A Report on Recreational Angler Survey of Lake Dora/Beauclair for November 2020 through April 2021

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This report is submitted to the Lake County Water Authority (LCWA) to fulfill the agreement between the Florida Fish and Wildlife Conservation Commission (FWC) and the LCWA for the creel survey on lakes Dora and Beauclair. The LCWA purchase order number is 20210645.

Introduction

Historically, Lakes Dora and Beauclair had a high-quality black crappie *Pomoxis nigromaculatus* fishery while a minimal fishery existed for largemouth bass *Micropterus salmoides*. Although bass had fast growth rates and some large bass were available to anglers, limited submersed aquatic vegetation (SAV) produced weak year classes and low bass densities (FWC unpublished data). FWC biologists speculated that the lack of juvenile rearing habitat was the primary bottleneck limiting recruitment. Excessive nutrients increased algal growth, which in turn decreased water clarity preventing expansion of SAV, resulting in a low bass population. Creel surveys from 2004–2011 showed below state-wide average estimates of angler catch rates for bass (0.50 bass per hour; Benton 2011). The Lake County Water Authority made significant investments to construct and operate a nutrient reduction facility (NuRF), with a goal of removing excess phosphorus from the water moving downstream from Lake Apopka (operational in March 2009). The project was a restoration effort to restore favorable water quality conditions to improve aquatic habitat, which would benefit fish and wildlife, along with users of the Harris Chain of Lakes.

Peak season angler creel surveys on Lakes Dora and Beauclair were conducted annually beginning in 2004– 2011 and 2019/2020 to assess the impacts of nutrient reduction from the NuRF and other management actions. In the first two years of operation for the NuRF, low water levels on the Harris Chain limited the amount of water available to treat and electrofishing catch rates showed no increase in recruitment and bass angler effort in the creel remained relatively low. However, any impacts from restoration activities to the fishery would not likely be observed in the first two years. Water quality improvements have been well documented by the St. Johns River Water Management District (SJRWMD) and University of Florida's Lakewatch program showing total phosphorus loading (TP; metric ton/year) and Chlorophyll-a concentrations on a decreasing trend (LAKEWATCH 2020). Nutrient reduction is paramount in improving overall water quality and in turn improving water clarity allowing for submersed aquatic vegetation coverages to expand. Submersed aquatic vegetation plays an important role in fish populations by serving as nursey habitat leading to improved recruitment and an overall improved population. Therefore, to determine how changes in water quality and habitat have impacted the sport fishery at Lakes Dora and Beauclair, there is a need to collect current angler survey data. Our objectives were to 1) estimate the angler effort, catch and success of sportfish and 2) compare estimates to long-term creel data to identify changes following restoration

activities at Lakes Dora and Beauclair. Specifically, we used data collected from a peak season angler survey in conjunction with information obtained by fisheries-independent methods (e.g. electrofishing and trawl nets) to gauge the status of the fish population.

Methods

Lakes Dora and Beauclair are two interconnected lakes with a collective surface area of 5,463 total acres and are part of the Harris Chain of Lakes located in central Florida (Figure 1). We completed peak season roving angler creel surveys on Lakes Dora and Beauclair from November 27th, 2020 to April 15th, 2021. Angler creel surveys are useful for obtaining fisheries dependent information and effectively assessing long-term trends in a fishery. The surveys measured angler effort, catch, and success of all sportfish species. A peak season creel survey (typically during the winter and spring months in Florida) captures the high use period for anglers in Florida.

This survey focuses on the black crappie and largemouth bass fisheries. Previous year-round creel surveys conducted on the Harris Chain of Lakes indicate that 90–98% of the effort and catch for black crappie occurs during the peak season (November through early May) compared to 50−72% for largemouth bass (Thompson et al. 2012; Bisping and Thompson 2014; Thompson et al 2020). Furthermore, our peak season creels only capture 10-44% of the bream *(*bluegill *Lepomis macrochirus* and redear sunfish *Lepomis microlophus* effort resulting in a non-representative estimate of the bream fishery (Thompson et al. 2012; Bisping and Thompson 2014; Thompson et al 2020).

