

**WISCONSIN DEPARTMENT OF NATURAL  
RESOURCES**  
**SMALLMOUTH BASS IN DOOR COUNTY**

2014 and 2022 Washington Island – Detroit Harbor  
Population Assessments



**Sturgeon Bay Fisheries Team  
Bureau of Fisheries Management  
Wisconsin Department of Natural Resources  
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## Executive Summary

Smallmouth bass populations in Detroit Harbor of Washington Island, Door County waters of Green Bay were evaluated during the pre-spawn period during the spring of 2014 and 2022. Population abundance and size structure were in relatively good condition each survey year. However, the number of smallmouth bass caught per unit of effort and the size composition of the population had decreased between the survey periods. There appeared to be few strong year classes produced during the period of the early to mid-2010s. For most years beginning around the 1970s, angling for smallmouth bass has been closed during the pre-spawn/spawning periods, so annual angling effort is likely considerably lower in Detroit Harbor than in most of the other areas around Door County. A UW-Stevens Point graduate research study commenced in 2022 examining potential impacts on smallmouth bass nesting success and evaluating young-of-year recruitment.

# Introduction

The waters surrounding Door County are well known for their flourishing smallmouth bass populations both in terms of fish size and abundance. Various discrete populations of smallmouth bass can be found in areas along the Green Bay side of Door County, beginning in Little Sturgeon Bay and north, as well as areas at the northern end of the Lake Michigan side of the county. The more isolated waters around Washington Island are known for their strong populations of smallmouth bass as well. The first documented assessments of smallmouth bass populations in Door County waters occurred between 1962 and 1965 (Wiegert 1966). Since then, smallmouth bass populations have been assessed in selected areas of Door County periodically beginning in 1995 (Kroeff 1995). However, before the surveys reported here, the population around Washington Island (Detroit Harbor) had only been assessed in 1997 (Kroeff 1997). While effort is made to rotate among the various sub-populations, the areas around Sturgeon Bay and Little Sturgeon Bay are assessed most often. Herein, we report results from the 2014 and 2022 Detroit Harbor (Washington Island) spring pre-spawn smallmouth bass population assessments.

## Methods

### POPULATION ASSESSMENT

Fyke nets (width = 6 feet, height = 3 feet, mesh size = 1.5 inches stretch; leads = 75 feet) were set in Detroit Harbor, Washington Island (Figure 1) in 2014, beginning May 13, and were fished intermittently through June 5. Between three and seven nets were fished on a given date, and effort was made to place them in locations similar to past surveys while also keeping them in areas with consistent smallmouth bass activity (nets were removed from the water or tied open during weekends and when weather conditions were not conducive to netting). In 2022, nets were set in Detroit Harbor beginning May 10 and were removed after May 27 (nets were removed from the water one weekend and when weather conditions were not conducive to netting). Four or five nets were fished on a given date, and effort was made to place them in locations similar to past surveys while also keeping them in areas with consistent smallmouth bass activity. Smallmouth bass total length was measured to the nearest millimeter. In 2014, scales were used for aging and sampled from the left side



**Figure 1.** Door County peninsula and surrounding areas of Green Bay and Lake Michigan. Red box indicates the Detroit Harbor area of Washington Island.

of the fish, near the tip of the relaxed pectoral fin just below the lateral line. In 2022, the second dorsal spine was removed and sectioned for aging. Age structures were taken from 15 fish per ten millimeter length increment, and an age-length key was developed to examine age composition. Fish health was evaluated by examining for any external lesions or other abnormalities (not reported here). All other game fish were identified, counted, measured and a fin was clipped to ensure fish were not being recorded multiple times. Non-game fish were identified and counted, although not clipped, so some non-game fish could have been recorded multiple times. Although the sampling effort extended into late May or early June for these surveys, only catch data from a relevant portion of the survey are reported herein for key metrics such as catch-per-unit-effort (CPE), size and age structure. Data from this period comprises the majority of the sampling effort and generally encompasses the pre-spawn period, when smallmouth bass are active and fish are generally mixed in terms of size and sex (Becker 1983). Restricting data to this time period also helps ensure some consistency when making interannual comparisons.

