

Illinois Department of Natural Resources

Division of Fisheries

# Lake Trout Monitoring in Lake Michigan: 2019 Spring and Fall Assessments

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08 January 2020

*This work was funded by Federal Aid in Sport Fish Restoration Funds (F-65-R)*

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## INTRODUCTION

Lake Trout *Salvelinus namaycush* was the top 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 extirpation 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 restricted (Figure 1). Julian's Reef was first stocked in 1981 and has received annual stocking each year with the exception of three years (Figure 2). Despite these efforts, successful natural reproduction was negligible and thus the Management Plan's goal of establishing a self-sustaining lake trout population went unmet.

Stocking locations and numbers were revised recently under *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan* (Dexter et al. 2011; referred to hereafter as the *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. The *Strategy* has four Evaluation Objectives to monitor progress toward targeted rehabilitation: 1) catch per unit effort (CPUE) of >25 Lake Trout/1000 ft graded-mesh gill nets in spring stock assessments by 2019; 2) CPUE of >50 Lake Trout/1000 ft graded mesh gill nets in spawning surveys by 2019; 3) spawning populations of at least 25% female and which have ten or more age groups older than age-7; and 4) an egg deposition rate of >500 viable eggs/m<sup>2</sup> (eggs with thiamine concentrations of >4 nmol/g). Evaluation Objectives 2-4 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 off-shore locations near Waukegan, IL and at spawning reefs in the fall. 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, catch data from Waukegan Reef may be substituted for Julian's Reef in assessing Evaluation Objectives 2 and 3 in circumstances when no fall sampling occurs at Julian's Reef (e.g., 2005).

A change in fall Lake Trout sampling site selection was instituted in 2017. In light of the similarities between Julian's and Waukegan reefs and an increase in Lake Trout of wild origin, it was decided to sample those sites in alternate years allowing for investigation of population parameters at other Illinois reefs where Lake Trout may be spawning. This report covers progress towards Evaluation Objectives 1-3 in Illinois waters; Evaluation Objective 4 is not included in this report since there is currently no quantitative sampling for eggs or juveniles in Illinois waters. Evaluation of sites other than Julian's or Waukegan reefs, some that had been sampled in the past, is included in a separate section entitled "Non-priority site sampling" for comparison.

## **METHODS**

Lake Trout were sampled with gill nets in two offshore surveys. Presented data are from surveys conducted in 1999-2019.

### **Spring Lake Trout Survey**

Graded mesh gill nets, 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). Gill nets were fished on 13-16 May 2019. One net was set at an established site within each of three depth bins (50-100, 100-150, and 150-200 ft) along two transects offshore of Waukegan, IL. A total of six nets were fished during the 2019 survey.

### **Fall Spawner Survey**

Graded mesh gill nets, with two 100 ft panels of 4.5" to 6" (½ inch increments) mesh sizes (800 ft total) were fished overnight. Two gill nets were fished on four occasions during 24 October-05 November 2019. Four nets were set at Waukegan Reef in fall 2019 and four nets were set at a previously unsampled reef location, Lake Bluff 10-Mile Reef. A total of eight nets were fished during the 2019 survey.

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.

### **Data Analyses**

Lake Trout CPUE was calculated as number of fish per 1000 feet of gill net in both the spring and fall surveys. CPUE values are highly dependent on standardized effort. Therefore, nets that were fished for more than 1 day in duration (since 2-day set  $\neq$  twice the number of fish of a 1 day set) or with incorrect mesh sizes were removed from CPUE analyses (two nets from the spring lake trout survey in 2007 and two nets from the fall spawner survey in 2011 were removed). Catch data from all net sets was used in the reporting of proportion female, number of age classes, proportion of unmarked fish, and stocking origin (CWT data) since effort and mesh size has less influence on these indices.

## **RESULTS AND DISCUSSION**

### **Spring Lake Trout Survey**

Spring Lake Trout CPUE was 9.8 fish/1000 ft of net in 2019. This was approximately 40% of the target (25 fish/1000 ft), which has only been achieved once in 21 years of spring LWAP sampling (Figure 3). Thus, Evaluation Objective 1 of the *Strategy* has not been achieved in Illinois waters.

