Illinois Department of Natural Resources

Division of Fisheries

# Lake Trout Monitoring in Lake Michigan:

# 2025 Spring and Fall Assessments

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## Table of Contents



## List of Figures

## INTRODUCTION

Lake Trout *Salvelinus namaycush* was the top native predator in Lake Michigan before its decline due to a combination of overfishing and mortality caused by the invasive Sea Lamprey *Petromyzon marinus*, resulting in the extirpation of Lake Trout in Lake Michigan by the 1950s (Wells and McLain 1972; Holey et al. 1995). A Sea Lamprey control program was initiated shortly thereafter and a Lake Trout stocking program, with the goal of rehabilitation, began in 1965 (Wells and McLain 1972).

Lake-wide stocking of Lake Trout continues annually at a combination of nearshore and offshore locations. Stocking locations and harvest restrictions were first formalized in *A Lakewide Management Plan for Lake Trout Rehabilitation in Lake Michigan* (LMLTTC 1985). Primary stocking sites (areas with the best spawning habitat and where high commercial harvests of Lake Trout occurred) were established as well as refuges in the northern and mid-lake regions that were closed to all forms of harvest. In addition, secondary stocking sites were adopted which were deemed to have sub-par habitat but provided for more localized fisheries. In Illinois waters, Julian's Reef was established as a primary stocking site and regulated as a commercial refuge, where sport fishing was allowed but commercial fishing was prohibited. Julian's Reef was first stocked in 1981 and has received annual stocking in all but five of the past 34 years (Figure 1). Despite these efforts, successful natural reproduction was negligible until recently and thus the Management Plan's goal of establishing a self-sustaining Lake Trout population has been unmet for decades.

Stocking locations and numbers were revised under *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan* (Dexter et al. 2011; referred to hereafter as the *Implementation Strategy*). Julian's Reef was retained as a First Priority stocking site and 60,000 yearling Lake Trout of Lewis Lake (LLW) strain and 60,000 yearling Lake Trout of Seneca Lake (SLW) strain have been stocked each year since 2011, except for the COVID-19 pandemic-related interruption of 2020-2021 (Figure 1). The *Implementation Strategy* contained four Evaluation Objectives to monitor progress toward targeted rehabilitation, which were updated and supplemented in 2024 under *A Stocking Strategy and Evaluation Objectives for the Rehabilitation of Lake Trout in Lake Michigan* (Wesley et al., 2024; referred to hereafter as the *Stocking Strategy*). The *Stocking Strategy* also contained objectives that only apply to regions outside Illinois waters (Objectives 4 and 5). The relevant objectives under the *Stocking Strategy* for Illinois waters are: 1) catch-per-unit-effort (CPUE) of >25 Lake Trout/1000 ft. of graded-mesh gill net in spring stock assessments; 2) CPUE of >50 Lake Trout/1000 ft. of graded mesh gill

net in fall spawning surveys; 3) spawning populations of at least 25% female and which have ten or more age groups older than age-7; 6) eggs with thiamine concentrations of >4 nmol/g; and 7) CPUE > 19 wild Lake Trout/1000 ft. of graded-mesh gill net in spring stock assessments. Objectives 2, 3, and 6 are used to assess first priority stocking sites.

To assess progress toward these Evaluation Objectives in the Illinois waters of Lake Michigan, annual gill net surveys are conducted in the spring at offshore locations near Waukegan, IL and at spawning reefs during the fall (Figure 2). Gill nets have been used annually to sample spawning Lake Trout at both Waukegan and Julian's reefs since the early 1980s. Patterson et al. (2017) found no significant differences in catch statistics between Julian's Reef and Waukegan Reef during 1999-2014. Thus, Evaluation Objectives 2, 3, and 6 were assessed annually at Julian's Reef, with data from Waukegan Reef being used in years when no sampling occurred at Julian's Reef. This report covers progress towards Evaluation Objectives 1-3, 6 and 7 in Illinois's Lake Michigan waters.

Similarities between Julian's and Waukegan reefs and an increase in Lake Trout of wild origin led to a change in fall Lake Trout sampling site selection. Beginning in 2017, these Illinois priority sites were sampled in alternate years to allow investigation of population parameters at other reefs where Lake Trout may be spawning. Fall Lake Trout sampling included the non-priority sites North Reef (2017), Wilmette Reef (2018), and Lake Bluff 10-Mile Reef (2019), which were sampled in addition to either Julian's or Waukegan reefs. However, this rotation of priority and non-priority sites was interrupted in 2020, when COVID-19 restrictions prevented both spring and fall Lake Trout sampling. The pandemic sampling disruption and inconsistent effort and catches at the priority sites in subsequent years resulted in a return to sampling Julian's and Waukegan reefs from 2021-2024. In 2025, a new strategy was implemented that included non-priority shallower sites (30-50 ft. depth) in areas that had been sampled historically (1990-2000). Due to adverse weather conditions, shallow sites at Highland Park and Lake Forest were the only sites sampled in fall 2025. While constituting a departure from the typical fall protocol of sampling at least one Illinois priority site annually, this sampling change in 2025 created an opportunity to compare characteristics of the spawning populations between typical offshore reefs and more nearshore shallow habitats. Herein, "nearshore" will refer to sites ranging in depth from 25-50 ft. (e.g., fall 2025 sample) and "offshore" will refer to spawning sites sampled in previous years that typically occur in waters 80-120 ft. deep.

## METHODS

Lake Trout were sampled with gill nets during two surveys. Data are presented from surveys conducted in 2006-2025.

### Spring and Fall Lake Trout Surveys

Two graded mesh gill nets, each with two 100 ft. panels of 2.5" to 6" (½ inch increments) mesh sizes (1600 ft. total) were fished overnight (Schneeberger et al. 1998) on 13-15 May 2025. One net was set at an established site within each of three targeted depth bins (50-100, 100-150, and 150-200 ft.) at each of two identified transects offshore of Waukegan, IL (Figure 2). A total of six nets were fished during the 2025 spring survey.

In fall, two graded mesh gill nets, each with two 100 ft panels of 4.5” to 6” (½ inch increments) mesh sizes (800 ft. total) were fished overnight on two occasions. A total of four nets were fished during the 2025 fall survey, two at nearshore Lake Forest sites (35 ft. and 47 ft. depth), one at a nearshore Highland Park site (35 ft. depth), and one at nearshore Highland Park Reef (25 – 35 ft. depth; Figure 2).

In both surveys, fish were measured to the nearest 5 mm (maximum total length) and weighed to the nearest 50 grams. In addition, clipped fins, lamprey wounds, sex, and maturity were recorded. Lake Trout with an adipose fin clip, indicating the presence of a coded-wire tag (CWT), had the head removed for tag extraction in the laboratory. For Lake Trout without any fin clip (putative wild origin) or with rotational fin clips (implying no CWT was given), maxillary bones were collected for aging.

