WISCONSIN DEPARTMENT OF NATURAL RESOURCES

LAKE SUPERIOR SISCOWET LAKE TROUT ASSESSMENT REPORT 2021

DRAY CARL

DNR Lake Superior Fisheries Management Team

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INTRODUCTION

Siscowet (i.e., Fat) Lake Trout evolved body morphology equipped to survive in the great depths of Lake Superior (e.g., stouter body, shorter snout, larger eyes, higher lipid content, longer paired fins). This morphotype primarily occupies depths greater than 230 feet, but it can be encountered in shallower depths. Although Siscowet are infrequently encountered by anglers, it is likely the most abundant predator in Lake Superior and is an important part of the fish community and Lake Superior ecosystem. Siscowet are also commercially harvested in the Wisconsin waters of Lake Superior and comprise a relatively large portion of the commerical harvest in management unit WI-1.

The Lake Superior Technical Committee (LSTC) initiated this coordinated lake-wide Siscowet survey with the primary objectives of sampling Siscowet populations throughout the lake and gaining a broader understanding of their ecological role, determining relative abundance, and assessing age and size composition. Information from this survey is used to monitor population dynamics and also to assess progress toward fish community objectives (FCOs) in the Wisconsin waters of Lake Superior. 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 and supporting sustainable fisheries" (Horns et al. 2003).

METHODS

The Wisconsin Department of Natural Resources (DNR) Siscowet Lake Trout assessment is conducted once every three years at sites chosen based on water depth and proximity to docking locations in management units WI-1 and WI-2. In 2021, eight stations were sampled, four in WI-1 and four in WI-2, with 823-meter monofilament gill net gangs (Figure 1). Each gang covers one depth strata (0-19 fathoms, 20-39 fathoms, 40-59 fathoms and 60-79 fathoms) and is composed of a series of 91-meter nets constructed with 51 to 152 millimeter mesh (stretch measure) by 13-millimeter increments. All nets were set on the lake bottom for one net-night (24 hours) using the R/V Hack Noyes. Biological information was collected from fish using standardized protocols.

Otoliths were dissected from most Siscowet to estimate fish ages. Unaged fish were assigned an age using a standard age-length key approach using only age samples within a given year (Isermann and Knight 2005; Ogle et al. 2020). Sea Lamprey wounding rates were calculated as the total number of A-1, A-2 and A-3 wounds per 100 fish (King 1980; Eshenroder and Koonce 1984).

Analyses were conducted using the program R (version 3.6.1) with help from packages tidyverse (Wickham et al. 2019) and FSA (Ogle et al. 2020), and this report was formatted using the package rmarkdown (Allaire et al. 2020).

RESULTS AND DISCUSSION

Relative abundance of Siscowet was similar to the past two survey years (2018 and 2015) in WI-1 and increased slightly in WI-2 (Figure 2). Collectively, relative abundance increased slightly in 2021 in all Wisconsin waters. CPEs generally declined throughout the 2000s in both management units, increased in the 2012 survey, and have since declined. This trend was generally reflected in other jurisdictions around Lake Superior (Seider et al. 2021). Relative abundance has been highest in the 60-79 fathoms (360-474 feet) depth stratification in WI-1 and the 40-59 fathoms (240-354 feet) stratification in WI-2 (Figure 3). Relative abunance metrics should be evaluated with caution due to lack of adequate replication in this assessment. Sea Lamprey wounding rate was below 3 scars per 100 fish in both management units, lower than the recommended rate of 5 scars per 100 fish (Figure 4). Sea Lamprey wounding rate has generally decreased in Wisconsin waters since 2000.

The median length of Siscowet in 2021 was 470 and 471 millimeters in WI-1 and WI-2, respectively (Figure 5). Length distribution has generally been smaller in the recent decade compared to the 2000s but has shifted to slightly larger fish since 2012 (Figure 6). Siscowet Lake Trout grow substantially slower than Lean Lake Trout, and individual growth rates are extremely variable (Figure 7). Therefore, assessing age structure of the population is required to evaluate population trends. Age structure has shifted throughout the period of this assessment (Figure 8). Age structure became progressively older between 1997 and 2009, likely due to little recruitment. Age structure in 2006 and 2009 was characterized by the presence of many age-classes from young to old fish. Age structure shifted substantially younger in 2012, as the population experienced large pulses in recruitment. Since 2012, the population age structure has shifted to slightly older fish. Similar patterns in Siscowet age structure have been observed in other management units in Lake Superior (Seider et al. 2021).