Twenty-one Lake Trout (22%) were not fin clipped and presumed to be of wild origin (Figure 4). The percentage of unmarked fish in our spring catches increased after 2010 and has averaged 17% (2011-2019 average). Forty-four Lake Trout had an adipose fin clip and a coded-wire tag. Of these, 43 tags were successfully decoded. A majority (29) were stocked on Julian's Reef (5 to 9 years old at capture), 12 were stocked on the Mid-lake Refuge (6 to 23 years old at capture). Other tagged fish were stocked on the Wisconsin shoreline (5 years old at capture) and Indiana shoreline (6 years old at capture). A single tag was lost during the extraction process and not able to be decoded.

### **Fall Spawner Survey**

Fall Lake Trout CPUE was 108.1 fish/1000 ft of net in 2019. Fall CPUE has exceeded the 50 fish/1000 ft target of Evaluation Objective 2 in all but three years of the fall survey (Figure 5). Consistent CPUEs above the target indicate that Evaluation Objective 2 of the *Strategy* has been achieved in Illinois waters.

Evaluation Objective 3 of the *Strategy* has two components. The goal of at least 25% female Lake Trout at spawning sites has been met in eight years, which included four straight years of sampling until this year, when the proportion of female Lake Trout dropped to 22% (Figure 6). Although the percent-female target has been met or exceeded in some years, there is inconsistency in attaining the target such that we cannot consider that the percent female portion of Evaluation Objective 3 has been achieved at this time. The catch consisted of 11 age groups older than age-7 in 2019 (Figure 7). Since 2006, Lake Trout catches have consisted of 10-14 age classes older than age-7 in 11 of 14 years, satisfying the age-class portion of Evaluation Objective 3.

Approximately three-quarters of Lake Trout sampled at Waukegan Reef (342 of 436) did not have a fin clip in 2019. The presence of unmarked, potentially wild fish has increased substantially in recent years (Figure 8). In 2019, 54 Lake Trout sampled at Waukegan Reef had an adipose fin clip and a coded wire tag, though two fish were found to have no tag detected when the head was processed in the lab. Most (32) of the tagged fish were stocked at the Mid-lake Refuge (5 to 29 years old at capture), 18 were stocked at Julian's Reef (6-24 years old at capture), and two at the Northern Refuge (5 and 8 years old at capture).

### **Non-Priority Site Sampling**

In fall 2019, we sampled the Lake Bluff 10-Mile Reef, east of Lake Bluff, IL. This site had not been sampled previously. CPUE at Lake Bluff 10-Mile Reef in 2019 was 80.0 fish/1000 ft, and over half (55%) of Lake trout sampled at Lake Bluff 10-Mile Reef did not have a fin clip. Sixty-eight Lake Trout with an adipose fin clip and coded wire tag were sampled at the Lake Bluff 10-Mile Reef in 2019, though two fish heads were found to have no tag in the lab. Most (34) of the tagged fish were stocked at the Mid-lake Refuge (6-35 years old at capture), 29 were stocked at Julian's Reef (4 to 21 years old at capture), and one was stocked in the nearshore waters Michigan (20 years old at capture). We also sampled two fish with lake-wide tags (i.e., multiple stocking locations within Lake Michigan).

## **CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS**

Spring Lake Trout survey CPUEs were anticipated to be lower than fall CPUEs, and targets were set accordingly, since Lake Trout aren't necessarily aggregated in the spring as they are during the fall spawn. Spring CPUEs in the Illinois waters of Lake Michigan however have remained below the target in a majority of years sampled, not reaching 25 fish/1000 ft since the mid-2000s. Similarly, the target has

been met only briefly at four of the twelve spring sampling sites lakewide and has not been achieved with any regularity or consistency at any site (LMLTWG 2018).

*Recommendations: Continue participation in spring Lake Trout survey and evaluate results toward achieving Evaluation Objective 1 of the Strategy; share results with 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 half 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 we may be close to declaring rehabilitation at some sites (LMLTWG 2018). The increased presence of unmarked fish in recent catches indicates successful recruitment to adult life stages, especially in Illinois waters.