### Data Analyses

Lake Trout CPUE was calculated as number of fish per 1000 feet of gill net in both the spring and fall surveys. Because CPUE values are highly dependent on standardized effort, nets that were fished for more than 1 day in duration (since a 2-day set ≠ twice the number of fish of a 1-day set) or with incorrect mesh sizes were removed from CPUE analyses. For this report, all nets from the spring Lake Trout survey in 2003, two nets from the spring Lake Trout survey in 2007, and two nets from the fall spawner survey in 2011 were removed from analysis. Across the time series (1999-2025), CPUE data from 144 gillnet sets is included in the spring Lake Trout survey analysis, while the fall spawner survey analysis includes data from 186 gillnet sets. Catch data from all net sets and information from CWTs was used in reporting proportion female, number of age classes, proportion of unmarked fish, strain, and stocking origin since effort and mesh size has less influence on these indices.

## RESULTS AND DISCUSSION

### Spring Lake Trout Survey

Spring Lake Trout CPUE was 12.4 fish/1000 ft. of net in 2025. This was the highest CPUE observed since 2016 (14.5 fish/1000 ft. of net), but still only 50% of the target (25 fish/1000 ft.) which has only been achieved once in 24 years of spring sampling (Figure 3). Thus, Evaluation Objective 1 of the *Stocking Strategy* has not been achieved in Illinois waters.

A total of 45 Lake Trout (37.8%) were not fin-clipped and presumed to be of wild origin (Figure 4). This is nearly the same proportion of wild fish observed in the spring survey in 2024 (37.5%) and below the highest recorded proportion of wild fish (41%) that occurred in 2023. The percentage of unmarked fish in spring catches increased after 2010 and has averaged 24% (2011-2025 average) since that time. The CPUE of wild fish was 4.7 wild fish/1000 ft. of net, which represents the highest CPUE of wild fish observed in the spring survey, though is still only 25% of the 19 wild fish/1000 ft. target. Thus, Evaluation Objective 7 has not been achieved in Illinois waters.

Sixty-four Lake Trout had an adipose fin clip, and their snout was collected for tag retrieval. One CWT was lost during extraction and another snout had no tag detected at the lab. A total of 62 CWTs were successfully decoded. A majority (43) were stocked on Julian's Reef (4 to 21 years old at capture), 18 were stocked on the Mid-lake Reef Complex (7 to 22 years old at capture), and one was stocked in northern Lake Michigan (from shore in Charlevoix, MI; 6 years old at capture).

Four strains of lake trout were represented in the catch of stocked fish (containing CWTs) during the spring 2025 survey (Figure 9): 40 were Lewis Lake (64.5%), 12 were Seneca Lake (19.3%), nine were Klondike (14.5%) and one was Green Lake (1.7%). Strain composition of the spring catch has been generally consistent since 2016 after a steep decline in the abundance of the Green Lake strain, which ceased to be stocked at Julian's Reef after 2006. Prior to 2016, Green Lake fish averaged 70% of the annual spring catch but have since only averaged 5%. Lewis Lake strain comprised an average of 60% of spring catch on an annual basis since 2016, compared to 30% for Seneca Lake strain. This is despite having been stocked in roughly equal numbers at nearby Julian's Reef since 2011. Because Seneca Lake strain fish are typically more common than Lewis Lake strain in the fall survey (see below), the discrepancy in spring catches between the strains does not necessarily reflect differential survival. It could also be due to differences in depth distribution, or another aspect of habitat use between the strains. In Lake Huron, Great Lakes-origin strains (including Lewis Lake) were found to occupy consistently warmer temperatures and shallower depths during stratification than Seneca Lake strain

(Bergstedt et al., 2012). It is possible this difference in temperature preference plays a part in the seasonal difference in catch composition between the two primary strains. In 2025, the Superior – Klondike strain increased in prevalence for the third straight year after first appearing in the LWAP survey in 2021. This strain was stocked at the Mid-Lake Refuge from 2012 to 2019 and is the only Lake Trout strain stocked in Lake Michigan that is a "humper" morph, which is thought to reside strictly on offshore reefs and shoals (Larson et al., 2021).

**Fall Spawner Survey**

Fall Lake Trout CPUE was 46.6 fish/1000 ft. of net in 2025 across all nearshore locations sampled. Fall CPUE has exceeded the 50 fish/1000 ft. target in all but three years of the fall survey (Figure 5). Though the 2025 survey CPUE fell below the objective level, the habitat sampled in 2025 was not targeted at offshore reefs as it has been in previous years and lower catches were expected. Consistent CPUEs above the target indicate that Evaluation Objective 2 of the *Stocking Strategy* has been achieved in Illinois waters.

Evaluation Objective 3 of the *Stocking Strategy* has two components. The first is a goal of at least 25% female Lake Trout at spawning sites. This target has been met in 8 out of 21 years at Julian's Reef, the priority site for the assessment of progress towards evaluation objectives. At nearshore sites sampled in 2025 female lake trout were only 10% of the catch, considerably lower than is typically observed at Julian's and Waukegan reefs (Figure 6). This implies a difference in spawning stock characteristics for fish spawning at nearshore locations compared to previously sampled offshore reefs. While this target has been met inconsistently at Julian's Reef (the priority site) over the time series, it has been met consistently at Waukegan Reef indicating that significant progress has been made towards meeting this objective.

The second component of Evaluation Objective 3 is a spawning population consisting of 10 or more age classes present greater than age-7. In 2025, 18 age classes above age-7 were observed (Figure 7). This represents a substantial increase in the number of age classes observed compared to sampling in previous years. Prior to 2025, CWTs represent the only source of ages for Lake Trout collected from spawning sites in the fall survey, thus ages from wild Lake Trout or Lake Trout with rotational fin clips are not represented within the data being used to evaluate Objective 3 in Illinois waters before the 2025 assessment. Aging structures (maxillary bones) have been collected from Lake Trout during previous

annual assessments and processing of these structures is anticipated in the coming years. Future inclusion of this data, particularly from unclipped, wild Lake Trout, should provide a more complete age structure of the existing mixed stock of hatchery-reared and wild Lake Trout. While the 2025 age data was more comprehensive than in previous years and thus not directly comparable, it does appear that the nearshore spawning stock consists of more older fish than is typically observed offshore. This is evident from the increased prevalence of fish with rotational fin clips, which are a minimum of 16 years old, and ranged from 16-27 years old in 2025. Rotationally fin-clipped fish typically make up a lower proportion of the catch at offshore reefs, indicating that these older fish are more abundant nearshore. However, we cannot fully compare age structures between the sites until ages are assigned to maxillaries from the fall offshore surveys in 2021-2024.

Only 13% of Lake Trout sampled at nearshore sites in 2025 (19 of 149) did not have any fin clip. The presence of unmarked, potentially wild fish has increased substantially in recent years (Figure 8); however, their abundance was substantially lower at the nearshore sites compared to the offshore reefs sampled in previous years.