We used a progressive count (creel-as-you-count) method where anglers were interviewed and counted simultaneously (Hoenig et al. 1997). Progressive counts allow us to be more efficient by increasing precision of estimates and eliminating the need for creel clerks to make two circuits around the lakes. This survey consisted of five 28-day periods. Within each 28-day period, six weekdays and four weekend days were randomly selected for sampling. For each creel day (11-hour work period), one of four time periods were randomly selected (T1: 700-945, T2: 945-1230, T3: 1230-1515, and T4: 1515-1800). Starting March 14th, 2021, the work period was extended to 12 hours to account for increased day length and the time periods were adjusted accordingly (T1: 730-1030, T2: 1030-1330, T3: 1330- 1630, and T4: 1630-1930). During each interview we recorded the following information: number of anglers, fishing start time, home zip code, fishing from boat or shore, targeted species, and number of each species kept and released. Largemouth Bass caught (both kept and released) were further broken down into four size classes: <12", 12-16", 16-24" and >24". We asked Largemouth Bass anglers whether they were actively fishing in an organized tournament or pre-fishing for an upcoming tournament. For tournament bass anglers, we considered bass as released if the angler had them in the live-well at the time of the interview, due to requirements of releasing fish from the FWC tournament exemption permit. Only bass anglers actively fishing in a tournament were classified as tournament bass effort, catch and success.

All data were entered into a creel analysis program developed by FWC (version 3.1., Connor 2007) and were stored in a Microsoft Access® database on an FWC server. This creel analysis program generates estimates of fishing effort (angler-hours), catch and harvest (number of fish), and success (fish caught per hour) using roving survey catch-rate estimators reported in Pollock et al. (1997), Jones et al (1995) and Hoenig et al. (1997). We reanalyzed past creel surveys (2004–2011) to show estimates for the same time period (late November to mid-April) so we could effectively compare between years.

We sampled the black crappie and largemouth bass populations of Lakes Dora and Beauclair following standard methodology outlined in the FWC's *Standardized Sampling Manual for Freshwater Systems, Version 6* (Bonvechio 2017). The purpose of collecting fisheries independent data is to provide a relative index of abundance (compare catch per unit effort, or CPUE, among years). For black crappie, we used fall otter trawl samples collected from randomly chosen blocks of Lakes Dora and Beauclair annually since 2004. Age-0 black crappie were classified by examining otoliths (ear bones) from a subsample of fish (Schramm and Doerzbacher 1982). Standardized electrofishing for largemouth bass has been conducted annually in the spring (February–March) since 2007 on lakes Dora and Beauclair to assess population trends. We calculated the mean CPUE (fish per 15-minute transect) along with age-1 (<230 mm TL) and bass over 16" (> 406 mm TL). Based on previous age samples in the Harris Chain, we assume that bass collected in the spring < 230 mm TL are age-1 bass.

Results and Discussion

During the 2020–21 survey we counted 1,224 anglers and interviewed 943 resulting in an estimated total fishing effort of 37,415 ± 3,771 hours (± standard error). The total fishing effort was similar to the 2019–20 survey (Table 1) and fell within the 95% confidence interval from the last three surveys completed (2009–2011 and 2019–20; Table 1). Of all anglers surveyed, 68% were Florida residents and 92% were boat anglers. Using home zip codes collected from the creel we found non-Florida residents represented 23 different U.S. states primarily due to the traveling tournament bass anglers (Figure 2). The full 2020-21 angler creel estimates for Lakes Dora/Beauclair can be found in Appendix 1.

Black Crappie

In 2020-21, the estimated black crappie effort was 10,255 ± 1,360 hours (± standard error) and only accounted for 27% of the total effort resulting in a decline from the 2019–20 survey and the lowest crappie effort recorded in all survey years (Table 1). From 2004–2011, the black crappie fishing effort ranged from 83%–93% of the total angling effort. Over the past two years we have documented a shift in directed effort with more anglers targeting largemouth bass. We have documented a similar shift on Lake Griffin, with higher effort now being directed towards largemouth bass (FWC unpublished data). In 2020-21, the black crappie harvest success rate was estimated at 1.09 ± 0.13 fish per hour, which was lower compared to last year's survey, but average compared to all surveys since 2004.

In Fall 2020, we used otter trawls to randomly sample 30 sites in Lake Dora and 12 sites Lake Beauclair to monitor the black crappie population. The catch per unit effort (CPUE; mean number of fish caught per min ± standard error) for black crappie >229 mm TL (> 9") was 0.23 ± 0.06 and 0.14 ± 0.05 fish/min for lakes Dora and Beauclair, respectively. The CPUE of Age-0 was 0.02 ± 0.02 and 0.06 ± 0.06 fish/min for lakes Dora and Beauclair, respectively, resulting in the lowest values for these lakes since sampling began in 2004 (Figure 3 and 4). Many crappie populations have erratic recruitment and experience cyclical patterns resulting in "boom or bust" trends (Guy and Willis 1995, Allen and Miranda 2001). For example, trawl data indicated a good year class produced in 2003 on Lake Dora likely resulting in above average angler success rates in 2005-06 (1.52 ± 0.14 fish/min; Table 1; Figure 3). In subsequent years, we saw the angler success rate decline to its lowest point in 2008-09 (0.81 ± 0.06 fish/min) as the year class moved through the fishery. In recent years trawl data indicated good year classes produced in 2015 on Lake Beauclair (10.41 ± 2.6 fish/min) and 2016 in Lake Dora (12.74 ± 2.18 fish/min), that likely helped drive the fishery, but with below average Age-0 catch rates in recent years we may continue to see a decline in angler success rates in upcoming years.