Trends in individual Siscowet growth rates are difficult to parse out through time, but trends in fish condition could give insight into how growth rates have changed. The relative condition factor for an individual fish is essentially the standardized residual from a linear model of length and weight of the population (Figure 9). Median relative condition factor increased from 2000 to 2012 and has decreased since (Figure 9). This decline in condition over the past decade could be caused by density-dependent factors as relatively large recruit classes emerged in the population or offshore prey biomass declines during this same period (Gorman et al. 2021).

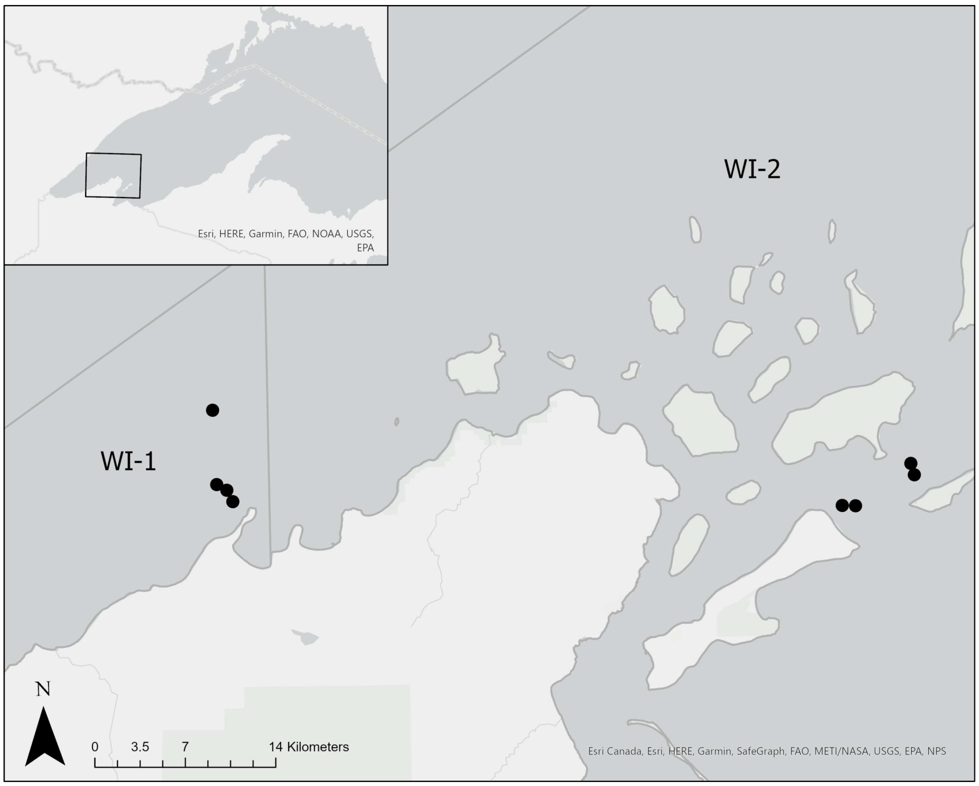

Figure 1. Map of the Wisconsin waters of Lake Superior and the inside-end buoy locations of all sampling stations in the Wisconsin DNR Siscowet Lake Trout Assessment 2021. Wisconsin management units include WI-1 (Western Arm region) and WI-2 (Apostle Islands region).