Due to its relative isolation, areas around Washington Island are not part of the annual Door County sport angler creel survey. However, the sport fishery for smallmouth bass has been assessed annually in the outlying waters around mainland Door County since the 1970s using a randomized angler creel survey (Masterson and Eggold 2013). Recent creel survey summary results for the Door County mainland can be found in previous smallmouth bass reports (Hansen 2024).

## Population Survey Results

### CATCH

#### 2014

Nets were fished for a total of 60 net nights (number of nets x number of nights fished) in 2014, including two days in early June. A total of 1,402 smallmouth bass were caught during the entire survey period. Approximately 165 fish of other species were captured including white sucker (n=32), northern pike (n=2), bullhead species (n=31), rock bass (n=43), yellow perch (n=5), bowfin (n=28), common carp (n=8), pumpkinseed (n=6), walleye (n=3), brown trout (n=3) and yellow bullhead (n=4).

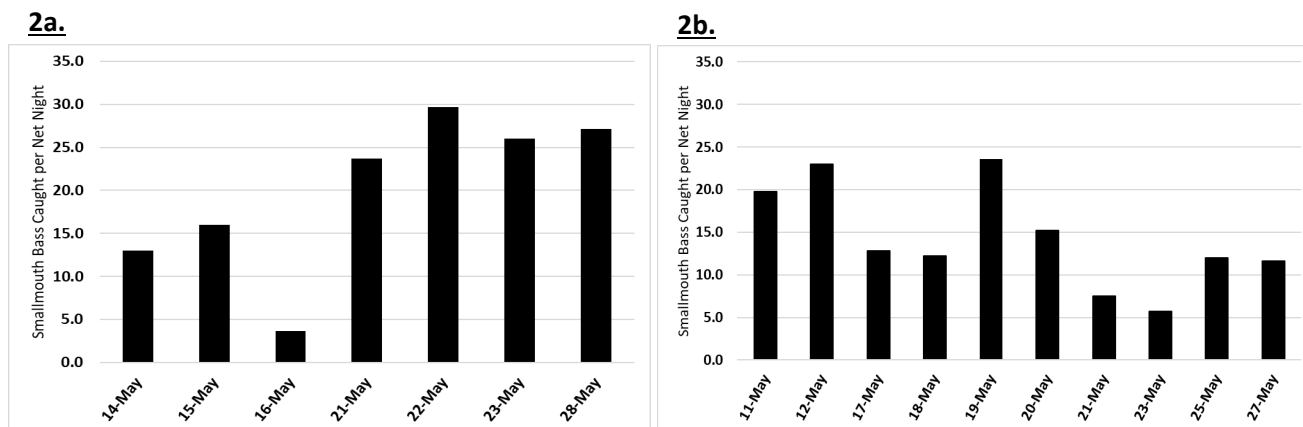
#### 2022

Nets were fished for a total of 56 net nights (number of nets x number of nights fished) in 2022. A total of 755 smallmouth bass were caught during the survey period. Approximately 982 fish of other species were captured, including white sucker (n=93), northern pike (n=1), bullhead spp. (n=405), rock bass (n=368), yellow perch (n=15), bowfin (n=59), alewife (n=6), pumpkinseed (n=11) and round goby (n=24).

### CATCH PER UNIT OF EFFORT

The overall CPE for May was considerably higher in 2014, with an average catch of  $19.9 \pm 9.4$  ((1 standard deviation (SD)) smallmouth bass per net night versus  $13.5 \pm 6.1$  (1 SD) smallmouth bass per net night in 2022. Although netting in 2014 continued several days into June, for consistency between surveys, only CPE data through May 28 are shown, and it is likely

