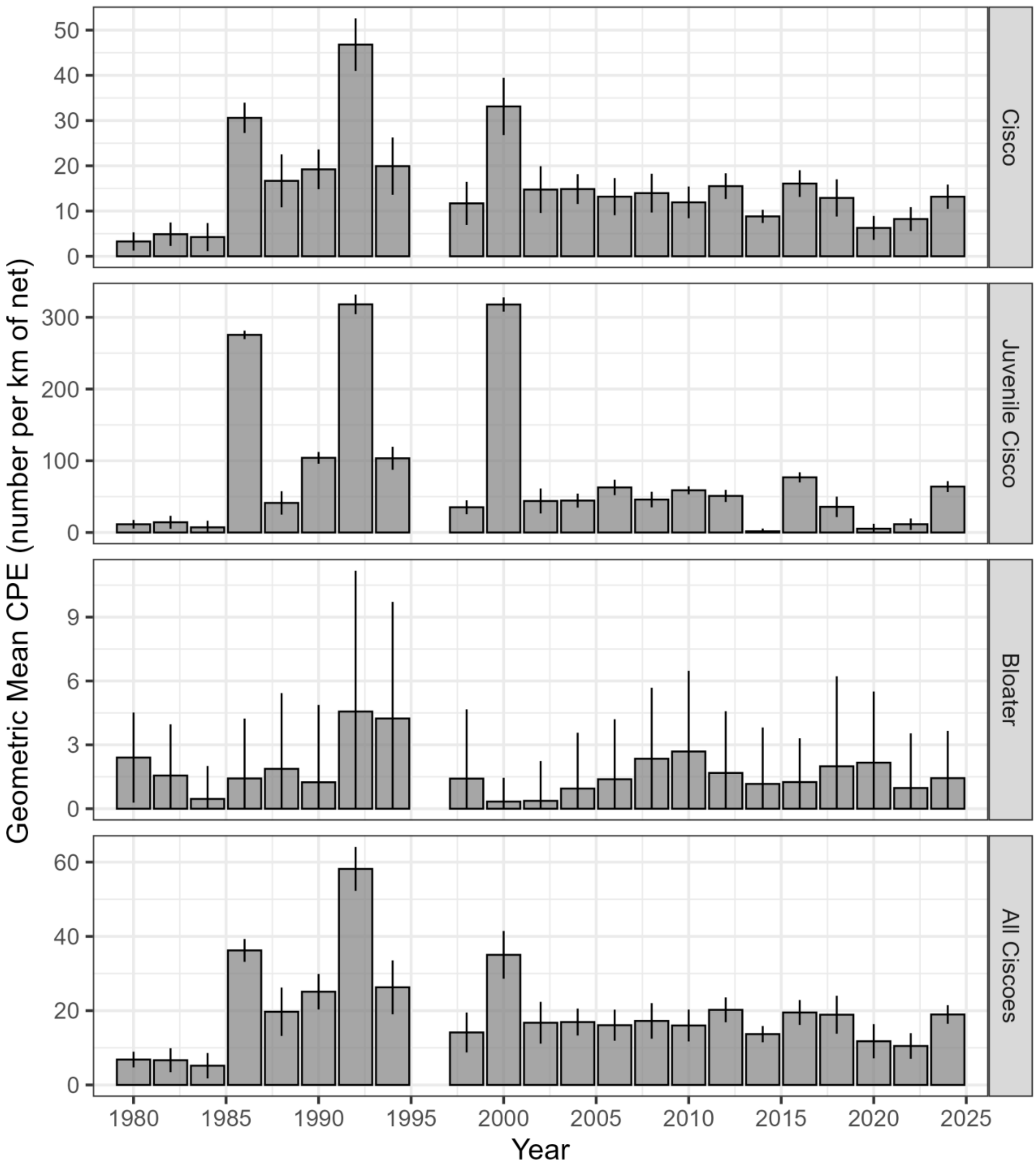

Figure 6. Time series of geometric mean catch-per-unit-effort (CPE) for all cisco *C. artedi* (all meshes), juvenile cisco (fish captured in the 38 mm mesh panel), bloater *C. hoyi* (all meshes), and all ciscoes, including *C. artedi, C. hoyi, C. kiyi* and *C. zenithicus* (all meshes) in the summer survey of the Apostle Islands region of Lake Superior, 1980-2024. Sampling did not occur in 1996. Error bars represent one standard deviation.