In 2025, 78 Lake Trout sampled at nearshore sites had an adipose fin clip and their snouts were collected for CWT extraction. No tag was detected in two of the snouts in the lab, while one tag was lost during extraction. Of the 75 CWTs decoded, 65 were stocked at Julian's Reef (4 to 23 years old at capture), while eight were stocked at the Mid-Lake Reef Complex (8 to 27 years old at capture). One was stocked from shore as a fall fingerling in southeast Lake Michigan (either Grand Haven, South Haven, or Michigan City; 13 years old at capture), and one was stocked from shore in Wisconsin (either Racine, Kewaunee, or Sturgeon Bay; 12 years old at capture). The proportion of CWT fish having been stocked on Julian's Reef (87%) was the highest recorded in the fall survey. The proportion of Julian's-stocked fish in the fall survey has been increasing steadily for years due to stocking cuts at the Mid-Lake Reef and elsewhere, so it is unknown if this observation is influenced by the nearshore site selection in 2025 or is simply a continuation of this trend.

Three strains of lake trout were represented in the catch of stocked fish (containing CWTs) during the 2025 Fall Spawner survey (Figure 9): 58 were Lewis Lake (77.3%), 13 were Seneca Lake (17.3%), and four were Green Lake (5.4%). The predominance of Lewis Lake strain fish in 2025 was in contrast with the previous trend in the fall offshore surveys that had skewed towards Seneca Lake strain fish in recent years (likely due to the stocking of only the Seneca Lake strain at the nearby mid-lake reef complex). This potentially indicates a difference in spawning habitat use between the two strains, where Seneca Lake

fish may be more likely to use larger offshore reefs while Lewis Lake fish might prefer shallower spawning sites.

Overall, compared to typical offshore reef sampling, we observed lower catch rates at nearshore sites, likely due to the size of spawning habitat patches being smaller and thus holding fewer fish. The nearshore spawning stock also consists of fewer females, appears to be generally older, and is largely represented by stocked fish. The Lewis Lake strain also appears to be more strongly represented at nearshore spawning sites than offshore. Figure 10 compares these metrics from the nearshore site in 2025 with the average of the past four years at Julian's and Waukegan reefs.

## CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

Spring Lake Trout survey CPUE was anticipated to be lower than fall CPUE when targets were set because Lake Trout aren't necessarily aggregated in the spring as they are during the fall spawning season. Spring CPUE in the Illinois waters of Lake Michigan however has remained below target in most years sampled, not reaching 25 fish/1000 ft. since the mid-2000s. Similarly, the target has been met only briefly at 4 of the 12 spring sampling sites lake-wide and has not been achieved with any regularity or consistency at any site (LMLTWG 2021). Spring CPUE of wild fish is also well below the target level (19 fish/1000 ft.) specified in Objective 7 of the newly updated *Stocking Strategy*.

*Recommendations: Continue participation in the spring Lake Trout survey and evaluate results toward achieving Evaluation Objectives 1 and 7 of the Stocking Strategy; share results with the Lake Trout Working Group of the Lake Michigan Technical Committee.*

Lake Trout population parameters for the fall spawner survey have been showing positive signs toward rehabilitation over the last decade. Catch per unit effort, proportion of females present in the spawning population, and number of older age classes have been at or above the targeted levels recently, suggesting movement toward rehabilitation success at some sites (LMLTWG 2021). The increased presence of unmarked fish in recent years indicates successful recruitment to adult life stages, especially in Illinois waters.

*Recommendations: Continue participation in the fall spawner survey at Julian's and Waukegan Reef with a special focus on presence of unmarked fish in the population as well as Objectives 2 and 3 of the*

*Stocking Strategy. Disseminate results of progress toward rehabilitation goals with constituents and the Lake Trout Working Group of the Lake Michigan Technical Committee.*

Although no new non-priority sites were sampled in 2021-2024, bathymetric surveys have been conducted by the Illinois Natural History Survey at other reefs (e.g., Gumby Reef) along with side-scan sonar surveys used to classify benthic substrate. These surveys will allow IDNR to plan future fall spawner surveys to investigate Lake Trout rehabilitation success at other non-stocked reef locations. Furthermore, sampling at nearshore sites in 2025 showed interesting contrasts in several population metrics when compared to offshore reefs indicating an older spawning stock consisting of fewer females.

*Recommendations: Expand the fall spawner survey sampling to other potential Lake Trout spawning reefs in the Illinois waters of Lake Michigan, based on Illinois Natural History Survey mapping project results*, *while maintaining an annual assessment of the Evaluation Objectives at either Waukegan or Julian's reefs. Utilize bathymetry and substrate information to target Lake Trout spawning locations on reefs. When time allows, incorporate a nearshore site into the fall spawner survey as well.*

**ACKNOWLEDGEMENTS**

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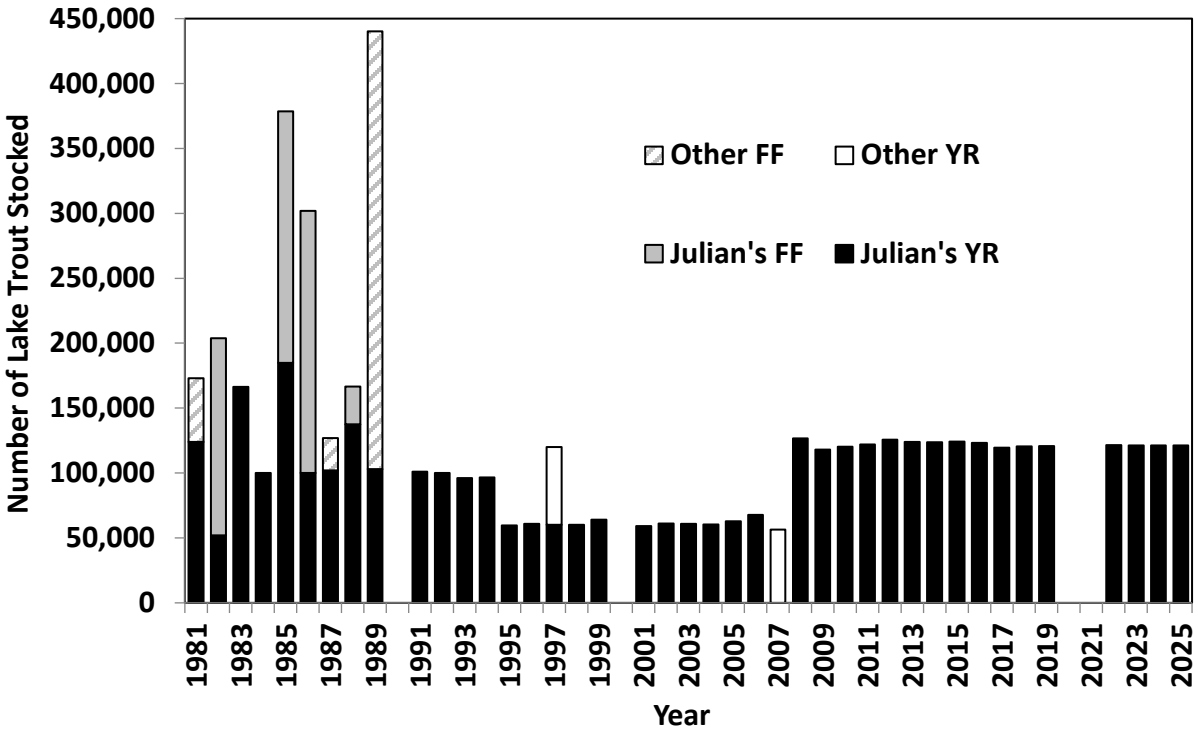


Figure 1. Lake Trout stocking in Illinois waters of Lake Michigan, 1981 to 2025 (FF = fall fingerling, YR = yearling). Due to COVID-19 restrictions, federally reared Lake Trout allocated to Illinois were stocked from shore in Wisconsin during 2020 and 2021.