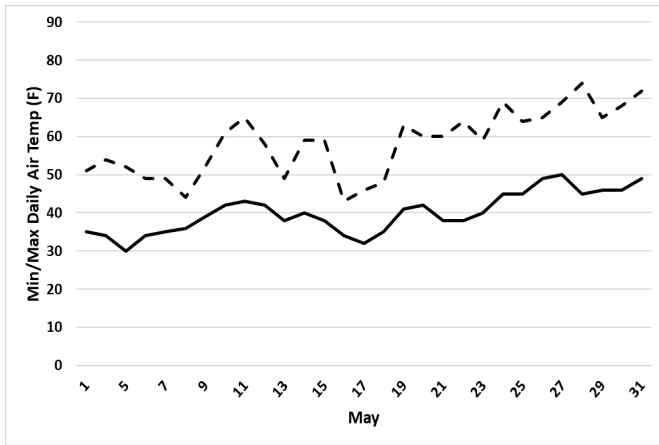
spawning was in place by this time, if not earlier.



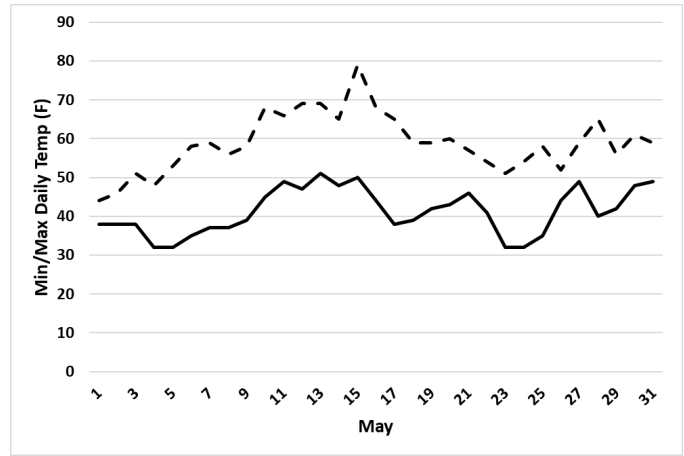
**Figure 2a-b.** Catch per effort of smallmouth bass caught per net night in 2014 (2a) and 2022 (2b) for surveys conducted in Detroit Harbor, Washington Island. Although the 2014 surveys ran several days later, for consistency and comparability, these days were not included here.

Smallmouth bass CPE generally followed water temperature trends, with catches building in 2014 and diminishing in 2022 during our sampling effort (Figures 2a-b and 3a-b). Distinct differences in spring air and water temperatures were noted between the survey years that may have affected smallmouth catch rates during certain periods. In 2022, there was a rapid warmup with air temperatures approaching 80°F by mid-May, while in 2014, air temperatures were lower and relatively consistent through mid-May, increasing by the end of the month. The progression of spring spawning activity is heavily dependent on water temperatures, and for smallmouth bass in Wisconsin, spawning generally occurs when water temperatures reach 60°F, although some spawning may occur in the mid-50°F range (Becker 1983). Patterns in water temperatures throughout May of each survey year were dramatically different (Figure 4). Water temperatures in 2014 were somewhat below preferred spawning temperatures until mid-May, while in 2022, temperatures at the start of the survey were already elevated to levels consistent with smallmouth spawning (Becker 1983). However, by the third week of May 2022, temperatures began to decline, while 2014 temperatures continued to warm, resulting in a period of overlap in temperatures between the surveys. As the water temperature in 2014 continued to increase through the end of the month, the 2022 temperatures likely moderated (data not shown).