Largemouth Bass

In 2020–21, the largemouth bass fishing effort was 26,869 ± 2,889 hours accounting for 72% of the total angling effort (Table 1). From 2004–2011, the largemouth bass effort was extremely low (< 4,000 hours) and only accounted for 4%–16% of the total effort. The last two years we have seen the bass effort significantly increase accounting for most of the effort on Lakes Dora/Beauclair indicating a shifted from a Black Crappie to a Largemouth bass dominated fishery. Furthermore, the 2020-21 success rate (number of bass caught per hour) was 0.58 ± 0.05, which was identical to last year's survey and remained at or slightly above the state-wide average (~0.50 fish per hour). The number of bass caught was 14,133 ± 1,741 with a high proportion (95%) of bass being released (Appendix 1). The increase in effort and success of bass angling suggest a significant improvement in the bass fishery. In 2020–21, the tournament related bass effort accounted for 57% of the total bass effort (tournament and prefishing anglers), resulting in an increase compared to last year's survey (2019-20: 42%). In recent years, the Harris Chain has received a lot of attention from local and national tournament anglers and has played host to many major bass tournaments including B.A.S.S. and Major League Fishing (MLF) events.

In spring 2021, we used electrofishing to sample 37 sites on Lake Dora and 13 sites on Lake Beauclair, resulting in a mean catch per unit effort (CPUE; mean number of fish collected per site ± standard error) of 32.54 ± 1.71 and 22.31 ± 2.87, respectively (Table 2). Historically, Lakes Dora and Beauclair have recorded low CPUE of age-1 bass (bass < 230mm TL) and high CPUE of bass > 406 mm TL (over 16") compared to other lakes on the Harris Chain. Over the last 2-3 years, Lakes Dora and Beauclair recorded higher than average catch rates of age-1 indicating high natural recruitment likely resulting from the substantial increase in submersed vegetation (Table 2; Figure 5 and 6).

Over the last 15-20 years we have seen major improvements in water quality within the Harris Chain of Lakes resulting from nutrient reduction efforts. Back in the 90's and 2000's, the Harris Chain suffered from excessive nutrients resulting in hypereutrophic conditions, poor water quality and low levels of submersed aquatic vegetation. The poor water quality and lack of habitat resulted in a suppressed bass population due to the lack of natural reproduction. Many major restoration efforts, including improved water management practices, key land acquisitions, marsh and habitat restoration projects, and the nutrient reduction facility (NURF), have played a major role in improving the overall quality by helping reduce/remove nutrients coming into the system. Specific to Lakes Dora and Beauclair, Total Phosphorus, Total Nitrogen, and Chlorophyll-a concentrations are showing a decreasing trend (LAKEWATCH 2020). Furthermore, in both the Lakewatch data and FWC spring sampling data (FWC unpublished data), there is an increasing trend in Secchi depth (water clarity) measurements in both lakes. This increased water quality has allowed for more light penetration and expansion of submersed aquatic vegetation in these lakes. Based on vegetation monitoring done by

FWC in summer 2020, the percent area coverage of SAV in Lakes Beauclair and Dora was 59% and 22%, respectively (Figures 5 and 6). Largemouth bass utilize SAV especially during the juvenile stage allowing for improved year class production and an increase in the overall bass population (Durocher et al. 1984, Miranda and Pugh 1997, Tate et al. 2003). Over the last two years, we have documented an increase in bass angling effort and success (from creel survey), along with increased catch rates of age-1 bass (from our electrofishing) on Lakes Dora and Beauclair suggesting major improvements to the bass fishery. This improvement can be attributed to the improved water quality and habitat in these lakes due to the many restoration projects throughout the Harris Chain of Lakes, including the NURF. It will be important to continue to monitor Lakes Dora and Beauclair to effectively assess any future trends.

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Table 1. Total recreational angler effort (hours) for lakes Dora and Beauclair from end of November through mid-April (five 28-day work period) from 2004–2011 and 2019-2021. Total estimated angler effort (hours fished ± one standard error unit), species-specific effort and success (fish per hour ± one standard error unit) for Black Crappie harvest (BLCR) and Largemouth Bass (LMB). Percentages in parenthesis are the proportion of effort directed toward each species.