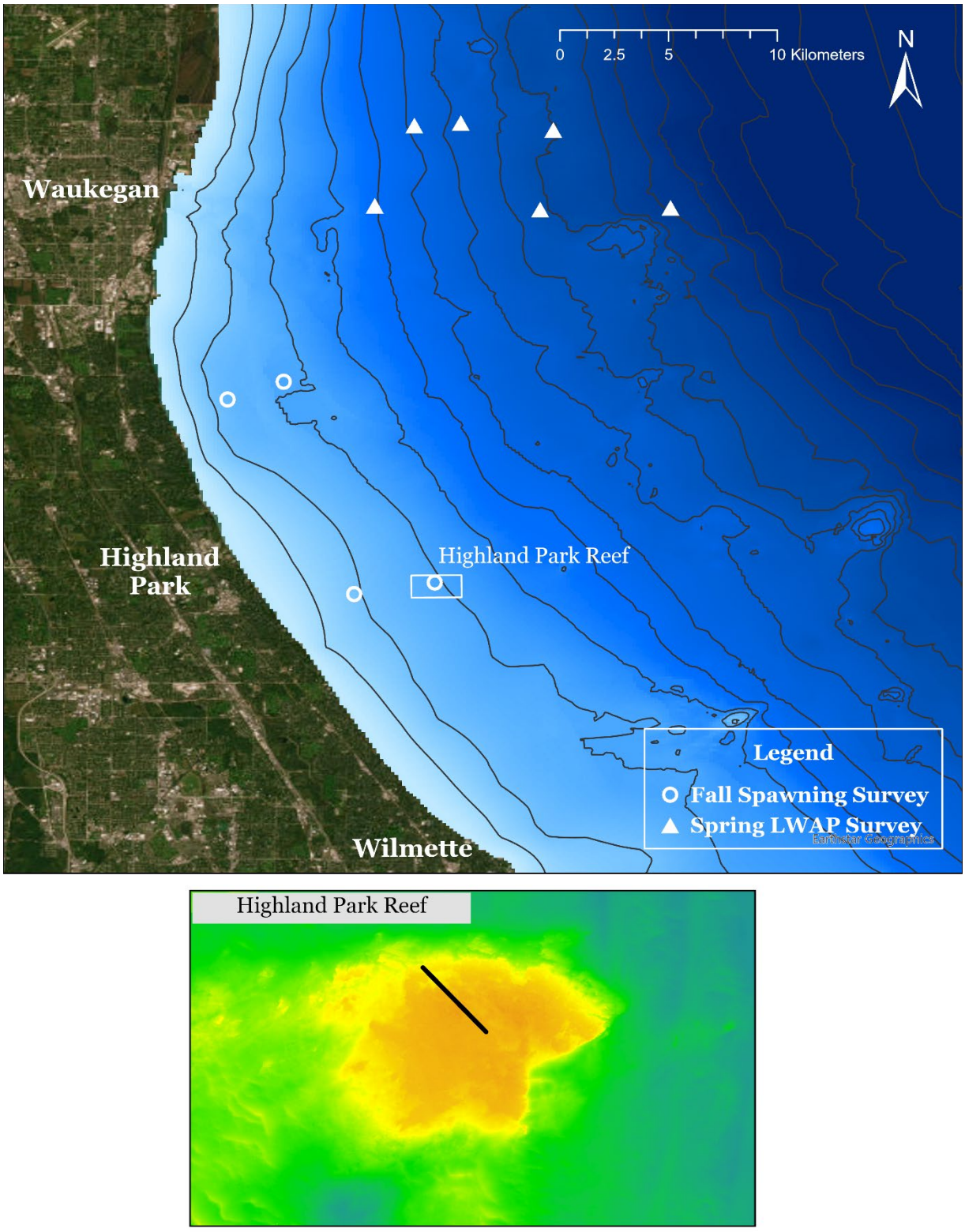


Figure 2. Location of the spring Lake Trout survey sites (white triangles) and fall spawning Lake Trout surveys (Open Circles) in the Illinois waters of Lake Michigan in 2025. Bottom inset shows bathymetric placement of the fall survey net set on Highland Park Reef.