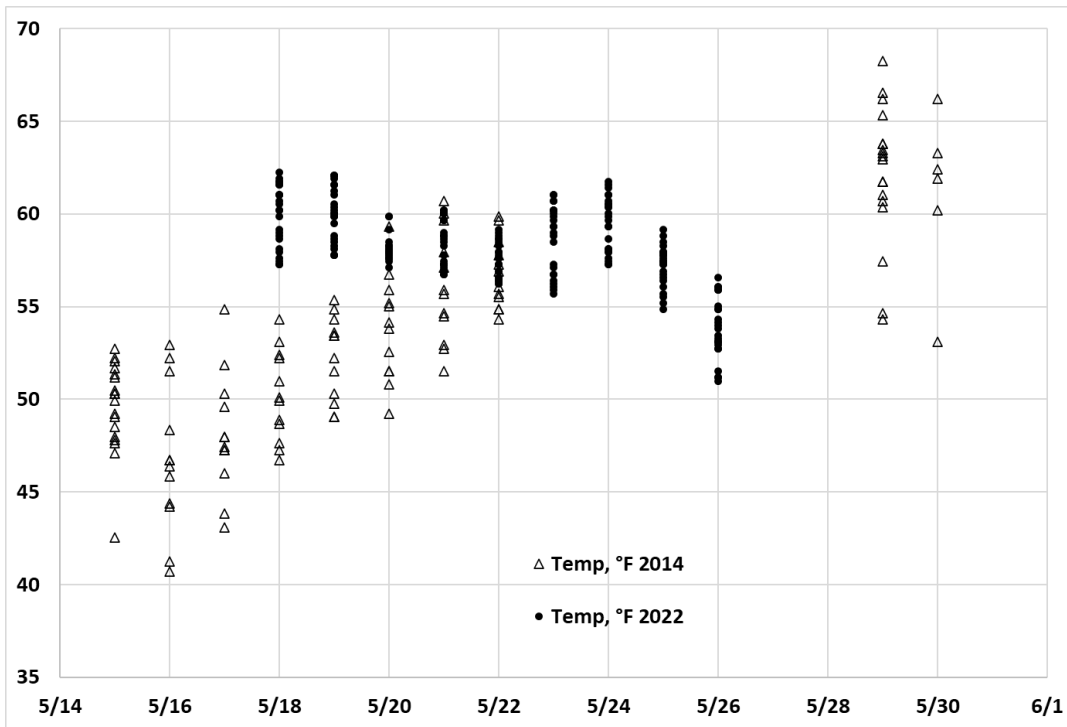
**3a.**



**3b.**



**Figures 3a-b.** Minimum and maximum daily air temperatures during May for Washington Island in 2014 (Fig 3a) and 2022 (Fig 3b) (NOAA 2023).

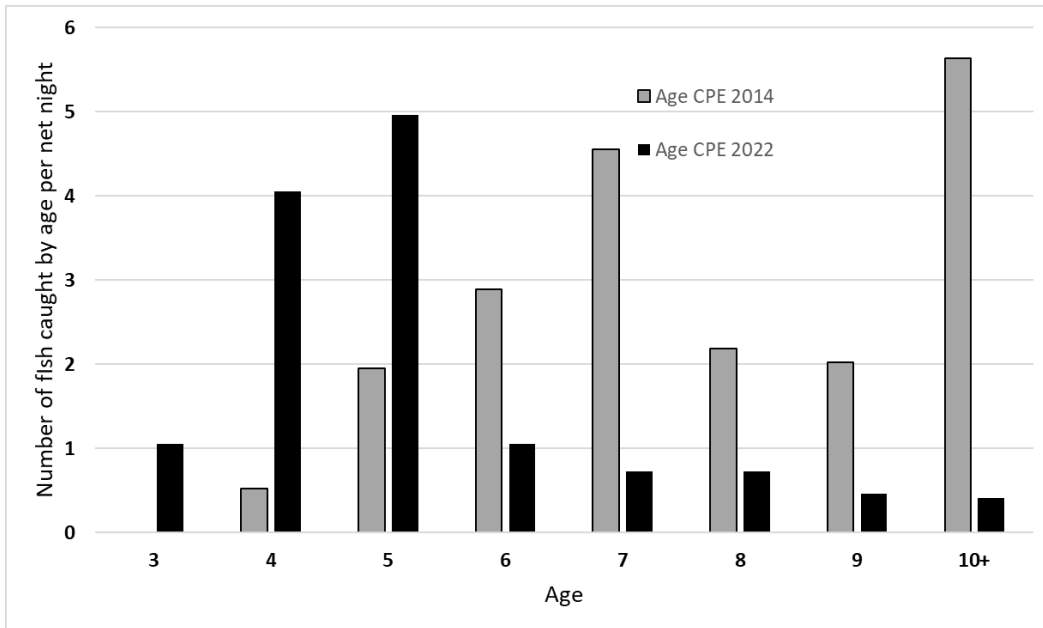


**Figure 4.** Daily water temperatures (°F) collected hourly for specific days in May in Detroit Harbor, Washington Island during 2014 and 2022.