Year	Total Effort	BLCR Effort	BLCR Success	LMB Effort	LMB Success
2004-05	29,751 ± 2,516	26,479 ± 2,365 (89%)	1.05 ± 0.07	2,164 ± 517 (7%)	0.03 ± 0.02
2005-06*	21,619	17,004 (79%)	1.52 ± 0.14	3,400 (16%)	0.26 ± 0.12
2006-07	29,559 ± 2,965	26,619 ± 2,849 (90%)	1.21 ± 0.07	2,117 ± 584 (7%)	0.10 ± 0.03
2007-08	21,047 ± 1,73	17,881 ± 1,587 (85%)	1.02 ± 0.09	2,174 ± 380 (10%)	0.28 ± 0.08
2008-09	23,037 ± 2,730	19,691 ± 2,419 (85%)	0.81 ± 0.06	1,573 ± 415 (7%)	0.25 ± 0.06
2009-10	35,008 ± 3,764	32,469 ± 3,580 (93%)	1.11 ± 0.06	1,504 ± 477 (4%)	0.45 ± 0.17
2010-11	36,279 ± 3,594	29,988 ± 3,406 (83%)	1.11 ± 0.07	3,331 ± 550 (9%)	0.44 ± 0.10
2019-20	39,225 ± 3,070	16,839 ± 1,709 (43%)	1.53 ± 0.11	21,322 ± 1,980 (54%)	0.58 ± 0.05
2020-21	37,415 ± 3,771	10,255 ± 1,360 (27%)	1.09 ± 0.13	26,869 ± 2,889 (72%)	0.58 ± 0.05

* using an estimated value for one period of missing data. The estimate was derived from the same period in 2004-05 from lakes Dora/Beauclair and the same period in both creel years of Lake Eustis.

Table 2. Electrofishing data for largemouth bass collected from Lakes Dora and Beauclair during spring 2021 (February through March). The table includes the number of sites, number of fish (N) collected, catch per unit effort (CPUE; mean number of fish collected per 15-min site ± standard error) of all fish collected (CPUE all), age-1 (CPUE age-1; fish < 230 mm [< 9”] collected), and fish greater than 16” (CPUE > 16”). Numbers in parenthesis constitutes historical ranges from 2007–2021.

	Sites	N	CPUE all	CPUE age-1	CPUE >16"
Dora	37	1204	32.54 ± 1.71 (13.02 - 39.93)	7.27 ± 0.77 (1.10 - 8.05)	6.40 ± 0.60 (2.48 - 9.65)
Beauclair	13	290	22.31 ± 2.87 (6.53 - 36.23)	8.00 ± 1.43 (0.67 - 11.31)	2.20 ± 0.50 (0.90 - 6.46)