*Recommendations: Continue participation in 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 Strategy, and disseminate results of progress toward rehabilitation goals; share results with the Lake Trout Working Group of the Lake Michigan Technical Committee.*

Significant progress toward Lake Trout rehabilitation (as measured by the Evaluation Objectives) has occurred at Lake Bluff 10-Mile Reef even though no stocking has occurred at the site and the site is not considered a First or Second Priority site for rehabilitation. This reef represents the third "Non-Priority" site sampled, following North Reef (east of North Point Marina) in 2017 and Wilmette Reef (R4) in 2018. Bathymetric surveys have been conducted by the Illinois Natural History Survey at other reefs along with side-scan sonar surveys (used to classify benthic substrate). These surveys will allow IDNR to plan future fall spawner surveys to investigate rehabilitation at other non-stocked reef locations.

*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.*



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Figure 1. Location of the spring Lake Trout survey sites (squares), fall spawning Lake Trout surveys (open circles), and Lake Trout stocking location (cross) in the Illinois waters of Lake Michigan.

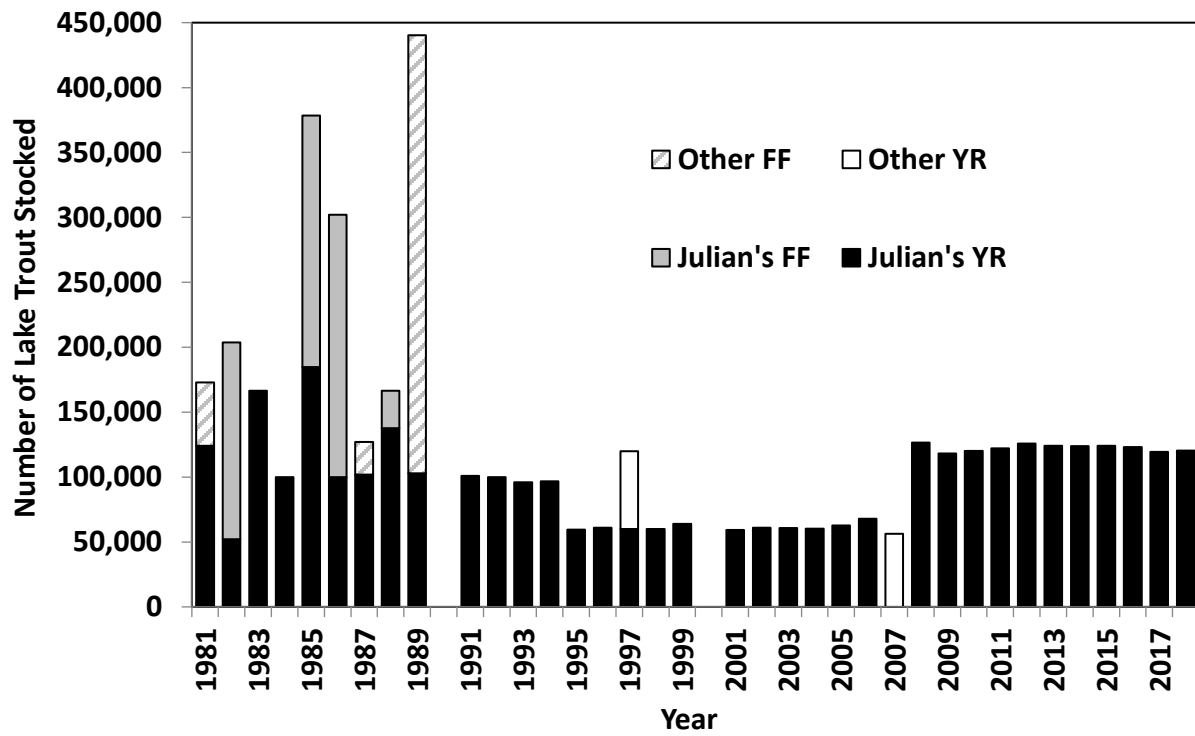


Figure 2. Lake Trout stocking in Illinois waters of Lake Michigan, 1981 to 2018 (FF = fall fingerling, YR = yearling).