**AGE COMPOSITION**

The ages for all smallmouth bass sampled in Detroit Harbor were between four and 19 years in 2014 and between two and 13 years in 2022. Fish were proportionally much older in 2014

than they were in 2022, demonstrating a considerable shift in the age structure of the population between these two survey years (Figure 5). Age data from the 2014 population sampling suggest that there were strong year classes generated from the early to mid-2000s as cohorts from those years are well represented in the catch (i.e., age-7 produced in 2007; age 10+ produced  $\leq 2004$ ). Meanwhile, the 2022 age data suggest there were strong year classes generated in 2017 (age-5) and 2018 (age-4), with relatively low recruitment during the early to mid-2010s (i.e., fewer fish ages  $\geq$  age-6).



**Figure 5.** Age composition in number of smallmouth bass caught per net night by age for 2014 and 2022. Due to decreasing accuracy for older fish, age-10 and older fish are pooled. (Maceina and Sammons 2006)

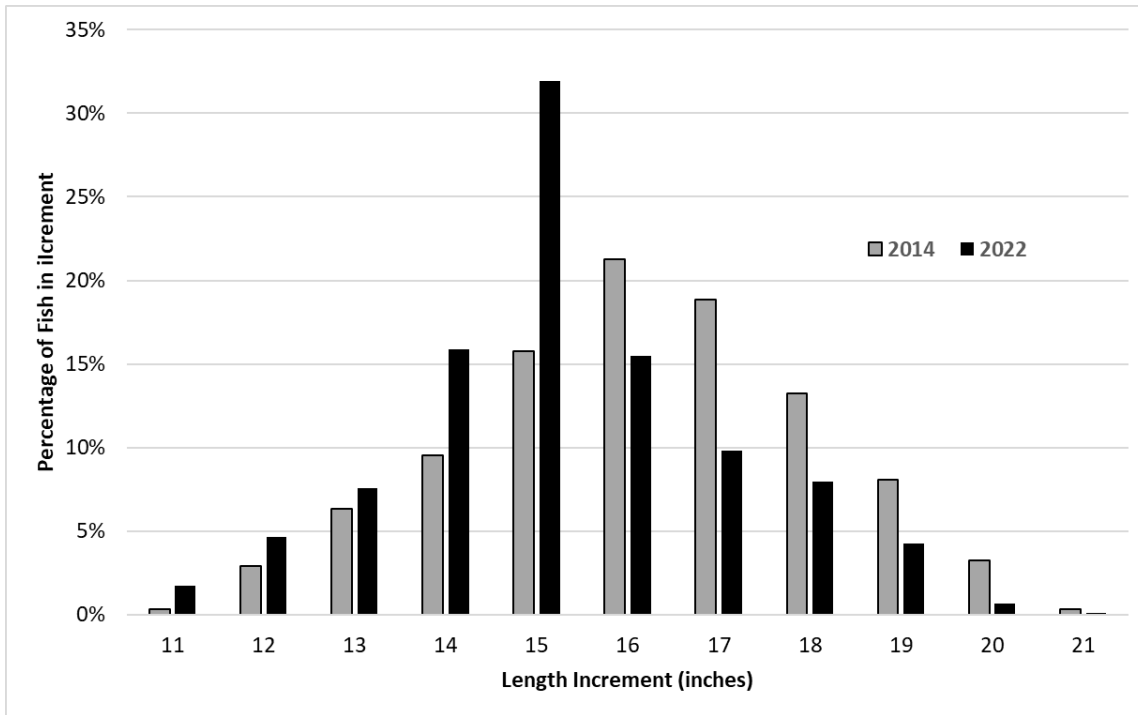
## SIZE STRUCTURE

The population length compositions generally follow the patterns of age composition between the two surveys, although the shift in length compositions was not as distinct as the shift in age compositions. In 2014, the population size composition was generally skewed to large fish, while in 2022, there was a shift toward relatively smaller fish in the overall sampled population (Figure 6). This is consistent with the relatively lower catches of younger fish in 2014 that are later reflected in the lack of older fish in the 2022 population assessment. Fish lengths ranged from 11 to 21 inches for both years and the largest fish measured 21.5 inches (2022). Over 65% of the 2014 population sampled was 16 inches or greater, while over 77% of the 2022 population sampled was 16 inches or less, again reflecting the different age compositions between survey years. However, the average length of smallmouth bass sampled between surveys was relatively similar (16.6 inches in 2014 and 15.8 inches in 2022).