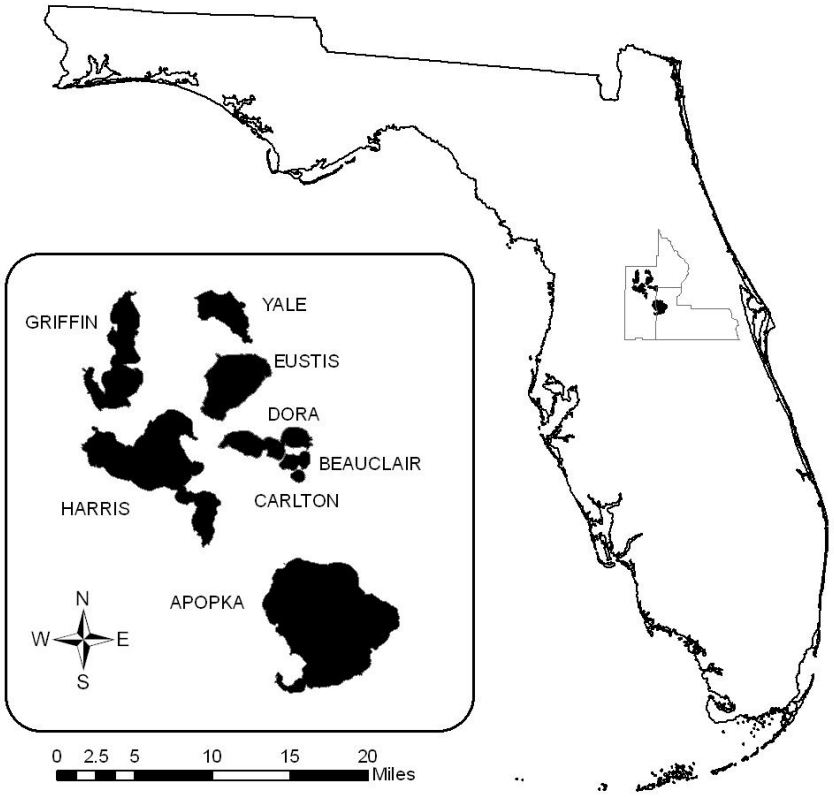

Figure 1. Location of Harris Chain of Lakes in central Florida

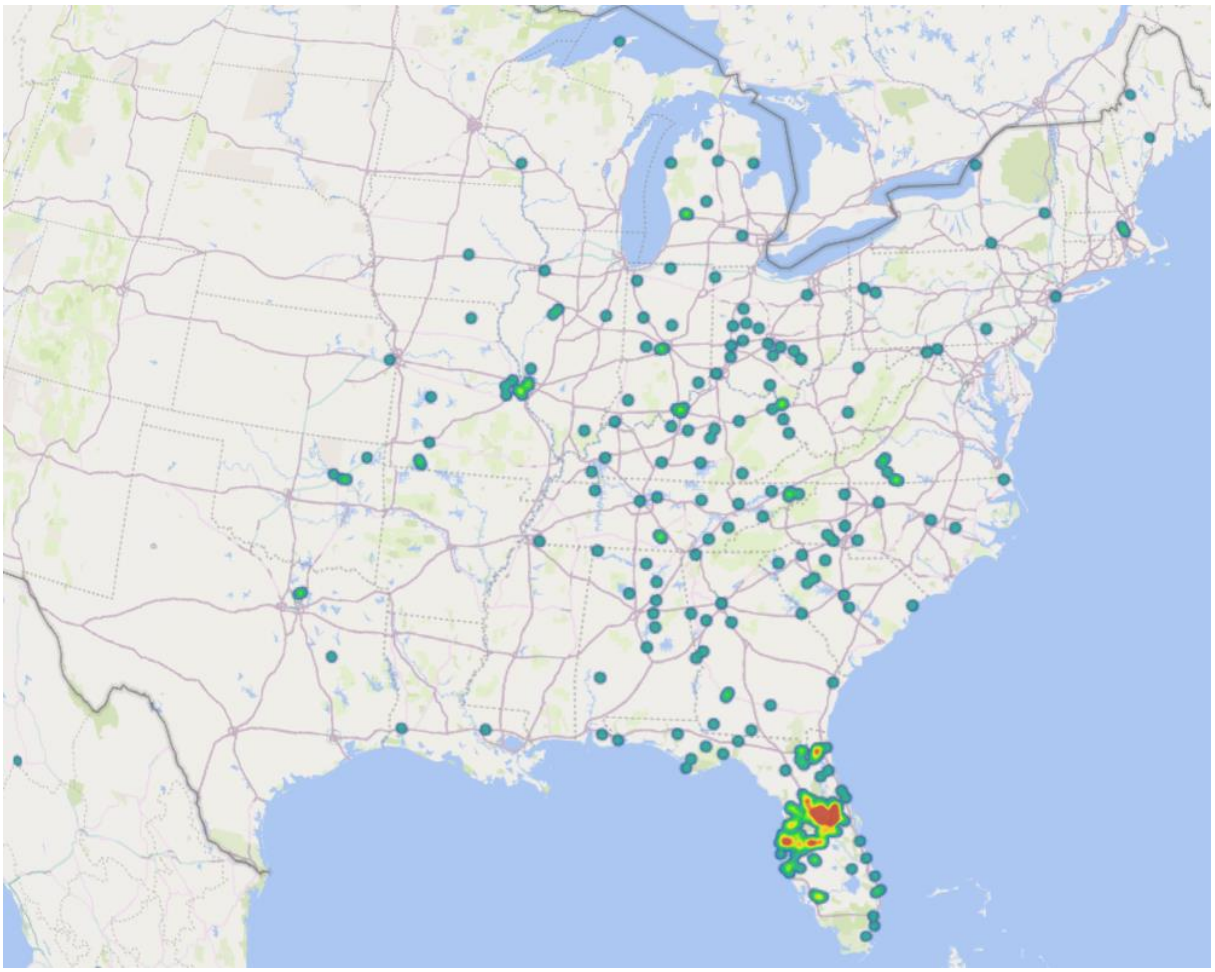

Figure 2. Distribution heat map of all angler zip codes taken during 2020-21 peak season creel survey on Lakes Dora and Beauclair.