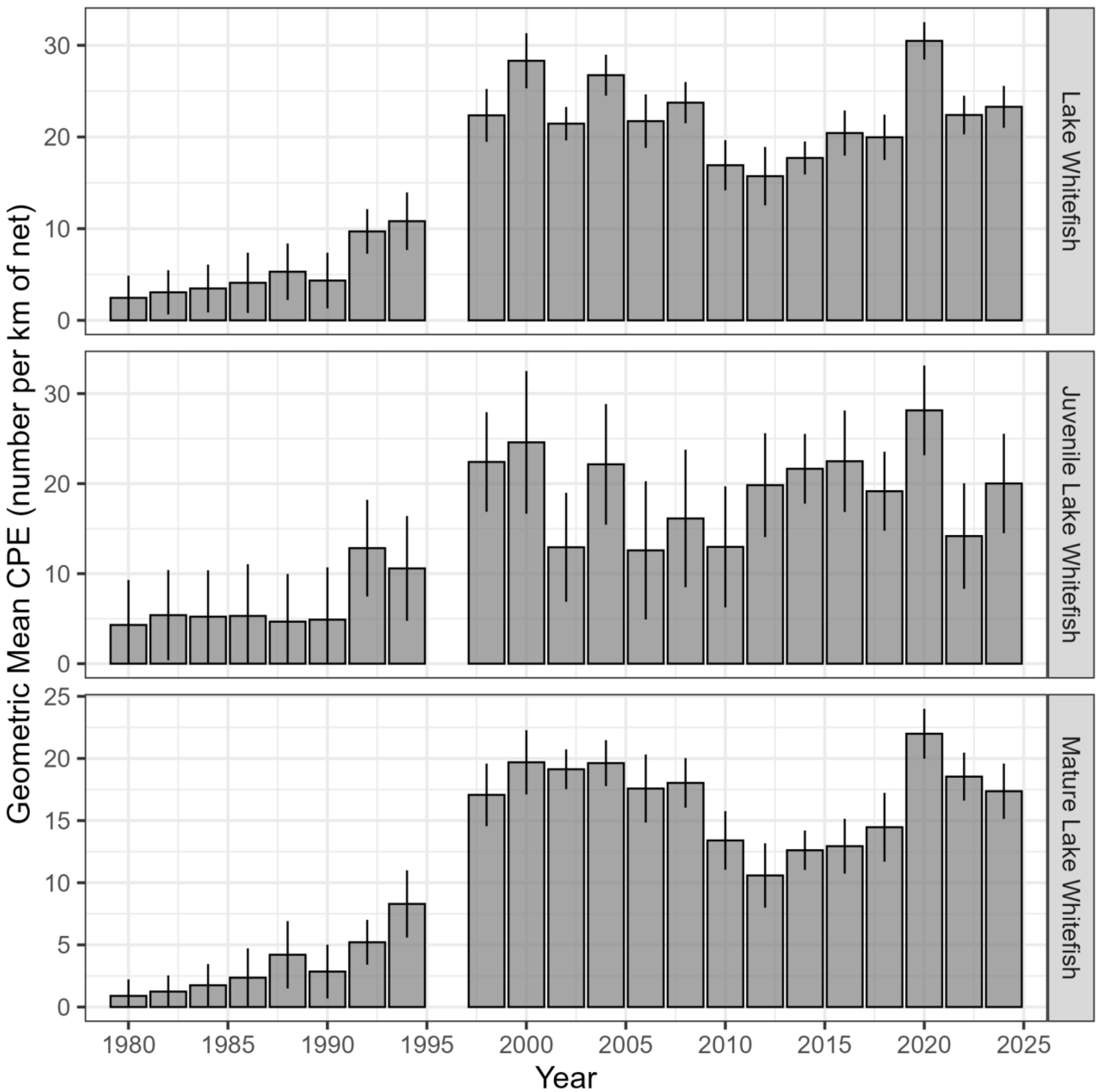

Figure 7. Time series of mean catch-per-unit-effort (CPE) for all lake whitefish *C. clupeaformis* (all meshes), juvenile lake whitefish (fish captured in the 38, 51 and 64 mm mesh panels) and mature lake whitefish (panels > 64 mm mesh size) in the summer survey of the Apostle Islands region of Lake Superior, 1980-2024. Sampling did not occur in 1996. Error bars represent one standard deviation.