It should be noted that because sampling started around mid-May for each of these surveys, it's possible the overall size structure of the sample could be skewed low (relative to the overall population). In general, our surveys have demonstrated that larger fish tend to make



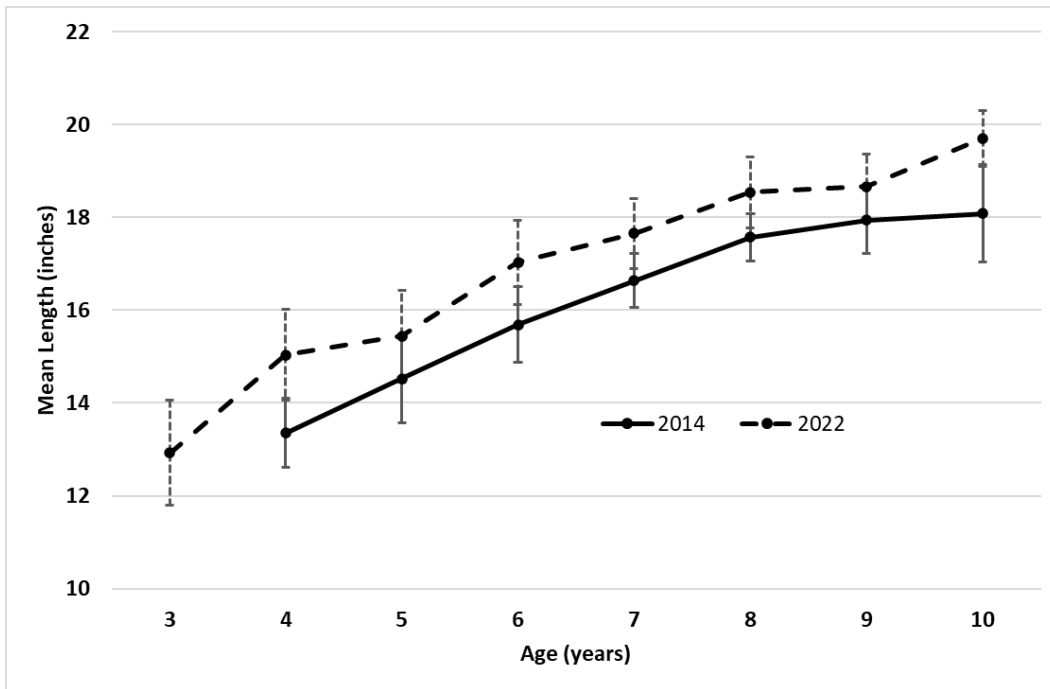
up a larger proportion of the catch early in the pre-spawn season. This could reflect older, more experienced males beginning to move into shallow waters in search of preferred spawning areas.



**Figure 6.** Length compositions for Detroit Harbor smallmouth bass surveys during 2014 and 2022. Length bins are delineated by any fish that fell within a particular inch group (e.g., a fish in the 16 inch bin could have been between 16 and 16.99 inches long).

The mean length at age increased between 2014 and 2022 (Figure 7). Mean length at age data from the 1997 survey (Kroeff 1997) indicate that, on average, a fish did not reach the 12-inch legal size limit for waters surrounding Washington Island until around five to six years of age. However, now fish, on average, reach the legal limit by three to four years of age.





**Figure 7.** Mean length in inches ( $\pm 1$  SD) at age of smallmouth bass sampled during the 2014 and 2022 spring spawning periods in Detroit Harbor, Washington Island. No age-3 fish were collected in 2014. (Due to decreasing ageing accuracy for older fish, data for fish older than age-10 are not shown.)