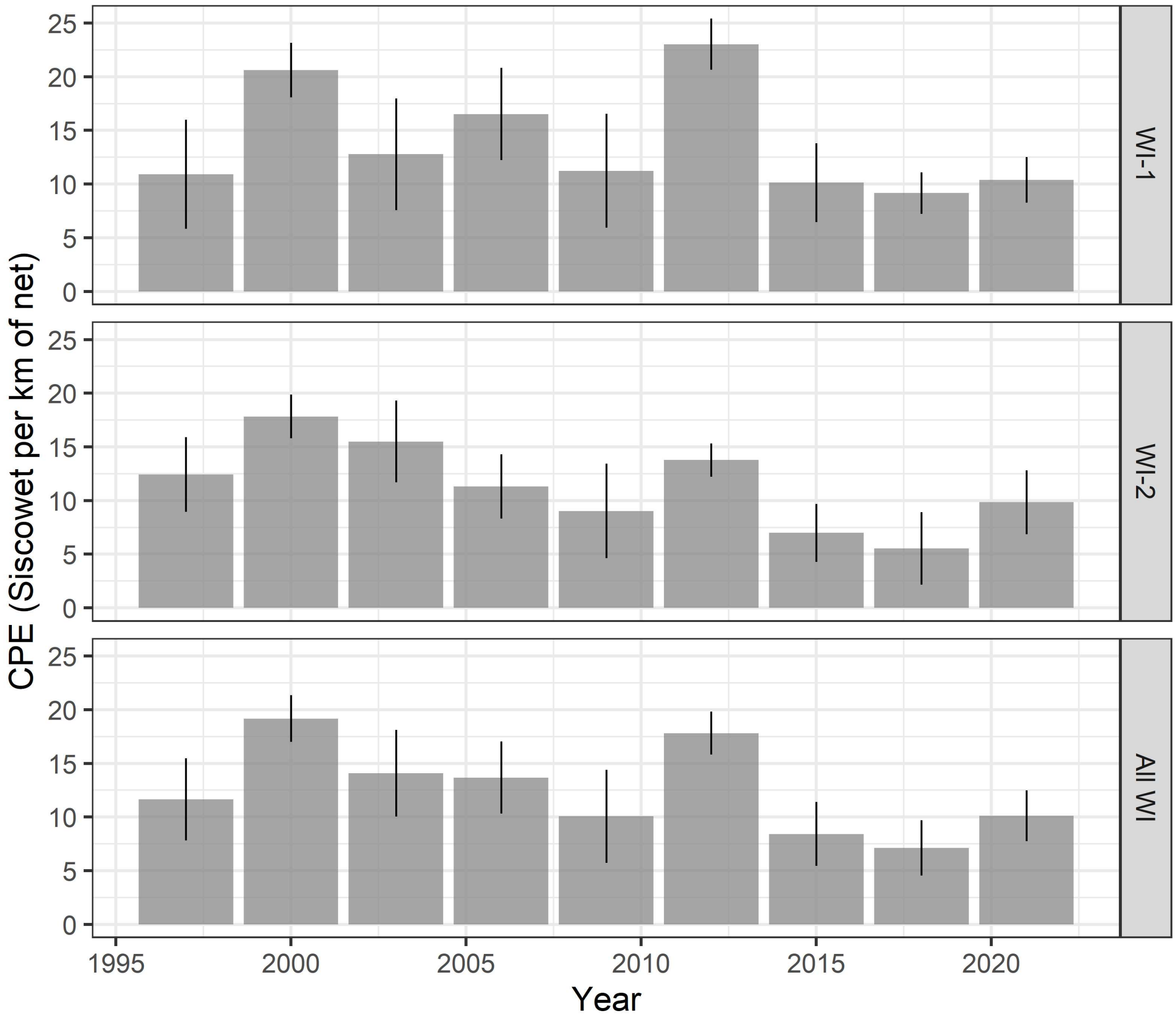

Figure 2. Geometric mean CPE (catch-per-unit-effort) of Siscowet Lake Trout in the DNR Siscowet Lake Trout Assessment conducted once every three years in WI-1 (top), WI-2 (middle) and all Wisconsin waters (bottom) from 1997 to 2021. Error bars are +/- one standard deviation.