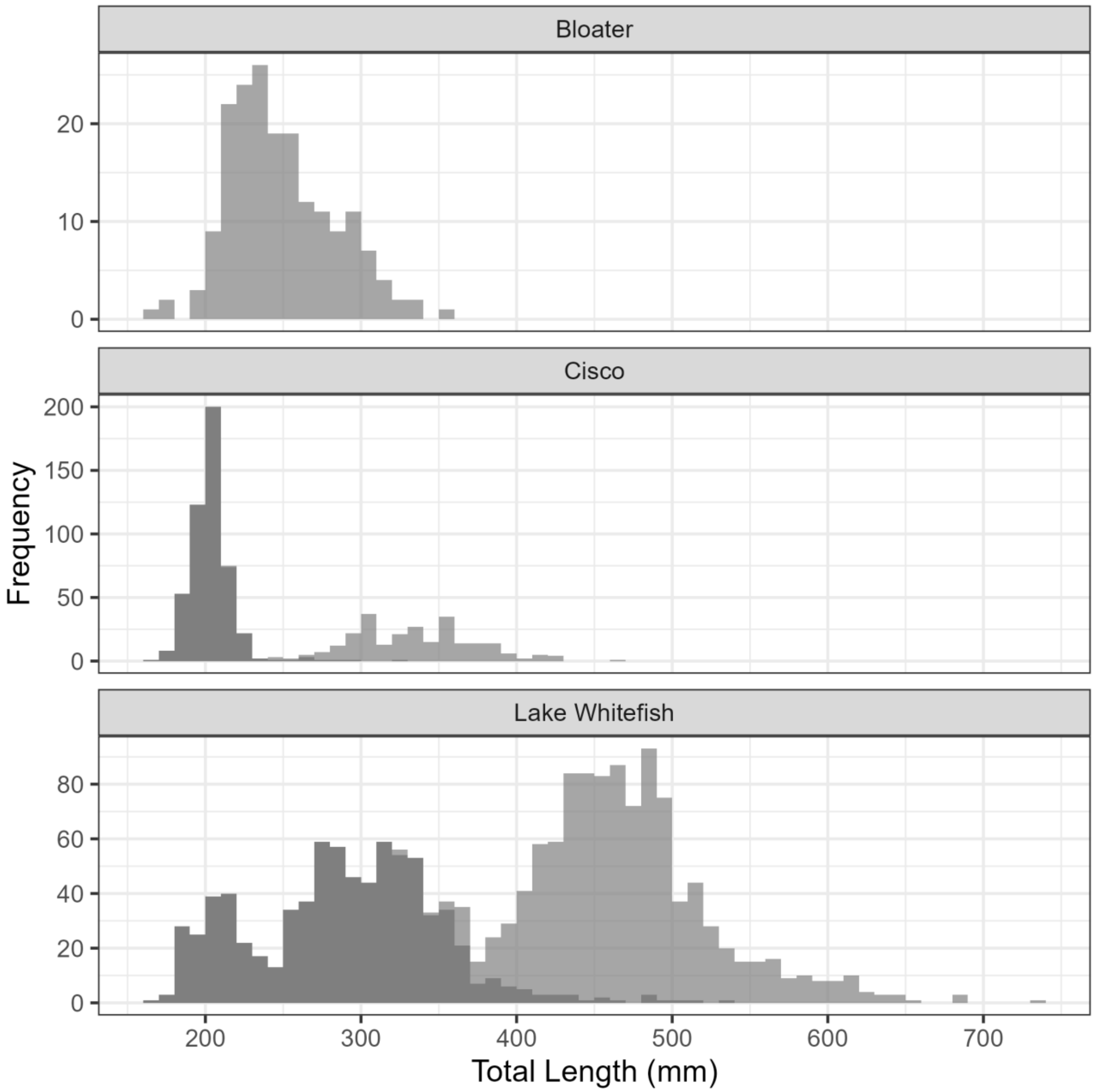

Figure 8. Length frequency histograms of bloater *C. hoyi* (top), cisco *C. artedi* (middle) and lake whitefish *C. clupeaformis* (bottom) caught in the Apostle Islands region of Lake Superior during the 2024 summer survey. Darker grey bars represent fish that were counted in the juvenile cisco or juvenile lake whitefish indices.