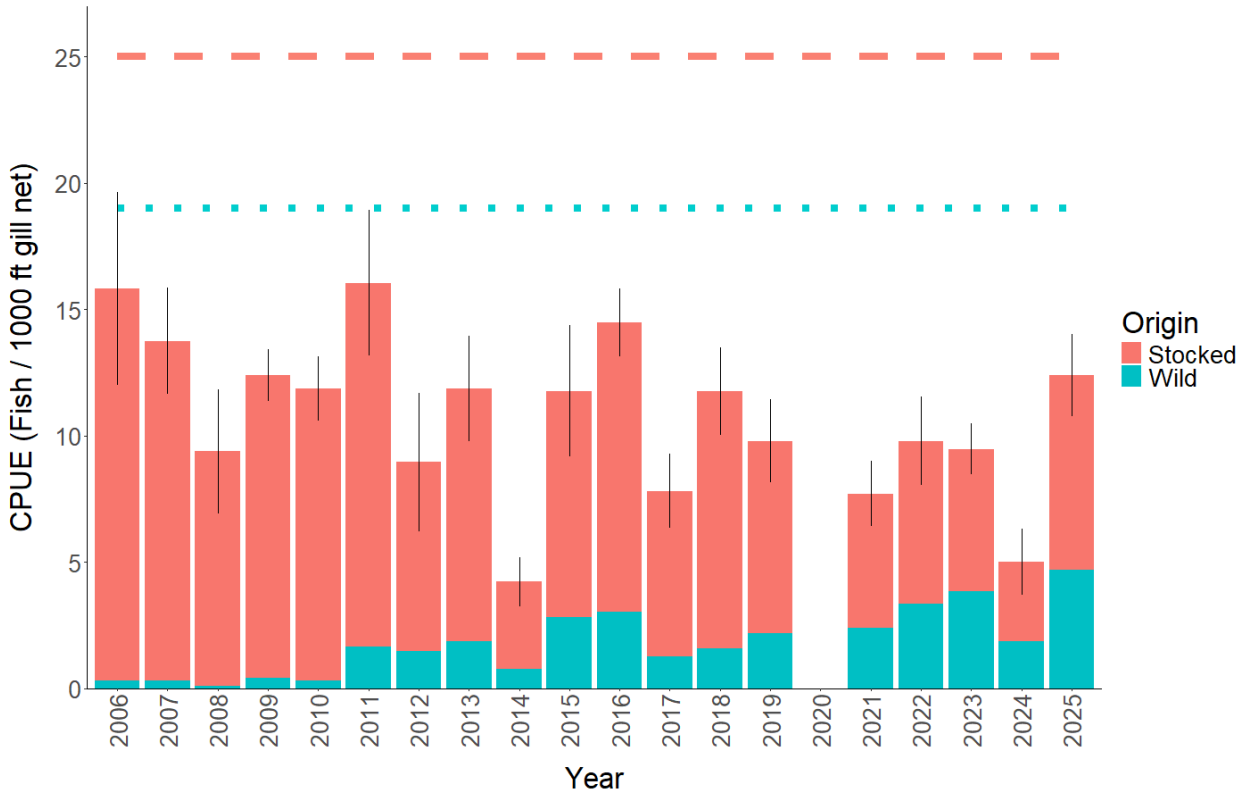


Figure 3. Catch per unit effort (CPUE) of Lake Trout sampled in spring 2006-2025 split into the portion of the catch consisting of wild (teal) and hatchery-reared (orange) fish. The orange dashed line represents the CPUE goal (>25 fish/1000 ft. of gill net) of Evaluation Objective 1 in A Stocking Strategy and Evaluation Objectives for the Rehabilitation of Lake Trout in Lake Michigan, while the teal dotted line represents the wild CPUE goal (>19 fish/1000 ft. of gill net) of Evaluation Objective 7. Error bars represent the standard error for the total CPUE (not accounting for hatchery or wild origin). Due to COVID-19 restrictions no sampling occurred in 2020.

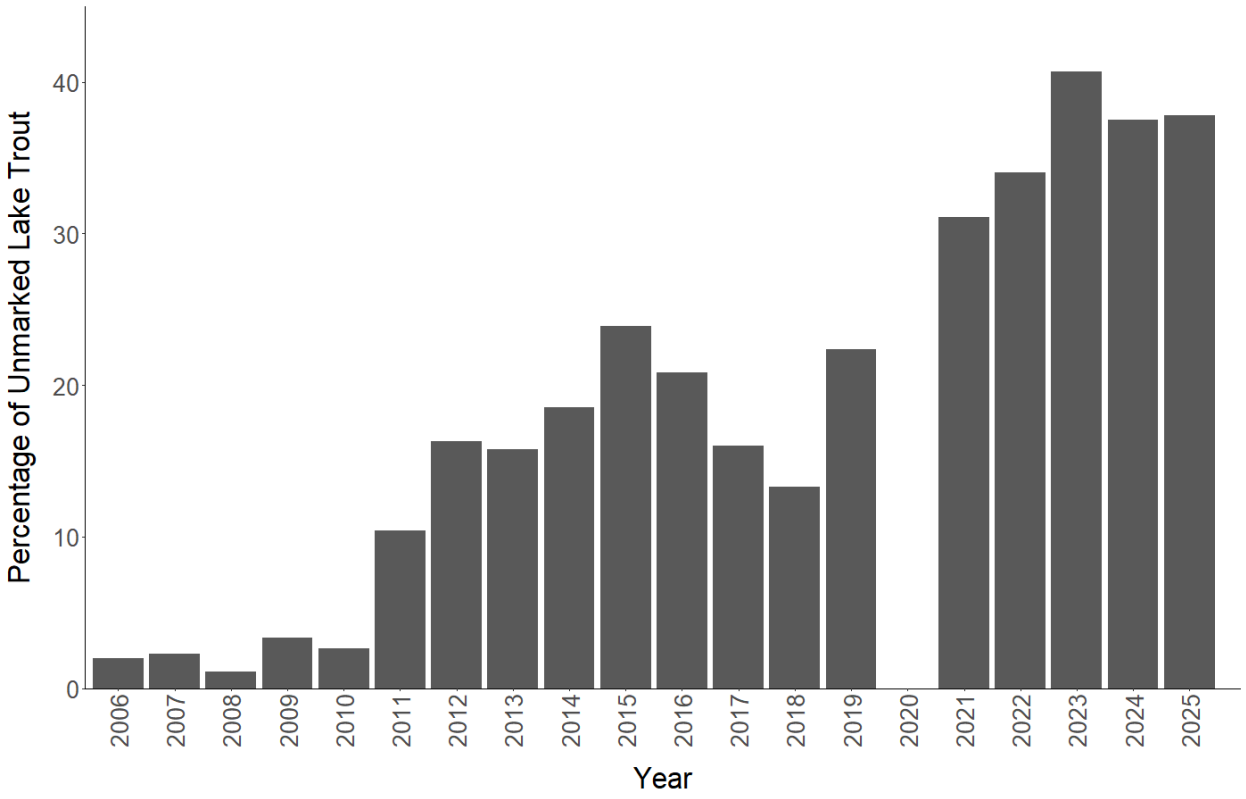


Figure 4. Percentage of unmarked Lake Trout sampled in spring 2006-2025 near Waukegan, IL. Due to COVID-19 restrictions no sampling occurred in 2020.