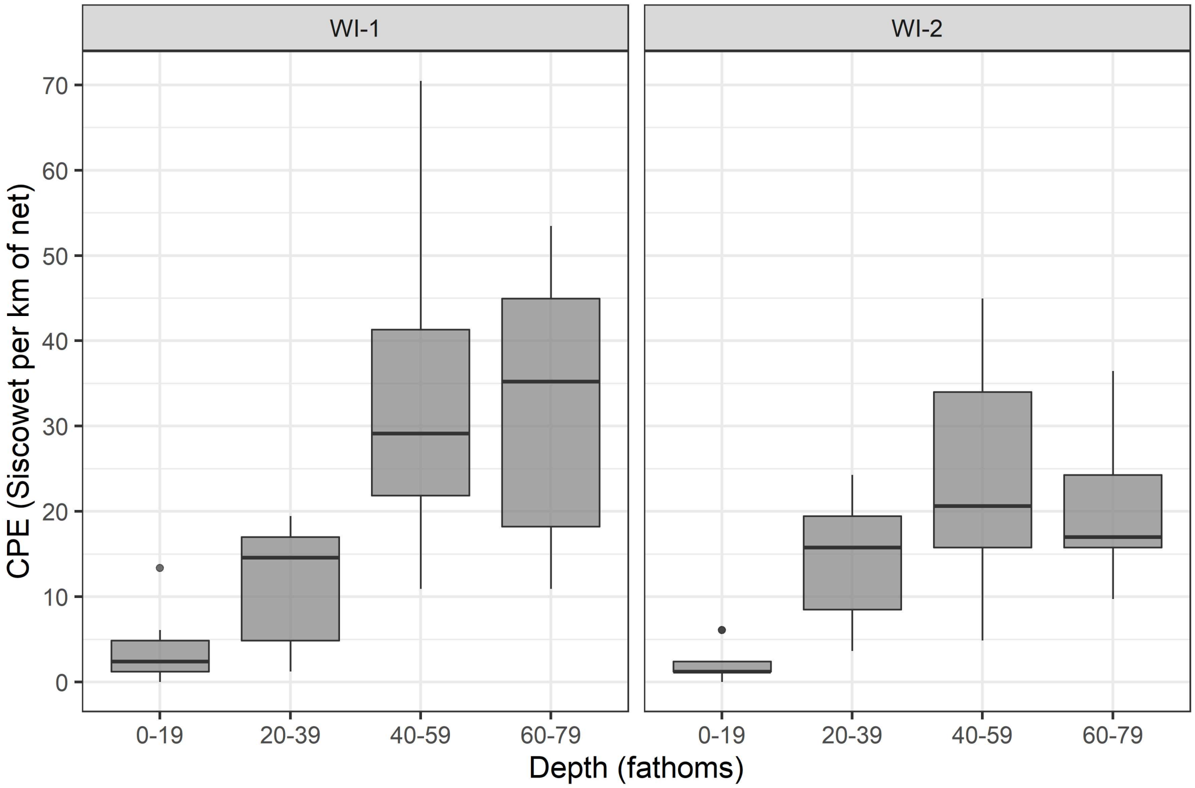

Figure 3. Geometric mean CPE (catch-per-unit-effort) of Siscowet Lake Trout by depth category in the DNR Siscowet Lake Trout Assessment conducted once every three years in WI-1 (left) and WI-2 (right) from 1997 to 2021.