## Summary

To compare population sizes, the number of smallmouth bass caught per net per night of fishing (total nets/nights fished) can be used as a general index of relative abundance. While mark-recapture population estimates are the preferred means of estimating abundance, the ‘open system’ characteristics of Great Lakes smallmouth bass populations and lower recapture rates confound making robust population estimates. To make reasonable comparisons of CPE for spawning populations between years, it’s important that the timing, locations and water temperatures of the sampling are relatively consistent to ensure some level of reliable catchability. However, given changing Great Lakes water levels and variable temperatures, maintaining interannual consistency between net sites can be challenging, and fish may change areas they inhabit within the embayment based on environmental conditions. Nets are occasionally moved to areas where fish are active and susceptible to capture. Nets were placed in relatively consistent locations between the two survey years for Detroit Harbor although a dramatic change in the shoreline structure likely from the influence of storm and ice forces in an area known as the ‘East Channel’ precluded repeating a net site in this general area in 2022. An additional net was fished in Peterson Bay in 2022, whereas only one was fished there in 2014. While the temperature patterns differed considerably between the two survey years and could account for some of the CPE differences, by around the third week in May, there were similar temperatures between years, and by the end of the month, most pre-spawn activity would have been expected to be completed. Therefore, we believe that the data suggest that there was a considerable decrease in population size of smallmouth bass in Detroit Harbor between 2014 and 2022, dropping by around 1/3 based on CPE during May. However, it is important to consider this

CPE calculation was restricted to the approximate pre-spawn periods in these years. In 2014, the CPE would have likely increased if June catch data were included in the calculations because catches into June were very high. This likely reflects a high percentage of sub-adult and first-time spawners in the population at a time when larger males are sedentary while guarding nests and larger females may have left the area. This was also the case during the 1997 survey, where June catch rates were very high, reflecting very good periods of smallmouth bass recruitment during the 1990s (Kroeff 1997). Because we did not allow nets to fish into June in 2022, the information on the youngest age classes may be somewhat limited for this year.

The population age and size composition in 2014 indicated that recruitment was good for several years during the early to mid-2000s, as cohorts from that period are well represented in the survey catch data. However, the limited catch of three and four-year-old fish in the 2014 survey suggests that by the early 2010s, there were no strong year classes produced. This is further supported by comparatively few numbers of older fish (age-10+) in the 2022 survey (i.e., production from  $\leq 2012$ ). The ensuing years in the early to mid-2010s were relatively weak as well, as indicated by relatively low catch rates for ages six and older in the 2022 survey. However, good catch rates of age-4 and age-5 fish in 2022 suggest that 2017 and 2018 (and possibly 2019) were good years for smallmouth bass production. While the data from these two survey years describe different dynamics in the Detroit Harbor smallmouth bass fish population (i.e., different CPEs, ages, and size structure across years), the results are reflective of what can occur with normal population cycling in a fishery. Despite overall catch rates dropping by around one-third between 2014 and 2022, the population should still be considered relatively robust, and a considerable number of younger fish (ages three to five) sampled in the population should provide for a good future fishery. Smallmouth bass fishing regulations for this area have promoted considerable protection for the spawning population. Although the current size limit of 12 inches (within one-fourth mile of all islands in the Town of Washington Island) is for many smallmouth bass populations not protective enough to allow even one year of spawning effort, the areas around Washington Island have had a closed season until July 1 for most years since at least the 1970s. (During 2020-2021, the regulations around Washington Island followed those for the rest of Green Bay due to an inadvertent administrative change, but the rules reverted to the previous ones in 2022.) The smallmouth bass fishing closure until July 1 effectively protects smallmouth bass during the spawning period from harvest and stressors from removing nesting fish. Because of this protection, the strong catch and release mentality for smallmouth bass and the relative isolation of Detroit Harbor, it's reasonable to assume that the reduced relative abundance measured in 2022 is not due to angling pressure but is more likely a reflection of environmental influence.