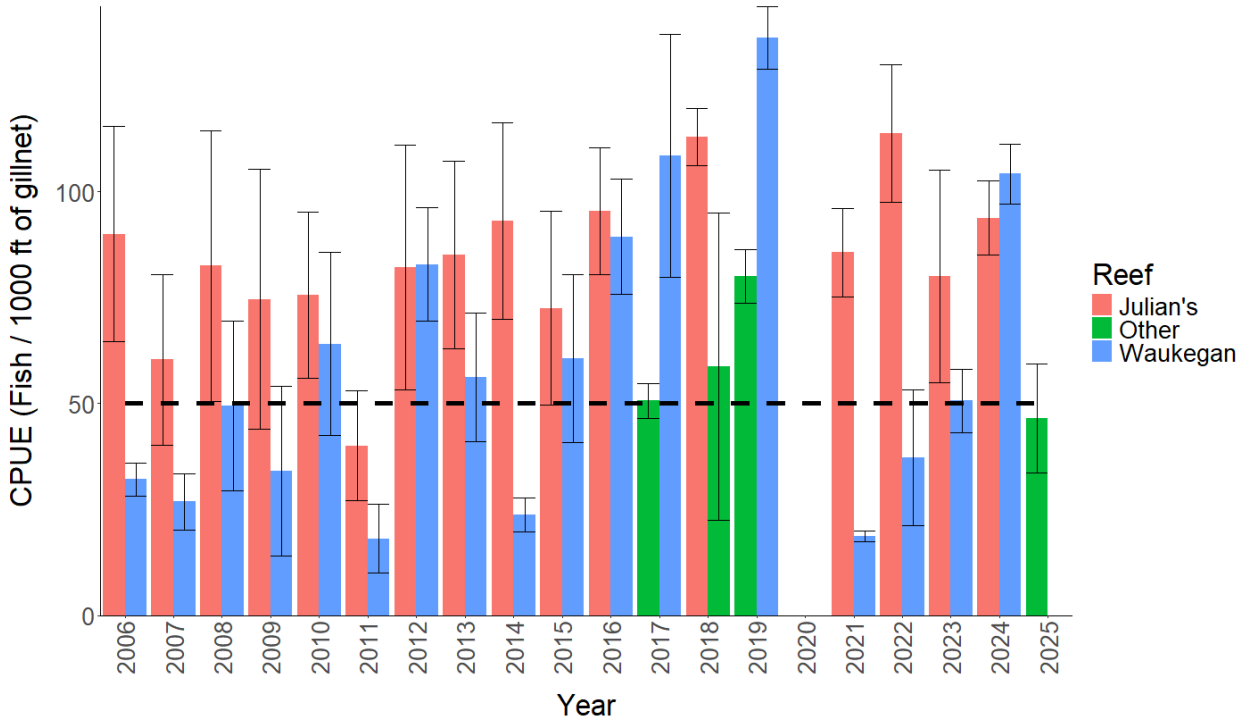


Figure 5. Catch per unit effort (CPUE) of Lake Trout sampled in fall 2006-2025 at Julian's Reef (red bars), Waukegan Reef (blue bars), and other locations (green bars). The dashed line represents the CPUE target (>50 fish/1000 ft. of gill net) of Evaluation Objective 2 in A Stocking Strategy and Evaluation Objectives for the Rehabilitation of Lake Trout in Lake Michigan. No sampling occurred in 2020.

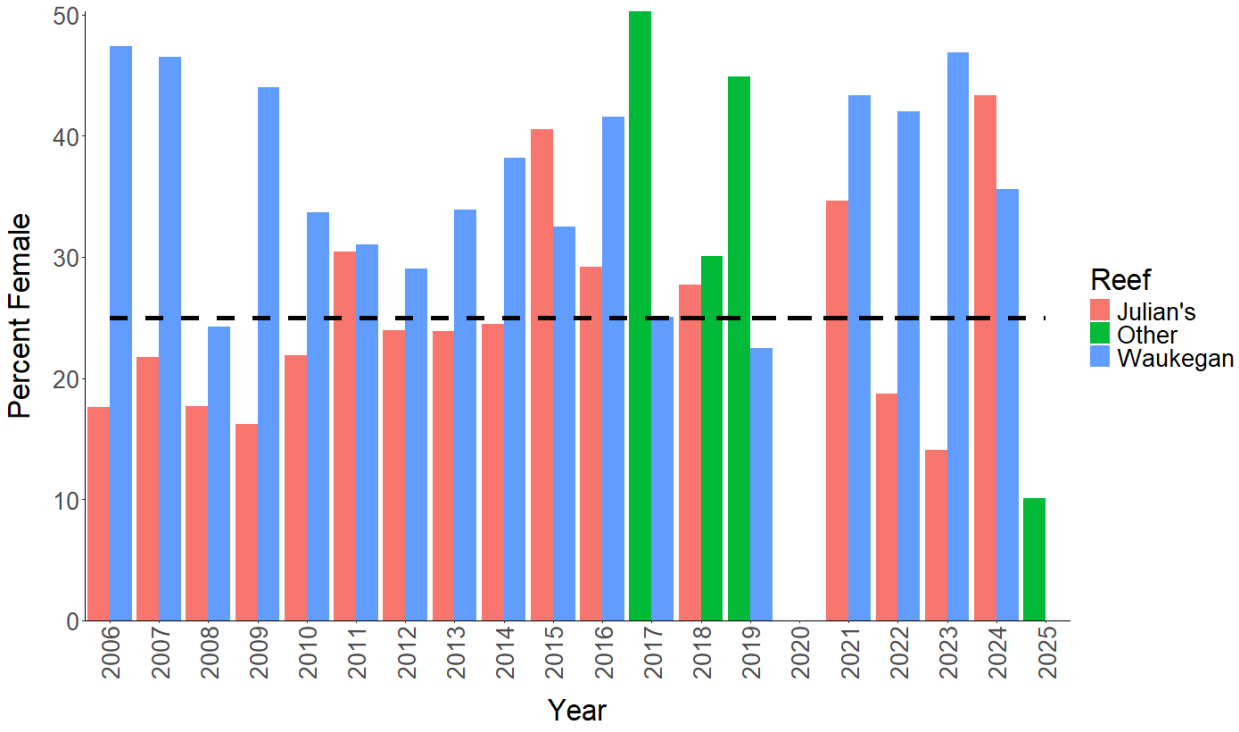


Figure 6. Percent female Lake Trout sampled in fall 2006-2025 at Julian's Reef (red bars), Waukegan Reef (blue bars), and other locations (green bars). The dotted line represents the female proportion target (>25% female for spawning populations) of Evaluation Objective 3 in A Stocking Strategy and Evaluation Objectives for the Rehabilitation of Lake Trout in Lake Michigan. No sampling occurred in 2020.