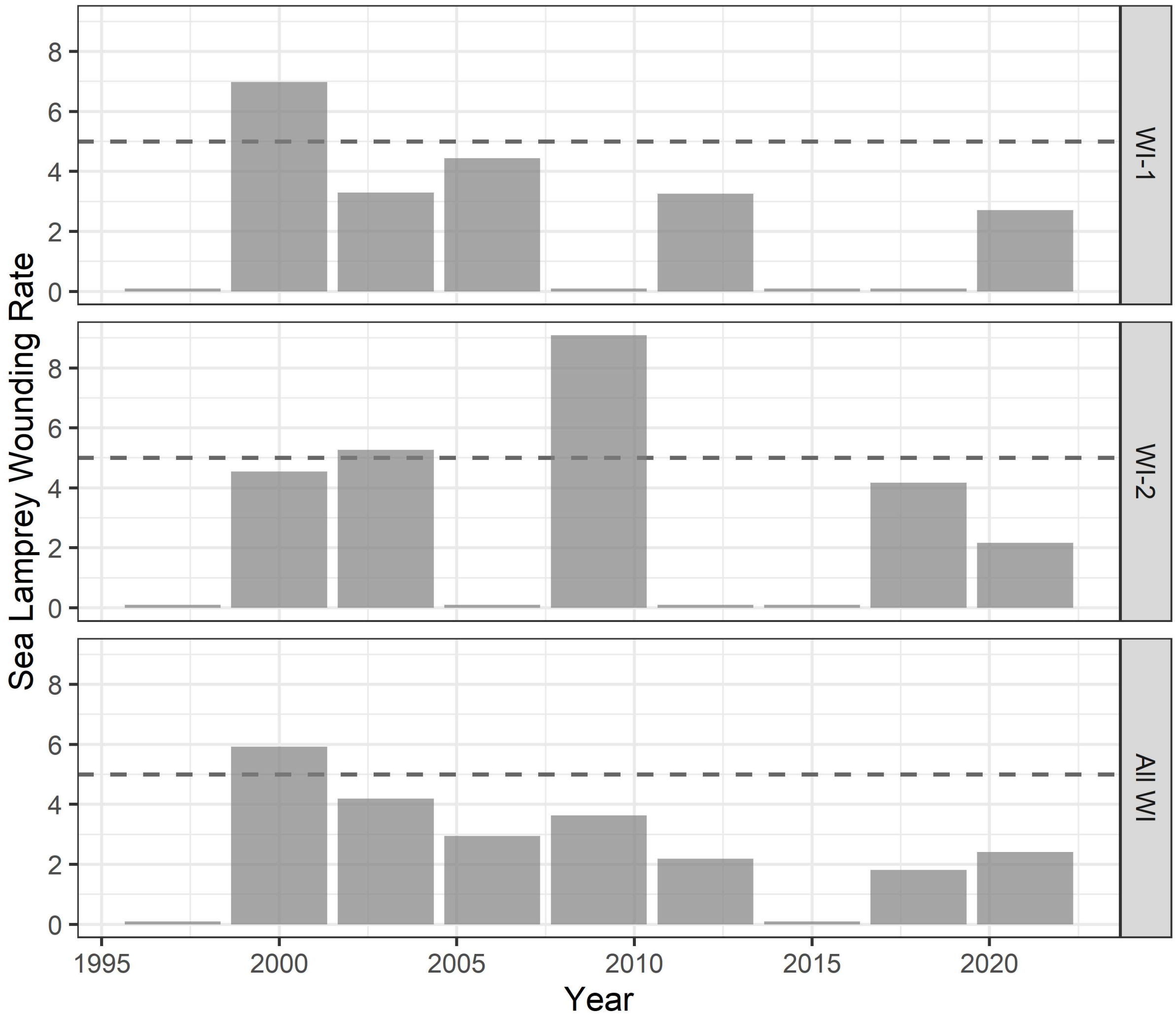

Figure 4. Sea Lamprey wounding rate of Siscowet Lake Trout in the DNR Siscowet Lake Trout Assessment conducted once every three years in WI-1 (top), WI-2 (middle) and all Wisconsin waters (bottom) from 1997 to 2021. Horizontal dashed lines are the target wounding rate of 5 scars per 100 fish set by the Lake Superior Technical Committee.

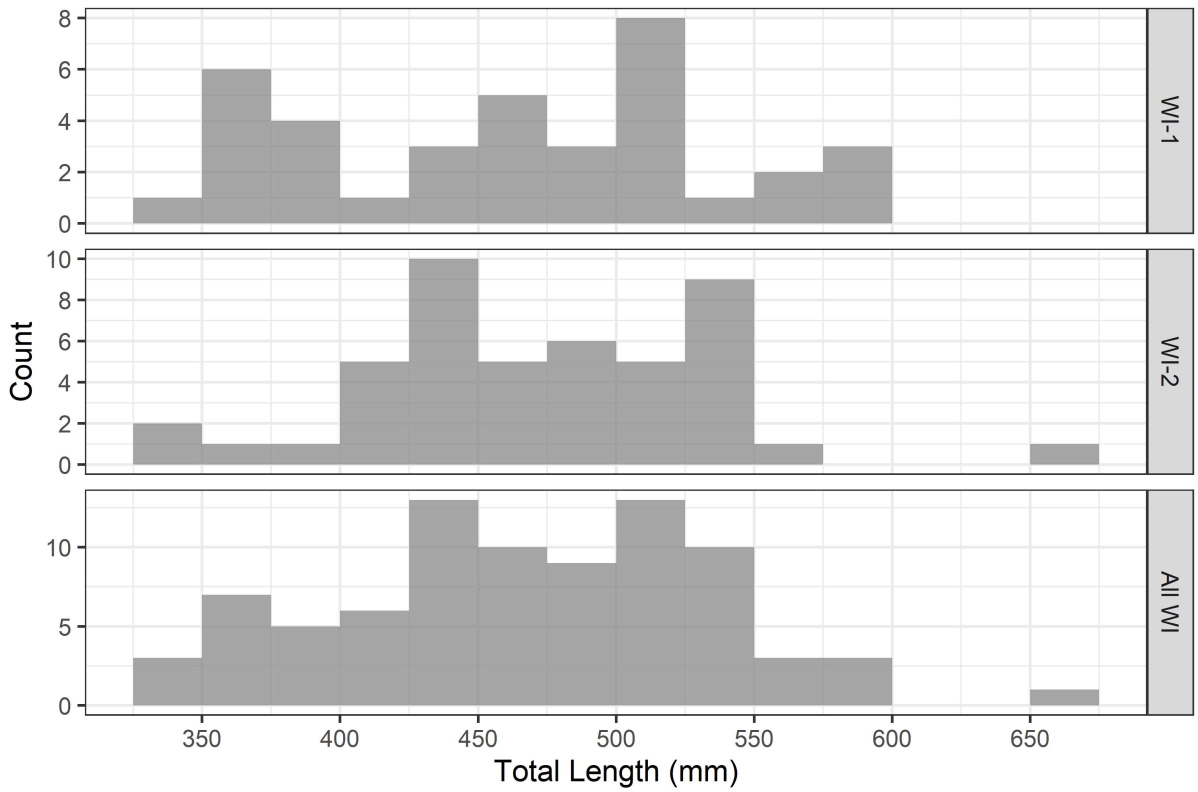

Figure 5. Length frequency histograms of Siscowet Lake Trout captured in the 2021 DNR Siscowet Lake Trout Assessment in WI-1 (top), WI-2 (middle) and all Wisconsin waters (bottom).