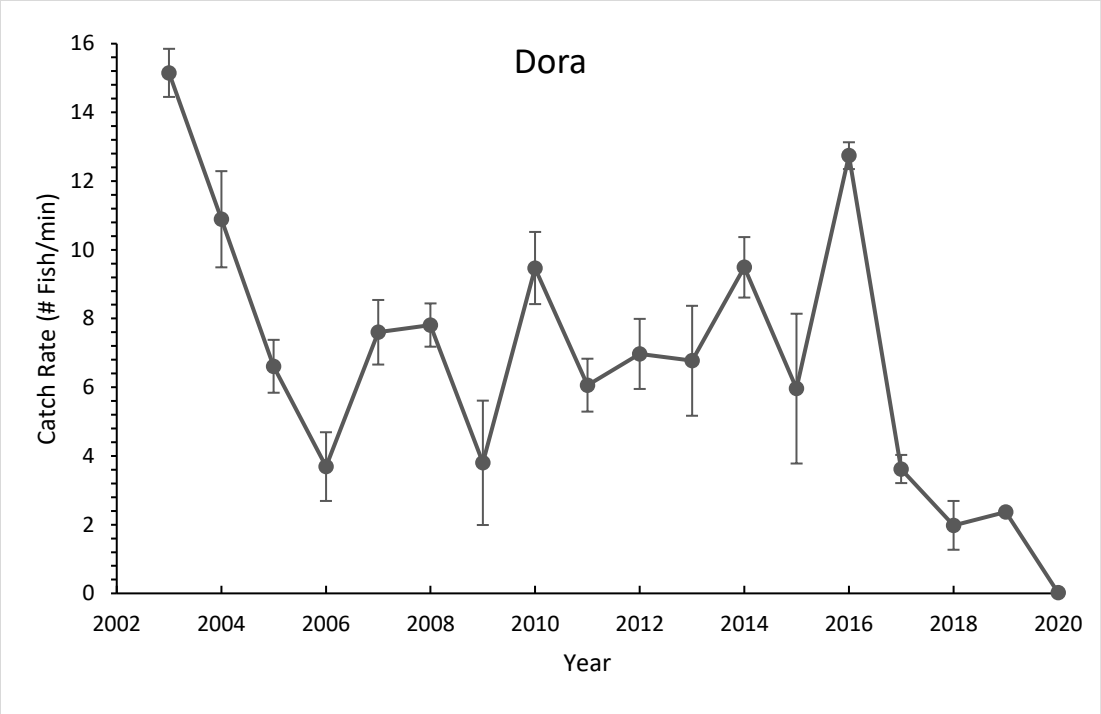

Figure 3. Catch rate (# of fish/min) of age-0 black crappie from trawl sampling on Lake Dora from 2003–2020. Error bars are in standard error.

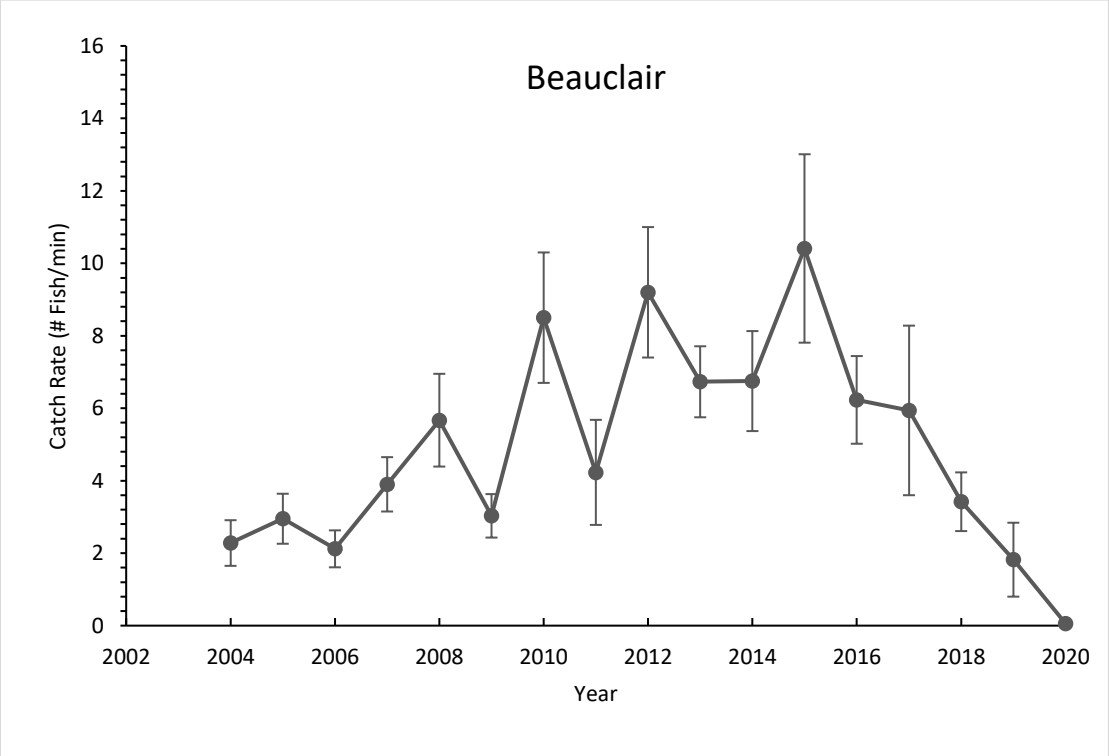

Figure 4. Catch rate (# of fish/min) of age-0 black crappie from trawl sampling on Lake Beauclair from 2004–2020. Error bars are in standard error.