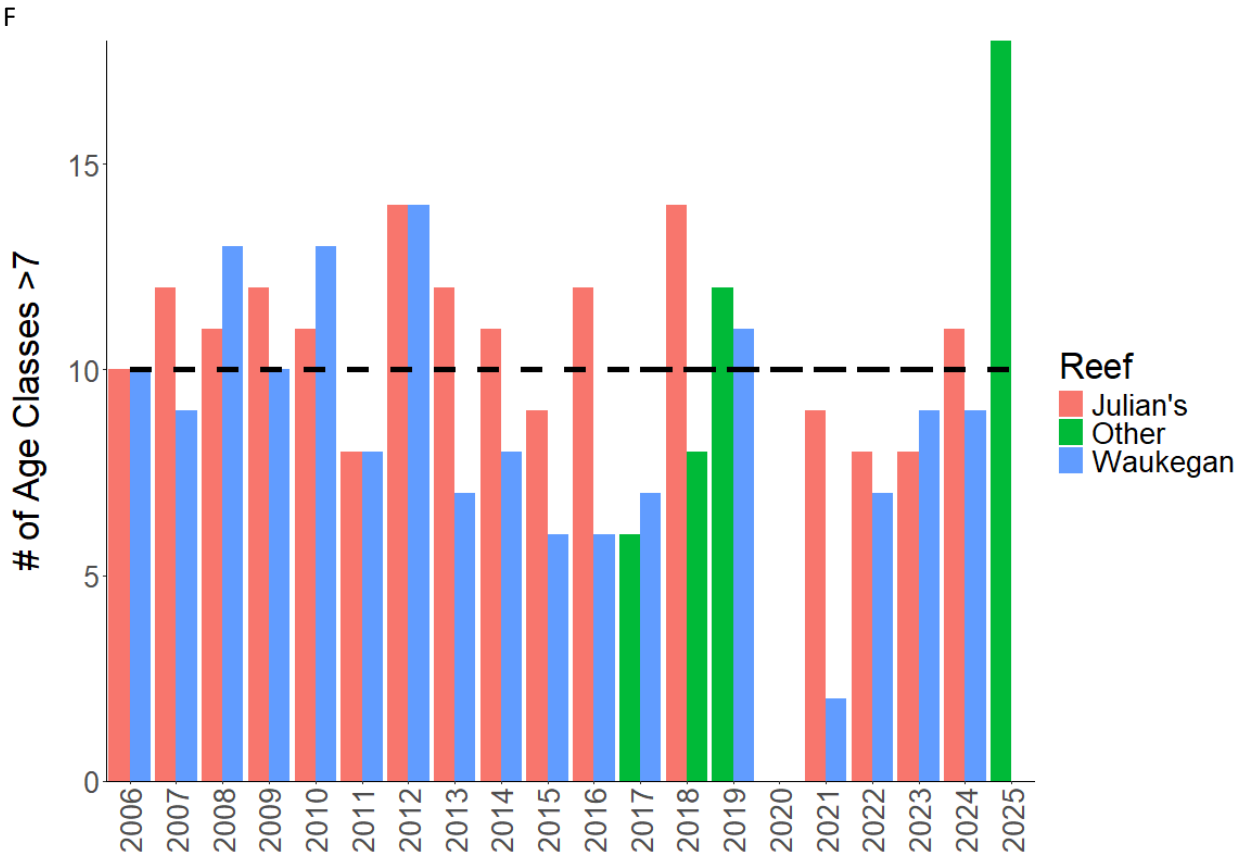


Figure 7. Number of Lake Trout age classes greater than age-7 sampled in fall 2006-2025 at Julian's Reef (red bars), Waukegan Reef (blue bars), and other locations (green bars). The dotted line represents the age class target (≥10 age groups older than age-7 for spawning populations) of Evaluation Objective 3 in A Stocking Strategy and Evaluation Objectives for the Rehabilitation of Lake Trout in Lake Michigan. No sampling occurred in 2020.

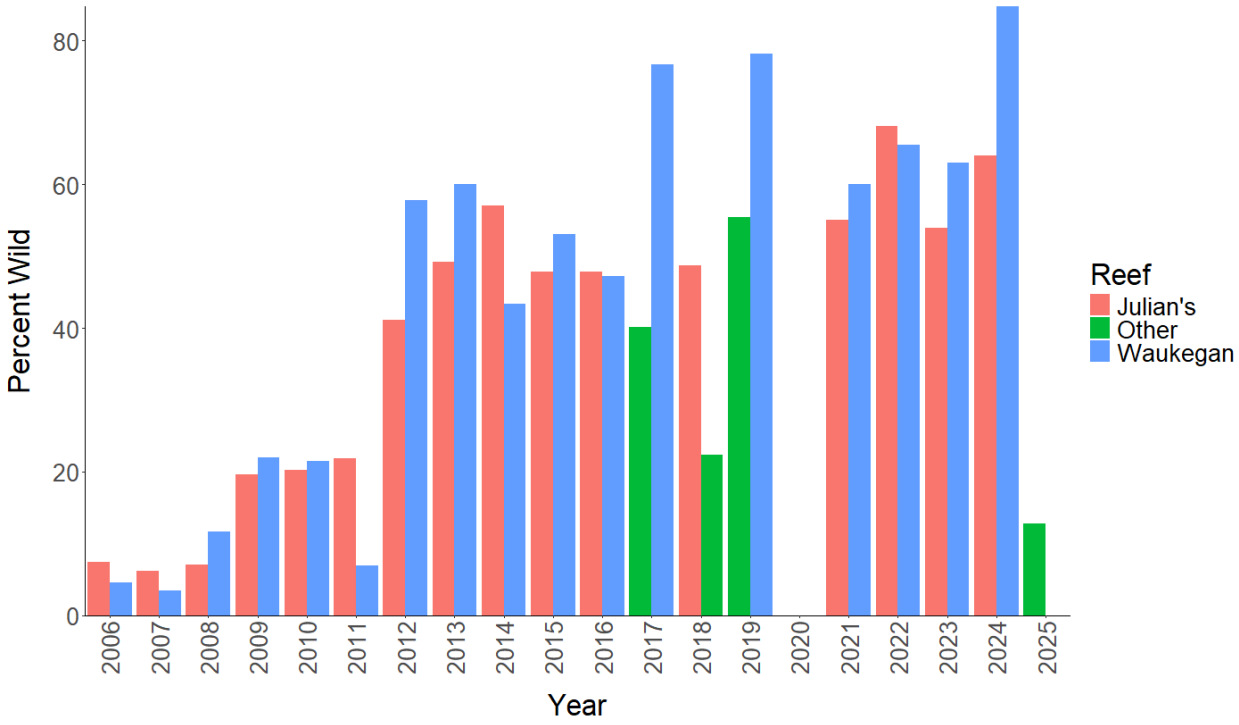


Figure 8. Percent of unmarked Lake Trout sampled in fall 2006-2025 at Julian's Reef (red bars), Waukegan Reef (blue bars), and other locations (green bars). No sampling occurred at Julian's Reef in 2005, 2017, and 2019 or Waukegan Reef in 2018 and neither site was sampled in 2020 or 2025. Other reefs sampled include Wilmette Reef (2017), North Reef (2018), Lake Bluff Reef (2019), and Lake Forest and Highland Park nearshore areas (including Highland Park Reef; 2025).