Growth continues to improve for smallmouth bass around Washington Island (consistent with other Door County smallmouth bass populations), with fish reaching the legal-size limit (12 inches) at around three years, whereas historically, it took five to six years, on average (Kroeff 1997). The interpretation of trends in the composition of the youngest age class (ages three to four) in the population is confounded because the gear selectivity to younger age classes of fish may be increasing with increased growth rates. Between 2014 and 2022, the mean size at age had increased considerably (Figure 7) and has increased even more dramatically since the 1997 survey, where an age-4 fish from Detroit Harbor averaged just 9.3

inches (Kroeff 1997). While these fish may have been large enough to be selected by our fyke nets, particularly in 2014, the age at maturity may be decreasing (i.e., growth increases potentially resulting in increased energy to reproductive organs), meaning smallmouth maturing at an earlier age could result in younger fish becoming more susceptible to the nets, therefore increasing catch rates somewhat. It is important to recognize that different fish aging structures were used when aging bass for each survey year, scales in 2014 and fin spines in 2022. While we recognize that some under-aging may have occurred using scales (for older fish in particular), we are confident in the accuracy of fish in younger age classes. Other variables, such as staff with considerable experience aging bass with scales and robust growth rates, add further confidence to our age estimates. However, paired structure analysis (scales:spines) would be prudent to evaluate the level of precision between the structures. Such paired structures were collected in 2022, and ages from each will be compared as time and resources allow.

## **MANAGEMENT IMPLICATIONS**

Lower relative sport fishing catch rates for smallmouth bass over the past five to ten years in the waters surrounding Door County have raised concerns among some anglers. Cohorts from the strong year classes in the 2000s survived well into the 2010s, resulting in a fishery made up of excellent catch rates for large fish among most populations in Door County waters, an often-infrequent occurrence in sport fisheries. There are many variables that can impact fish abundance, with angler exploitation one that is often in the spotlight. Considering the waters surrounding Washington Island have long had relatively conservative regulations during the spawning period when fish are susceptible to harvest and other stressors, the artifact of angler exploitation and pressure during the spawning period has mostly been removed. Fish populations often cycle naturally, and factors including climate change and invasive species can impact recruitment and exacerbate challenges with maintaining a strong fishery. However, it's important to consider the issues in a relative sense. Smallmouth bass populations around Door County are still considered healthy by most standards (i.e., good relative abundance, age and size structure). Therefore, we are not recommending any smallmouth bass management changes to the areas around Washington Island at this time.

The focus on adults during the pre-spawn surveys limits our ability to evaluate year class strength before the fish become reproductively mature and before they become susceptible to the sport fishery. While we have conducted periodic young-of-year recruitment and nest success surveys, given the inherent challenges with these types of surveys and the scale of the smallmouth bass fishery in Door County, it is challenging to incorporate these results into management applications. Consequently, a two-year UW-Stevens Point (UWSP) graduate study began in 2022 that was designed to measure Door County smallmouth bass nesting success/failure more intensively in these same populations and evaluate the mechanisms that may contribute to nesting failures including, nest predation (e.g., round gobies), angler-targeted bed fishing and changing climate patterns. This study will also measure young-of-year recruitment from various Door County smallmouth bass populations, experimenting with different sampling methods to determine the most effective and efficient method for evaluating this life stage. Detroit Harbor was selected as one of the sites to be included in these studies. The results of these UWSP studies, along with current survey data, should help provide insight into the mechanisms that affect smallmouth bass populations in Door

County, as well as help inform DNR management approaches to best measure smallmouth bass recruitment in the future.

Various other factors may play a role in smallmouth bass life history and should be considered when trying to manage for healthy smallmouth bass populations in Door County waters of Green Bay and Lake Michigan. This may include possible impacts from tournaments (Maynard et al 2013), disease ([DNR Press Release](#)), invasive species (Steinhart et al 2004), frequent large-scale changes in Great Lakes water levels (NOAA, The Great Lakes Dashboard), shoreline development (Wensink and Tiegs 2016) and impacts from changing climate conditions (Steinhart et al 2005). See Hansen 2024 for further discussion of these topics as well as information regarding other current research studies concerning smallmouth bass in waters surrounding Door County.

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