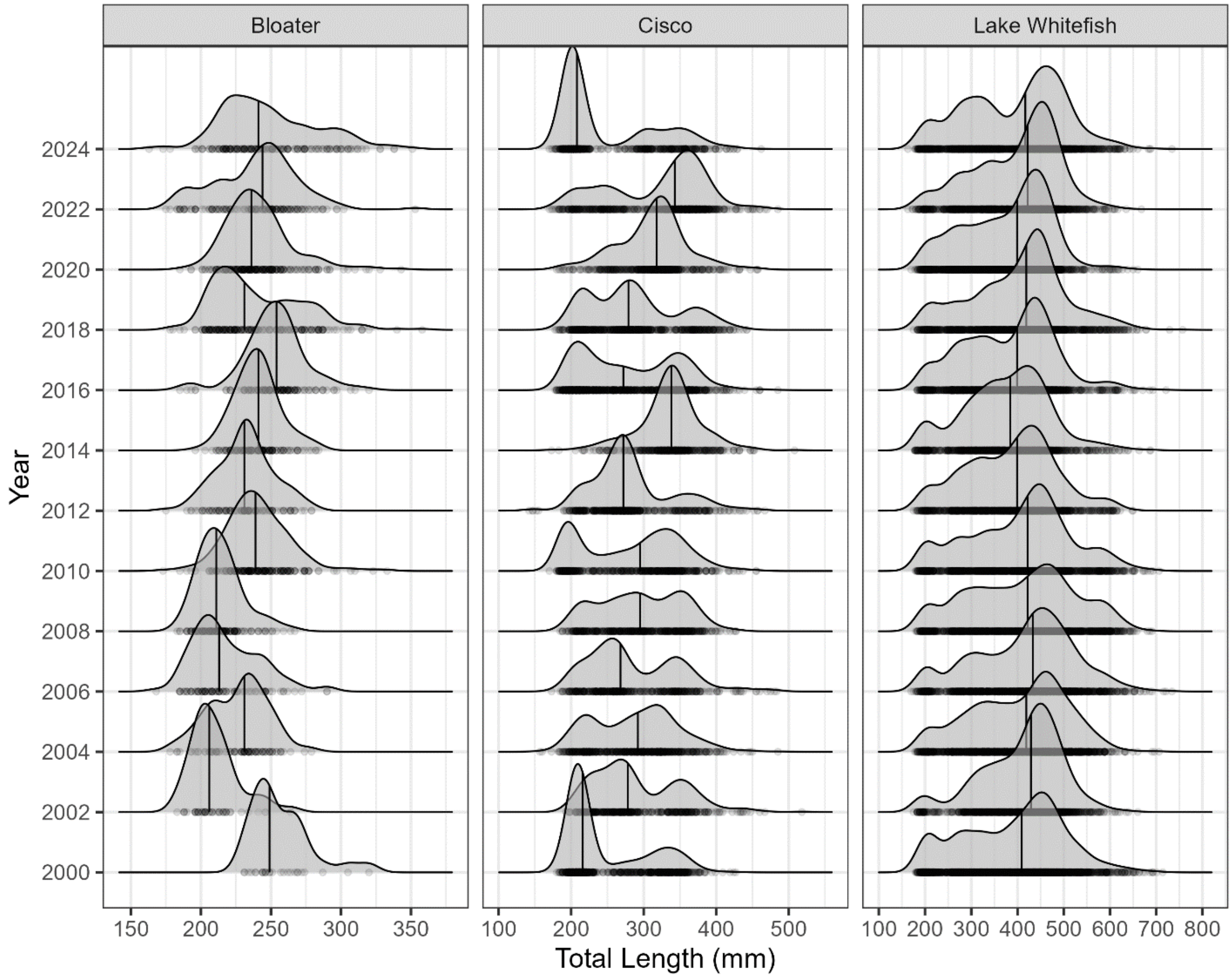

Figure 9. Time series of bloater, cisco and lake whitefish length distributions from 2000 to 2024 captured during the summer community survey in the Apostle Islands region of Lake Superior. Vertical lines represent the median total length sampled each year.