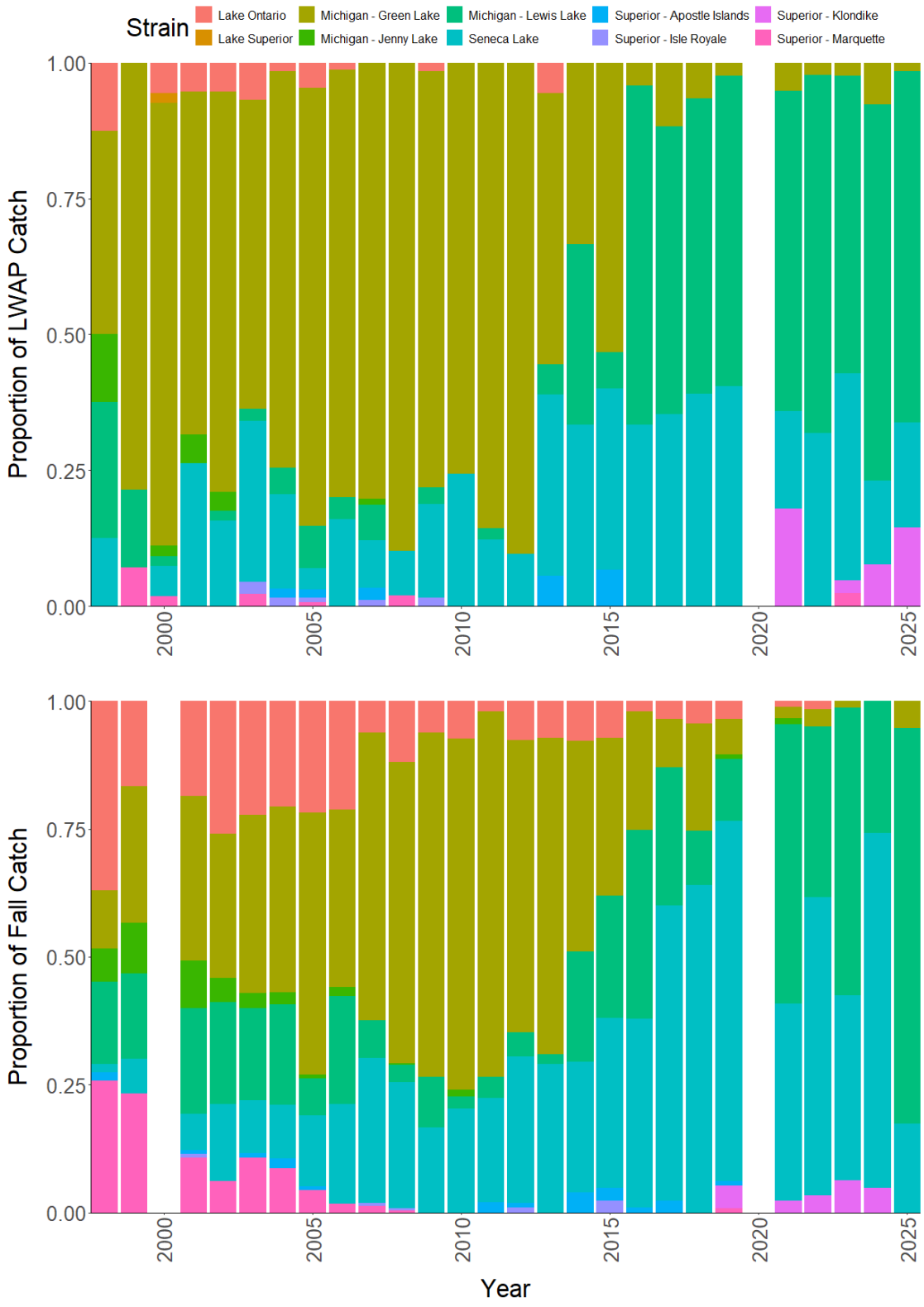


Figure 9. Lake Trout strain composition of the catch of hatchery-reared fish with CWTs in the spring (top) and fall spawner (bottom) surveys. No fall sampling occurred in 2000 and no spring or fall sampling occurred in 2020.

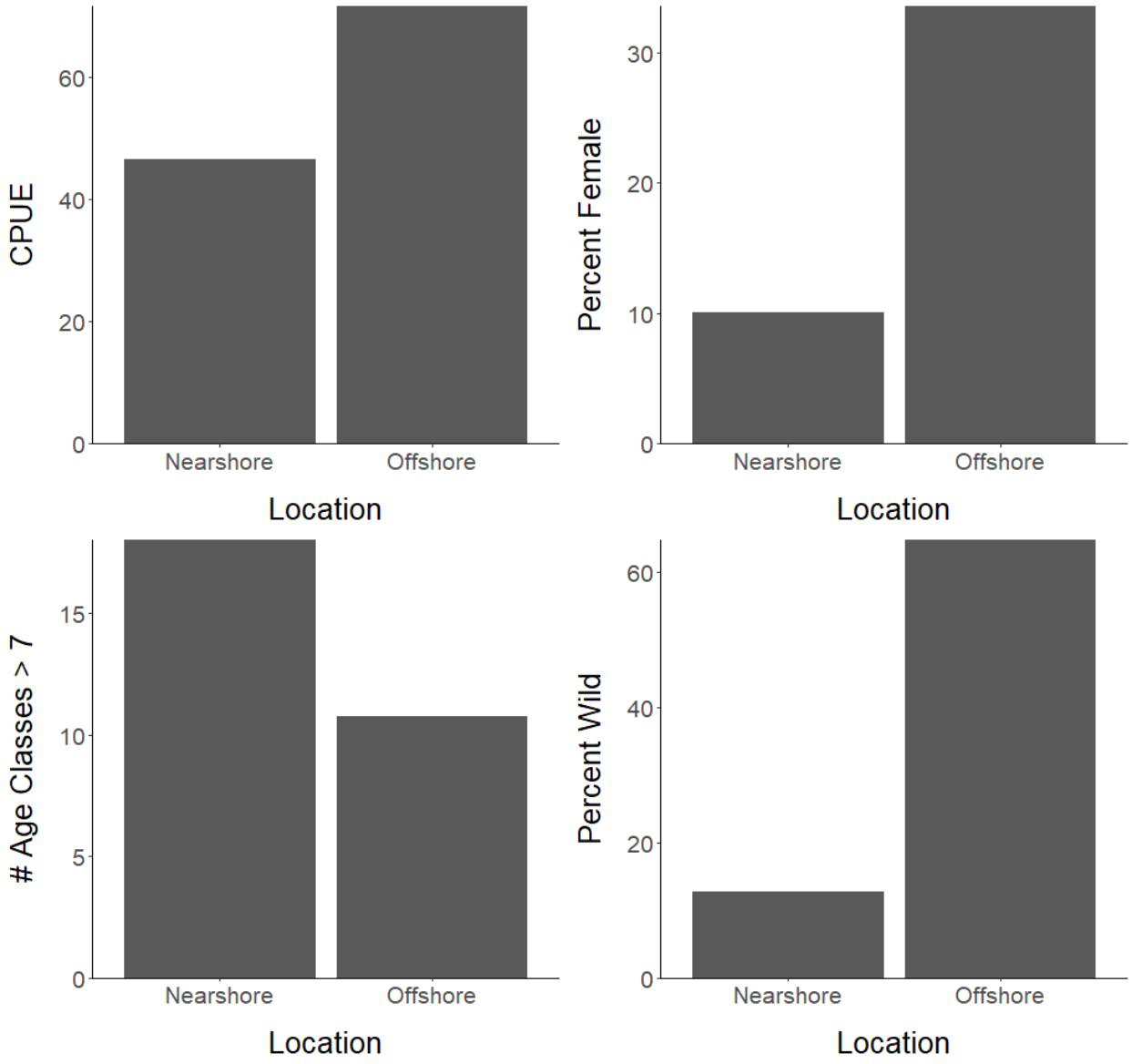


Figure 10. Comparison of the primary fall survey metrics at the nearshore sites (Highland Park, Lake Forest) sampled in 2025 with the 4-year average (2021-2024) observed at standard offshore sites (Julian's and Waukegan Reefs).