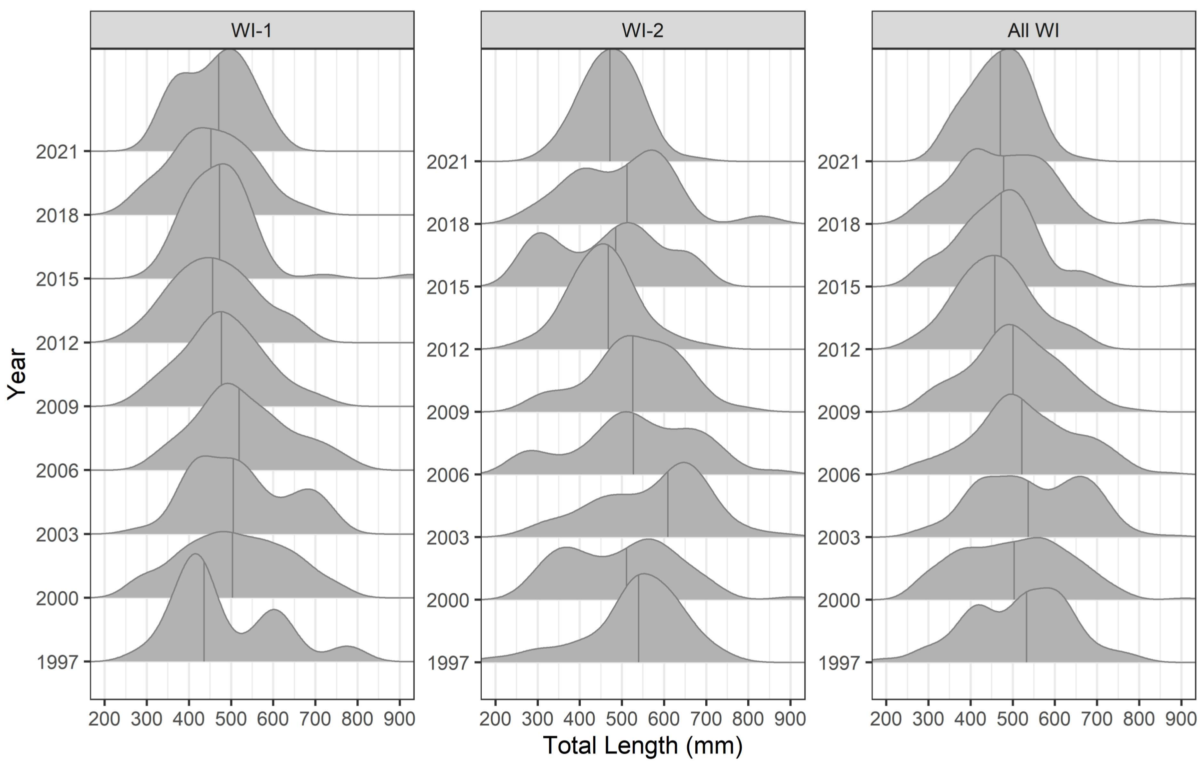

Figure 6. Time series of Siscowet Lake Trout relative length frequency captured during the DNR Siscowet Lake Trout Assessment conducted once every three years from 1997 to 2021 in WI-1 (left), WI-2 (middle) and all Wisconsin waters (right). Vertical lines represent the median total length sampled in a given year.