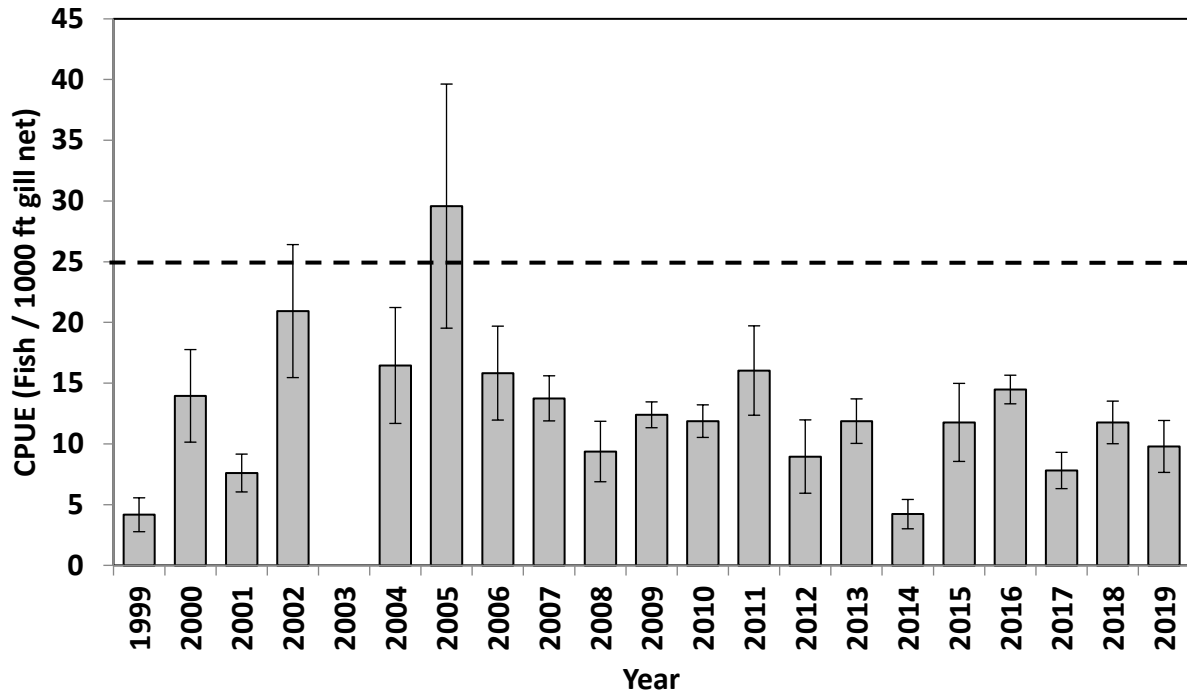


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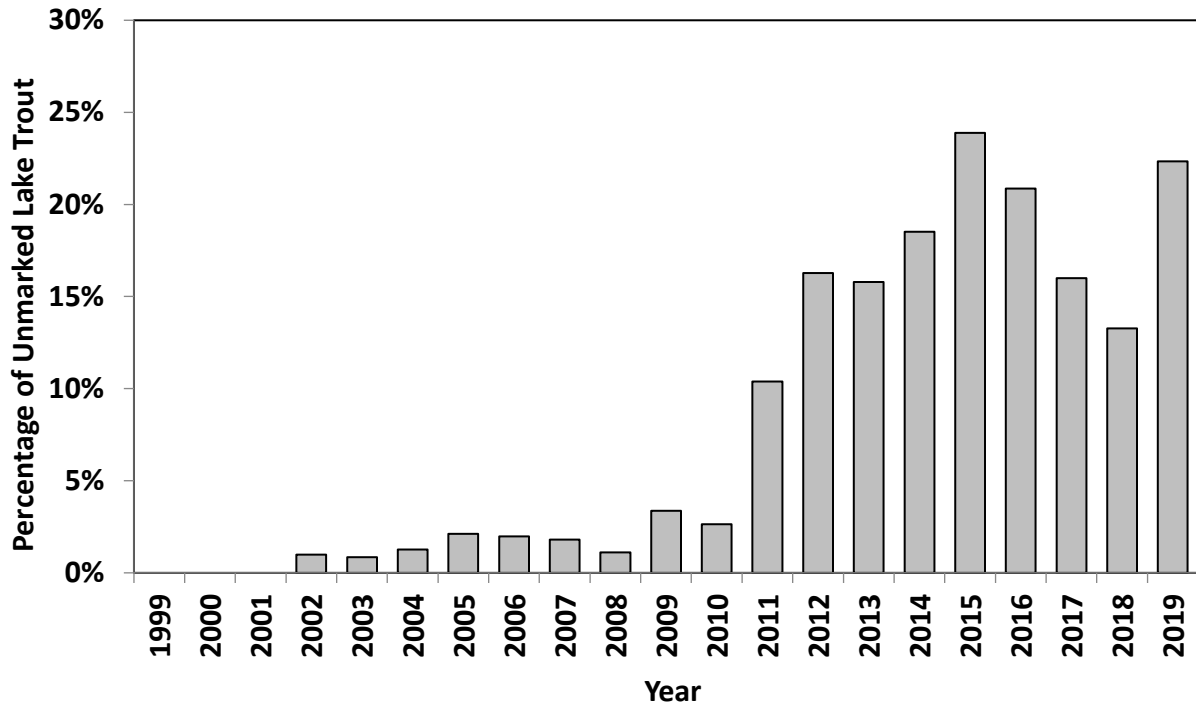