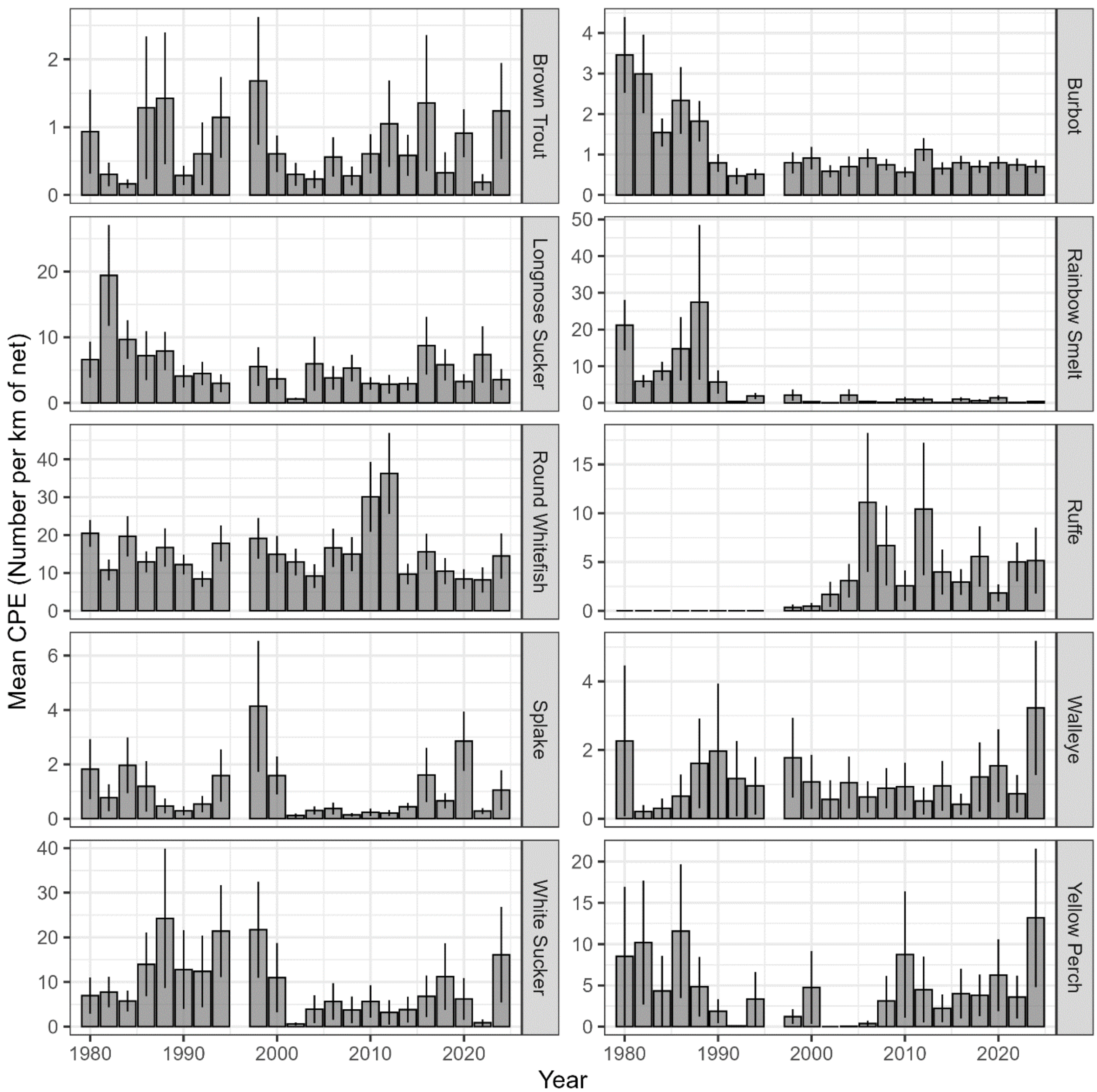

Figure 10. Time series (1980-2024) of mean catch-per-unit-effort (CPE) in the DNR summer survey for ten common species in the Apostle Islands region of Lake Superior including: brown trout, burbot, longnose sucker, rainbow smelt, round whitefish, Eurasian ruffe, splake, walleye, white sucker and yellow perch. Sampling did not occur in 1996. Error bars represent one standard error.