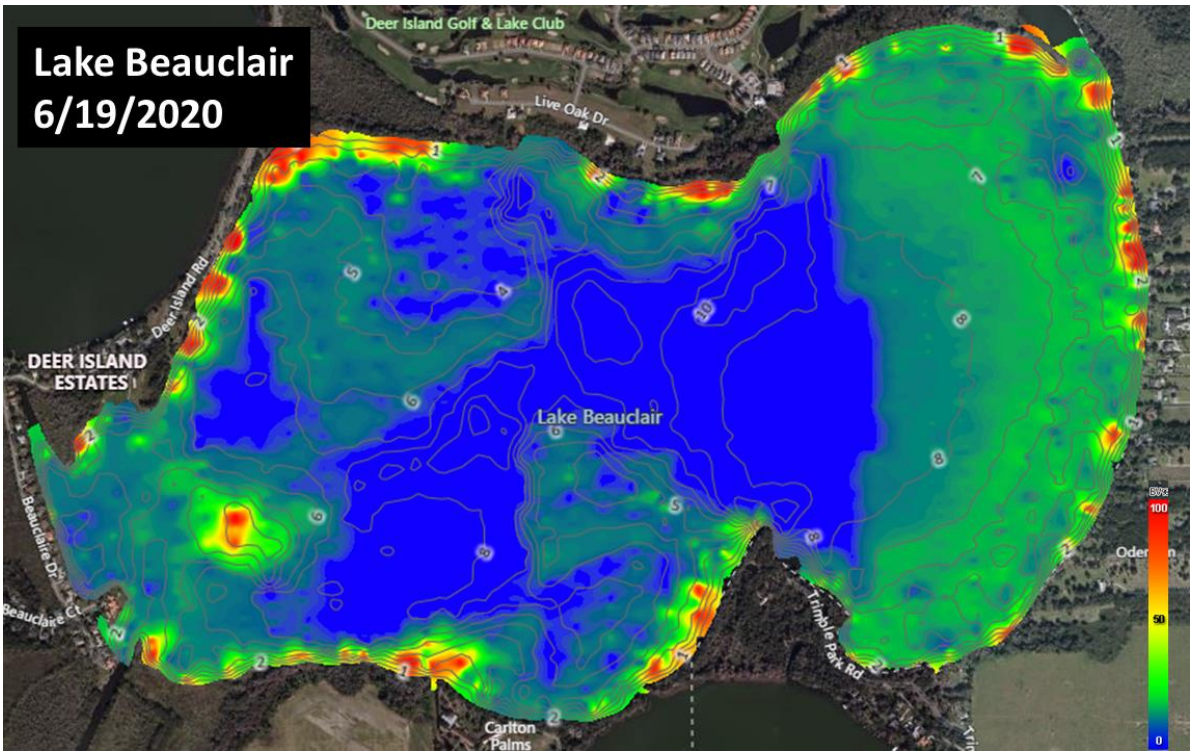

Figure 5. Submersed vegetation heat map for Lake Beauclair completed in June 2020.