Figure 4. Percentage of unmarked Lake Trout sampled in gill nets in May 1999-2019 near Waukegan, IL.

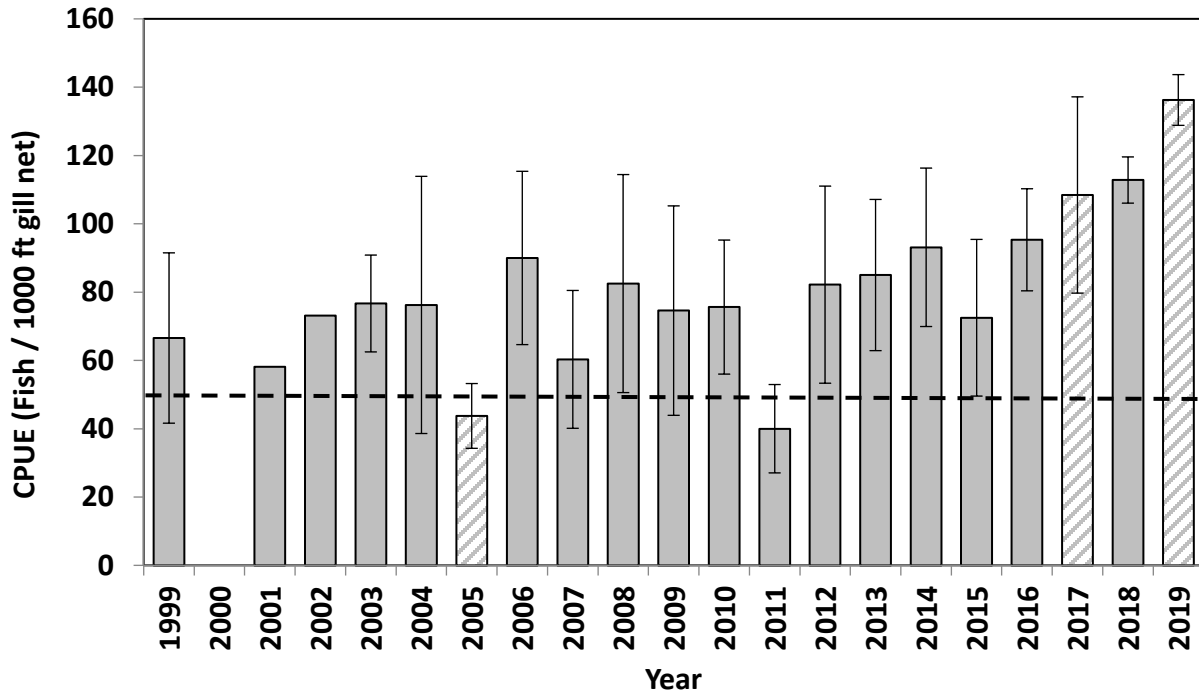


Figure 5. Catch per unit effort (CPUE) of Lake Trout sampled in gill nets in October and November 1999-2019 at Julian's Reef (solid gray bars) and Waukegan Reef (crosshatched). The dotted line represents the CPUE target (>50 fish/1000 ft of gill net) of Evaluation Objective 2 in *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan*. No sampling occurred at either site in 2000.