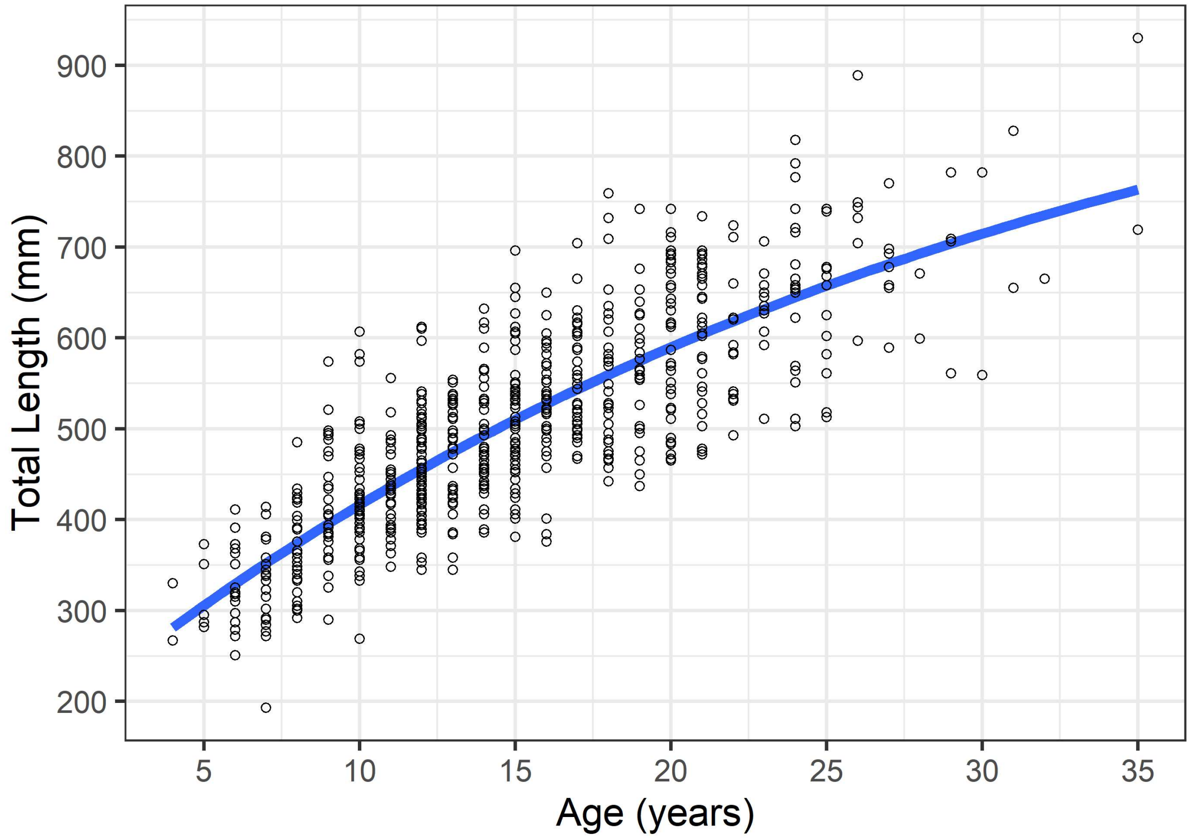

Figure 7. Length-at-age for all Siscowet Lake Trout age samples from the DNR Siscowet Lake Trout Assessment from 1997 to 2021 and a line representing the von Bertalanffy growth model fit to the data.