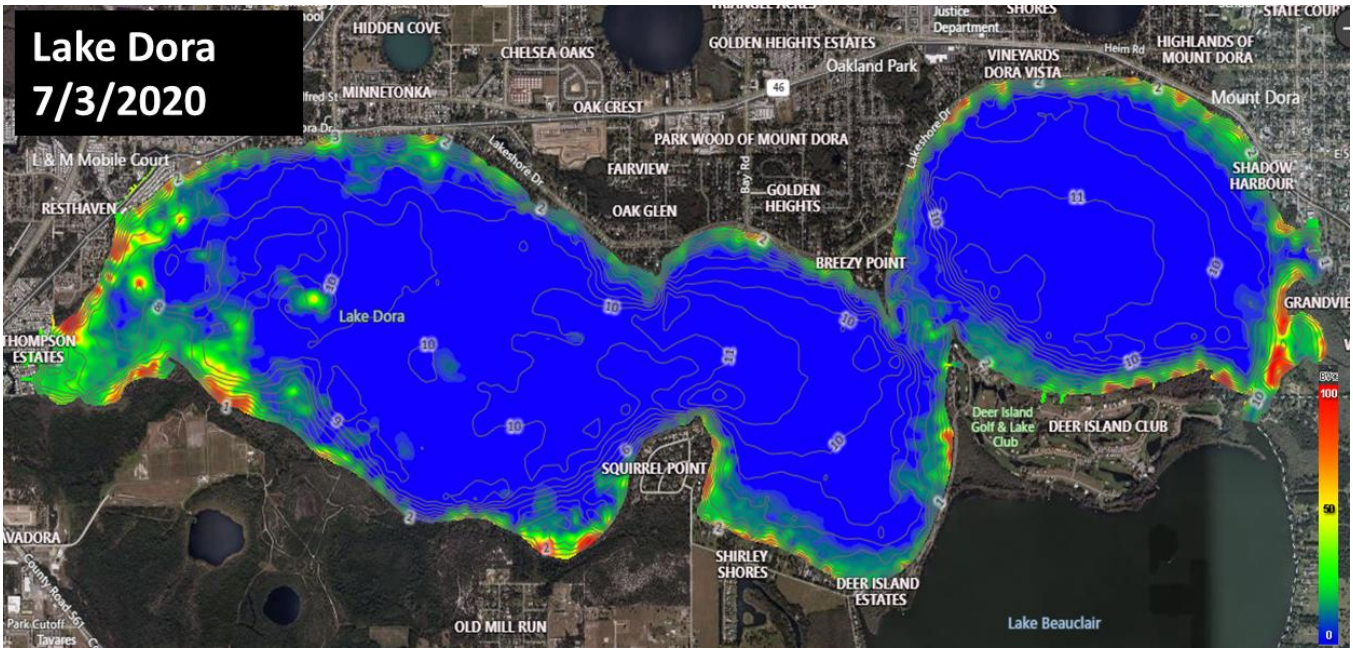

Figure 6. Submersed vegetation heat map for Lake Dora completed in July 2020.

APPENDIX: Creel Results

Appendix 1. The 2020-21 angler creel survey results for Lakes Dora/Beauclair. Estimates for species-directed effort (hours) catch (number of fish) and success (number of fish per hour) for black crappie, bream species (bluegill and redear sunfish) and largemouth bass (LMB); including tournament (T LMB) and non-tournament (NT LMB) largemouth bass and length category estimates for largemouth bass. Standard error (SE) was calculated for each estimate.

	Effort		Catch		Success	
Category	Estimate	SE	Estimate	SE	Estimate	SE
Black crappie caught	10,255	1,360	21,192	3,874	1.54	0.18
Black crappie harvested	–	–	14,979	2,654	1.09	0.13
Black crappie released	–	–	6,213	1,486	0.44	0.08
Bream harvested *(Lepomis spp.)*	309	168	1,240	717	1.1	0.49
Total LMB caught	26,869	2,889	14,133	1,741	0.58	0.05
Total LMB caught <12"	–	–	2,809	474	0.11	0.02
Total LMB caught 12-16"	–	–	8,140	1,076	0.34	0.03
Total LMB caught 16-24"	–	–	3,079	514	0.12	0.02
Total LMB caught >24"	–	–	108	41	0	0
Total LMB released	26,869	2,889	13,400	1,687	0.57	0.05
Total LMB released <12"	–	–	2,785	474	0.11	0.02
Total LMB released 12-16"	–	–	7,663	1,035	0.33	0.03
Total LMB released 16-24"	–	–	2,848	486	0.12	0.02
Total LMB released >24"	–	–	108	41	0	0
Total LMB harvested	19,200	2,155	735	287	0.02	0.01
Total LMB harvested <12"	–	–	24	24	0	0
Total LMB harvested 12-16"	–	–	421	186	0.01	0.01
Total LMB harvested 16-24"	–	–	290	168	0	0
Total LMB harvested <24"	–	–	0	0	0	0
NT LMB released	19,200	2,155	9,968	1,367	0.58	0.06
NT LMB released >12"	–	–	2,216	414	0.13	0.02
NT LMB released 12-16"	–	–	5,532	811	0.33	0.04
NT LMB released 16-24"	–	–	2,125	405	0.12	0.02
NT LMB released <24"	–	–	99	40	0.01	0
T LMB released	7,669	1,351	2,771	579	0.52	0.06
T LMB released <12"	–	–	279	107	0.06	0.02
T LMB released 12-16"	–	–	1,910	458	0.34	0.05
T LMB released 16-24"	–	–	572	169	0.12	0.03
T LMB released >24"	–	–	9	9	0	0
Total Effort	37,415	3,771	–	–	–	–