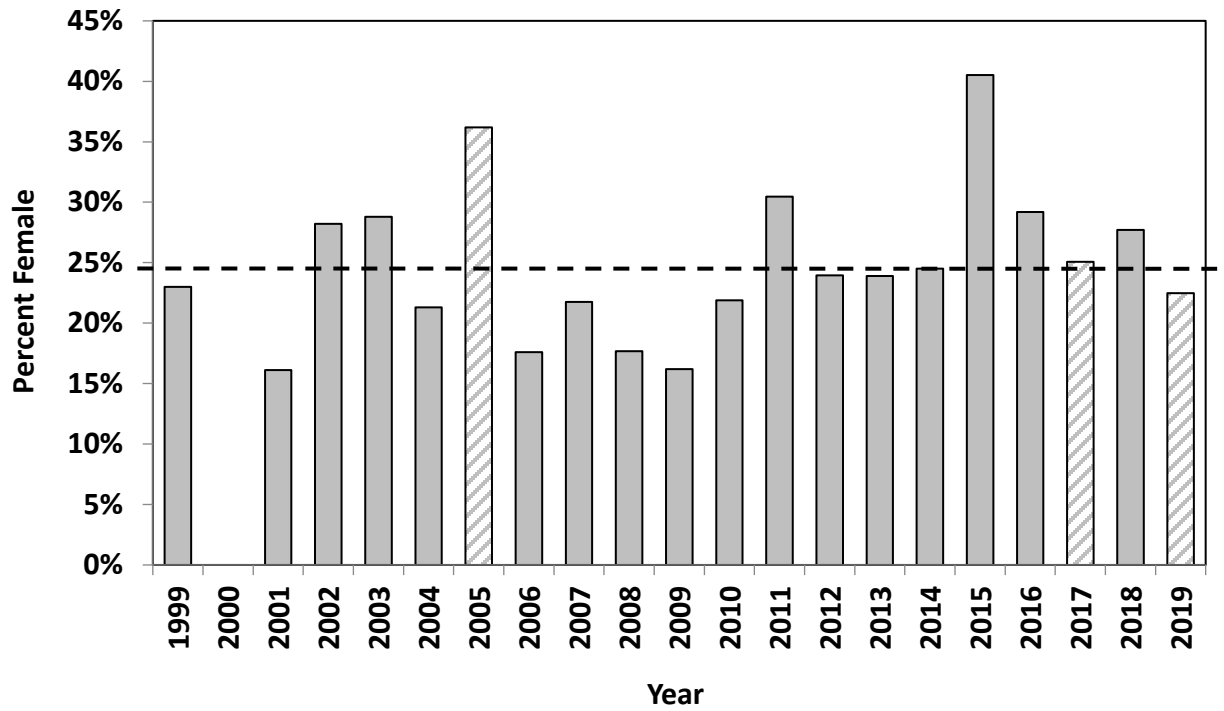


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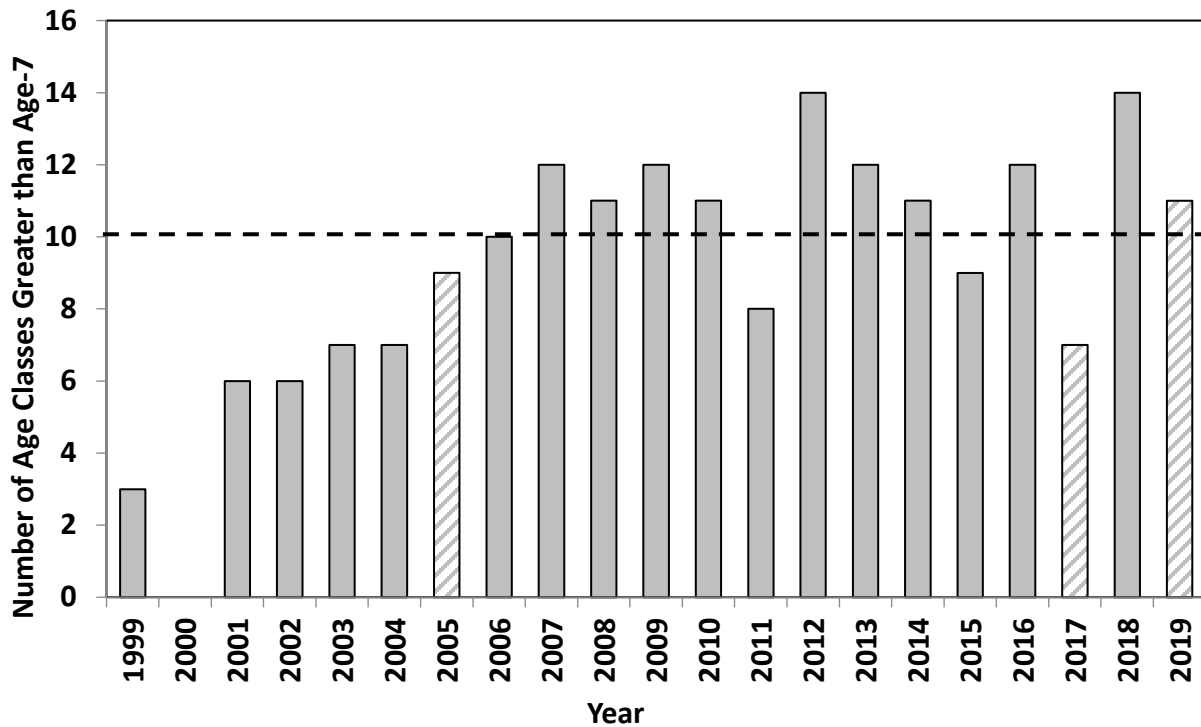