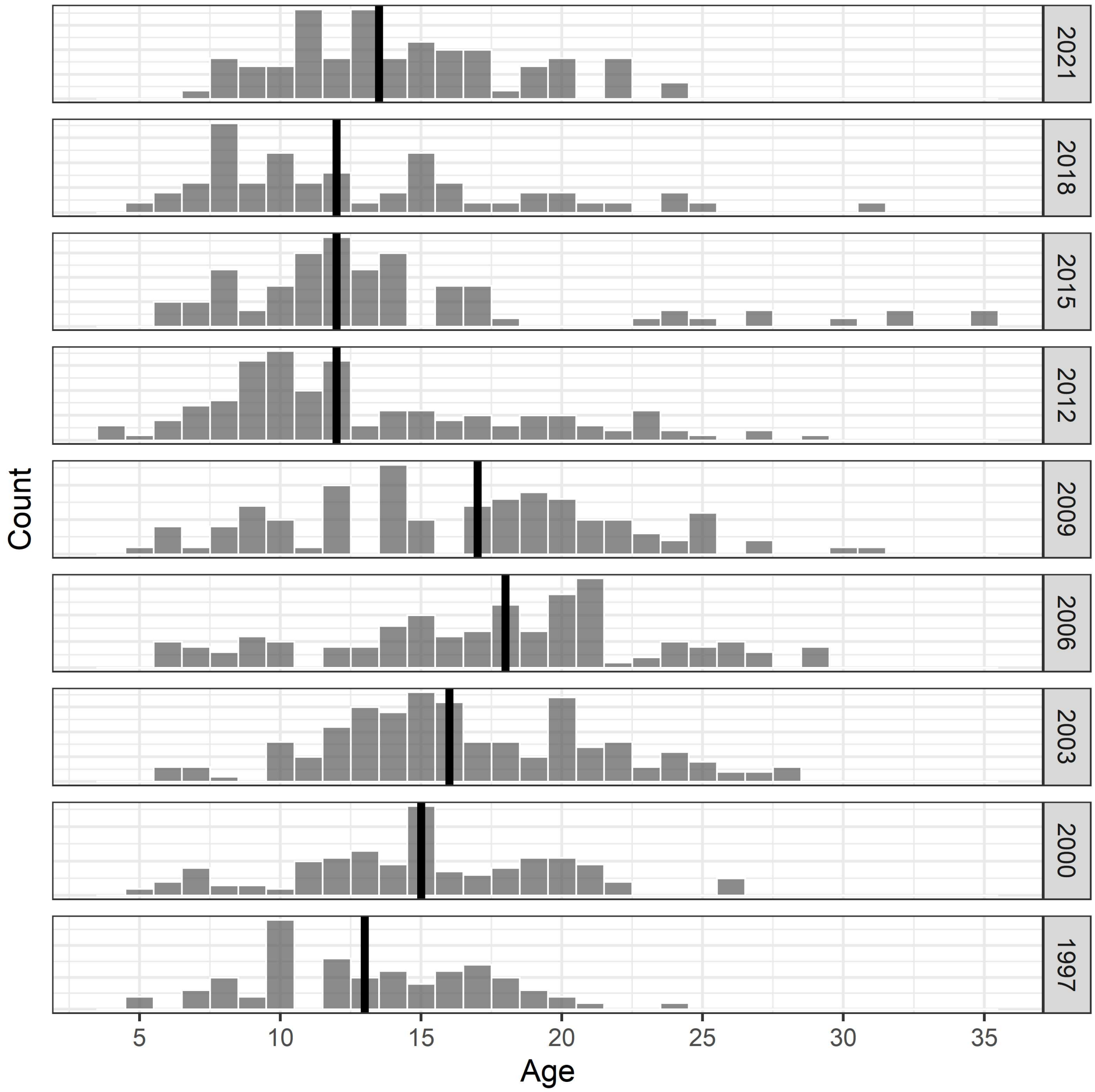

Figure 8. Age composition of Siscowet Lake Trout captured during the DNR Siscowet Lake Trout Assessment conducted once every three years from 1997 to 2021 in the Wisconsin waters of Lake Superior. Solid vertical lines represent the median age within each sampled year.

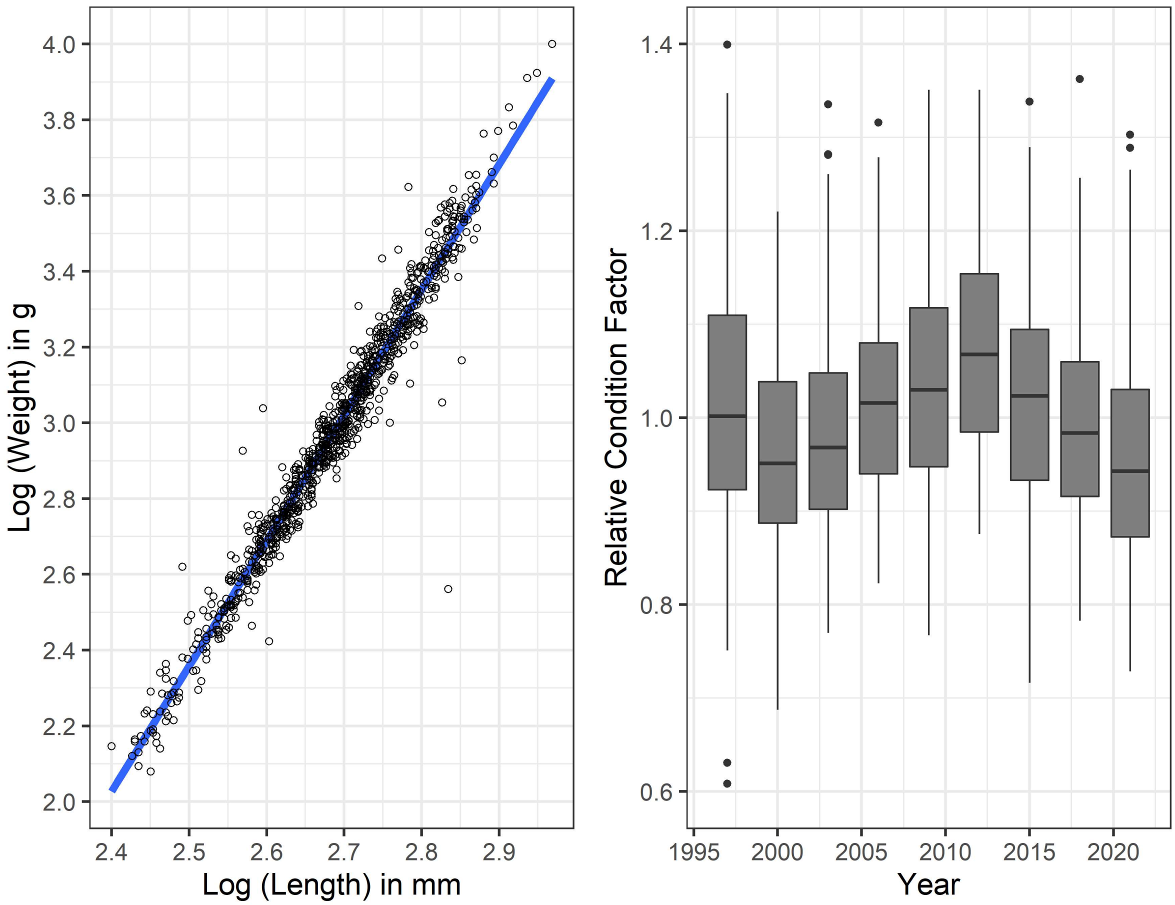

Figure 9. Length-weight regression model using all Siscowet Lake Trout sampled during the DNR Siscowet Lake Trout Assessment from 1997 to 2021 (left) and relative condition factor by year (right).

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