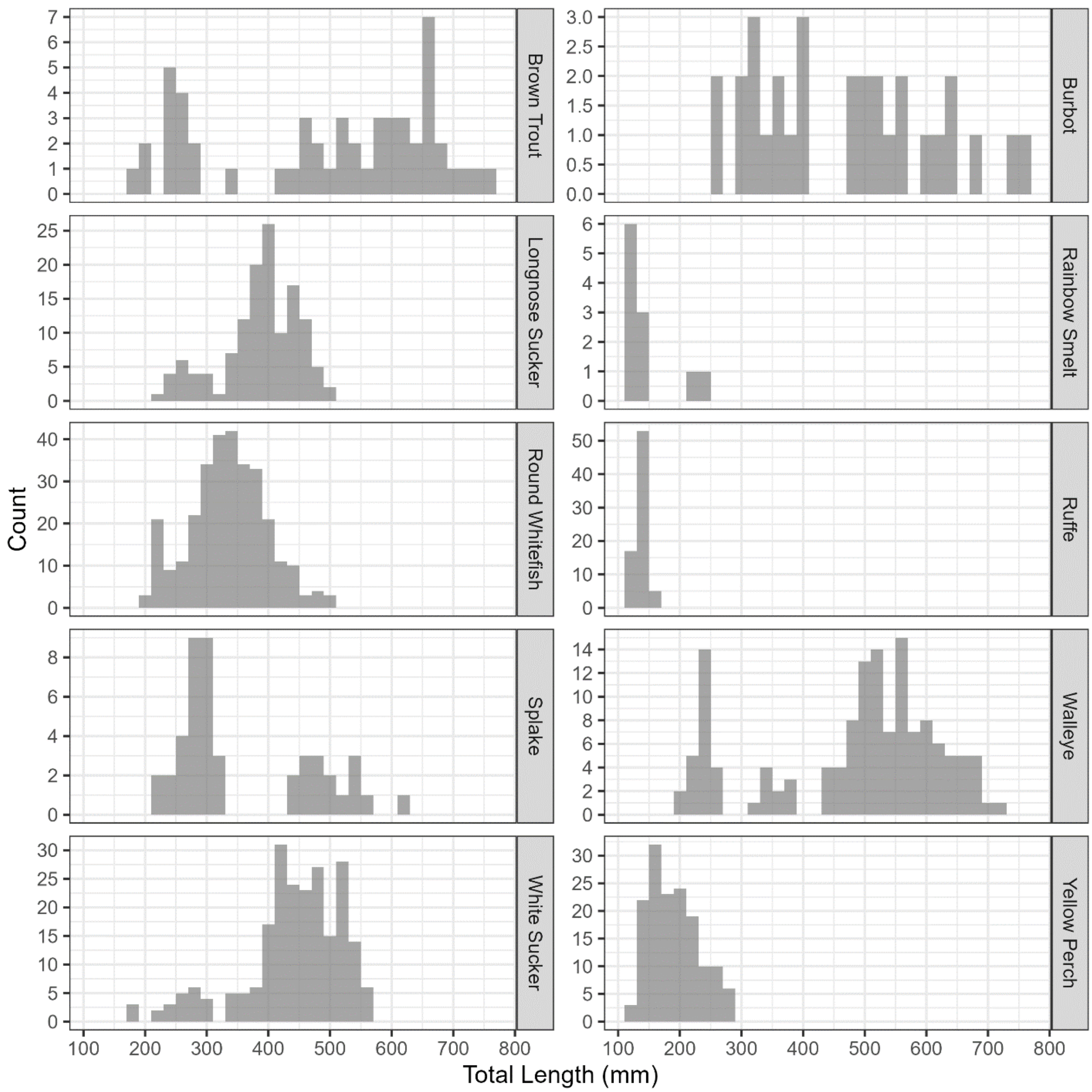

Figure 11. Length frequency histograms of ten common species captured in the Apostle Islands region of Lake Superior in the 2024 summer survey including: brown trout, burbot, longnose sucker, rainbow smelt, round whitefish, Eurasian ruffe, splake, walleye, white sucker and yellow perch.