Figure 7. Number of Lake Trout age classes greater than age-7 sampled in gill nets in October and November 1999-2019 at Julian's Reef (solid gray bars) and Waukegan Reef (crosshatched). The dotted line represents the age class target ( $\geq 10$  age groups older than age-7 for spawning populations) of Evaluation Objective 3 in *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan*. No sampling occurred at either site in 2000.



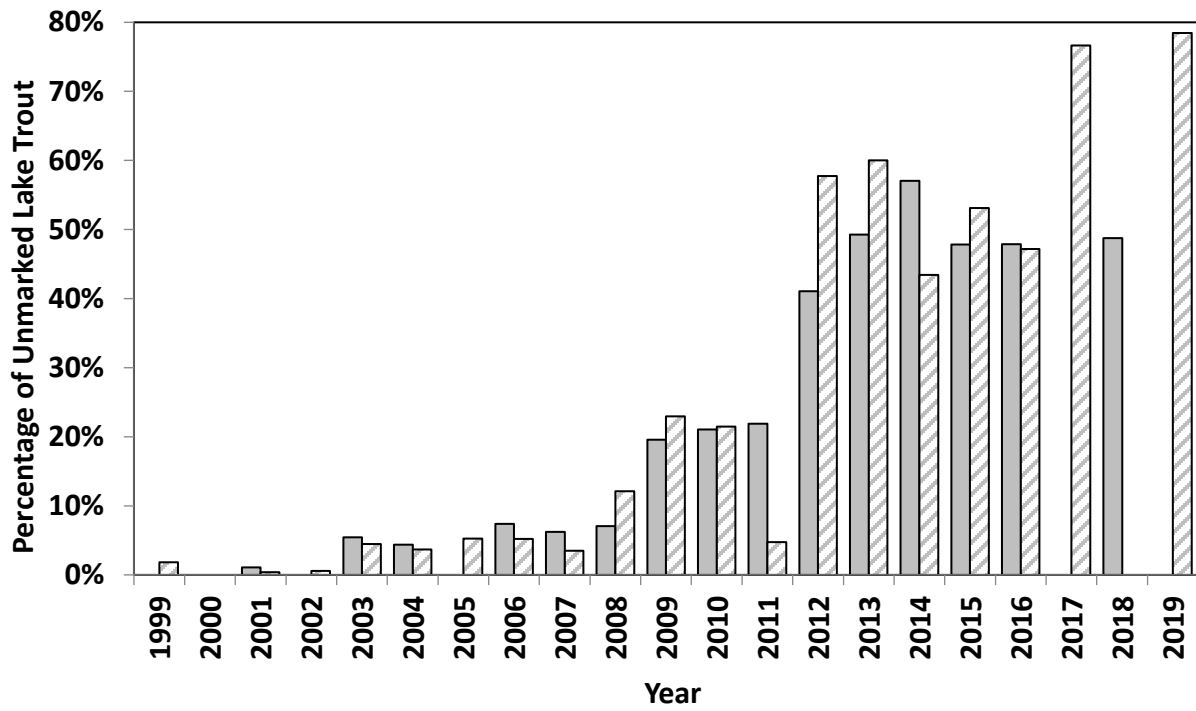


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