

# Historical Trends in Bass Reproduction and Population Numbers in Rideau Lakes

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## INTRODUCTION

Largemouth bass (*Micropterus salmoides*; LMB) and smallmouth bass (*M. dolomieu*; SMB), two species of fish native to much of eastern North America (Macrimmon and Robbins, 1975) arguably serve as the basis for the most economically important sport fishery in North America, one valued in the billions of USD annually (Quinn and Paukert, 2009). Developing sound, science-based strategies to responsibly manage and conserve these valuable natural resources, therefore, makes sense from both an environmental and an economic standpoint. The complex life history for these two species, however, complicates management and conservation strategies. That is, males of both species are entirely responsible for building nests, courting females for spawning, and then solely providing extended parental care of the resulting offspring for another 4-6 weeks post fertilization. Uninterrupted parental care during development is imperative for offspring survival (Ridgway et al., 1989; Cooke et al., 2006). If the male abandons (or is removed from) his nest during this parental care period, brood predators will quickly consume all of the offspring (Suski et al., 2003), with upwards of 50% being preyed upon within the first 8-10 minutes of the male's absence (Stein and Philipp, 2015). In situations where anglers catch and harvest nesting bass, rapid predation of the entire brood occurs universally. Catch-and-release angling, however, can theoretically allow a nesting male the opportunity to return to his nest and resume guarding his brood, but not all males can do that (Philipp et al., 1997; Cooke et al., 2000; Suski and Philipp, 2004; Zuckerman et al., 2014).

To protect black bass reproductive success in many areas across Ontario, the Ontario Ministry of Natural Resources and Forestry decades ago instituted a seasonal closure of fishing for nesting black bass during the spawning season. Currently, for the Rideau Lakes and other most popular black bass fishing locations in the province, that closed season is defined as the period from December 15<sup>th</sup> until the third Saturday in June. Although that regulation specifically prohibits the use of angling tactics that would hook nesting male bass, the fact that it is legal during this period to fish for other species complicates compliance with and enforcement of that regulation. Anglers can use this "loophole" in the regulation to (illegally) target, catch, and release nesting male bass, which renders this regulation ineffective at accomplishing its objective of protecting black bass reproductive success (Kubacki et al., 2002). The question for managers then becomes, how bad is that impact and what can be done to alter things.

We have studied the reproductive ecology of black bass (both LMB and SMB) and the impacts that fishing during the reproductive period has on black bass reproductive success and recruitment (annual year class production) in Opinicon Lake, Ontario since 1990. Our research monitoring smallmouth bass (SMB) and largemouth bass (LMB) reproduction and year class production in Lake Opinicon every year since 1990 has determined the following:

1. Year class production of bass is directly proportional to reproductive success.
2. Reproductive success is inversely proportional to the level of illegal preseason angling of nesting bass.

The level of pre-season angling in Opinicon has increased dramatically since 2000, with concomitant decreases in successful reproduction and recruitment. In fact during 2019, the hook-wounding rates from recreational angling observed among nesting male largemouth bass *Micropterus salmoides* (LMB) and smallmouth bass *M. dolomieu* (SMB) were 61% and 69%, respectively. These were the highest recorded hook-wounding rates since an annual survey monitoring reproductive metrics of these species began on this lake in 1990. That level of illegal, preseason angling resulted in only 17% and 29% of LMB and SMB nesting males being successful at raising their broods to independence, the lowest rates observed over that same time period. We predicted that if left unabated, such a level of illegal preseason angling of nesting bass would have substantial negative consequences for the black bass populations in Opinicon.

During the COVID-19 Pandemic of 2020, however, access to fishing in much of Ontario was severely limited over the bass spawning season, which serendipitously provided a natural “whole-lake bass spawning sanctuary” to study. Not surprisingly, the 2020 hook-wounding rates for nesting LMB and SMB in Opinicon Lake were only 5% and 13%, respectively. The result was that 76% of LMB and 77% of SMB males in 2020 were successful at raising their broods to independence, resulting in a 334% and 164% increase in the number of surviving free-swimming fry relative to 2019. That translated into record levels of 1+ juveniles as well, making the 2020 year class of LMB and SMB the most abundant observed since the beginning of the study in 1990.

The question remained, however, are the historical levels of angling-induced reductions in SMB and LMB reproductive success and year class strength observed in Lake Opinicon present in other lakes within the Rideau system? To answer that question, we expanded our summer underwater snorkel assessments of bass year class strength to include three lakes at the top of the Cataraqui River portion of the canal system (Opinicon, Indian, and Sand Lakes), three lakes at the top of the Rideau River portion (Upper, Big, and Lower Rideau Lakes), and one feeder lake off the canal (Devil Lake). For this, we had teams of 2-4 snorkelers swim transects counting YOY, 1+ and 2+ SMB and LMB in each of the seven study lakes several times during the late summer of 2021. Those data are shown in Table 1 and provide us with comparative year class strength data among these lakes across 2019 (full on angling), 2020 (COVID-19, no angling), 2021 (barely a transition year to normal conditions, almost no angling), and 2022 (a return to pre-COVID angling levels).

## FINDINGS

The data from the snorkel survey conducted in 2021 are presented in Table 1 and those data from the snorkel survey conducted in 2022 are presented in Table 2. The relative strength of each specific year class of LMB and SMB were quite similar among all seven of the study lakes across 2019-2022. For example, in all lakes the 2019 year class (i.e., the 2+ group in Table 1) was very weak. In addition, the 2020 year class (i.e., the 1+ group in Table 1 and the 2+ group in Table 2) was very strong

We take those results as preliminary evidence for the following:

(1) in each of the seven study lakes, the 2019 and 2022 year classes of black bass were greatly diminished as a consequence of heavy fishing pressure on nesting bass during the 2019 spawning season.

(2) similarly, in each of the seven study lakes, both the 2020 and 2021 year classes were extremely abundant because there was no to very little angling of nesting bass.

Table 1. Results of snorkeling surveys from 2021

Lake		LMB			SMB		
		YOY	1+	2+	YOY	1+	2+
Opinicon	#	49	86.	4	44	50	3
	%	35	62	3	45	52	3
Indian	#	26	22	2	23	24	2
	%	52	44	4	48	49	3
Sand	#	30	23	2	23	26	1
	%	55	42	3	45	53	2
Upper Rideau	#	21	34	5	156	105	12
	%	36	57	7	58	38	4
Big Rideau	#	69	44	4	83	61	5
	%	59	38	3	55	41	4
Lower Rideau	#	40	28.	3	40	38	7
	%	67	39	4	47	45	8
Devil	#	25	28	2	64	46	2
	%	45	52	3	57	41	2

Table 2. Results of snorkeling surveys from 2022

Lake		LMB			SMB		
		YOY	1+	2+	YOY	1+	2+
Opinicon	#	10	74	49	19	83	73
	%	10	54	36	11	47	42
Indian	#	11	10	17	5	16	13
	%	24	40	36	15	47	38
Sand	#	7	24	18	2	17	16
	%	14	49	37	5	49	46
Upper Rideau	#	10	15	11	37	59	34
	%	27	42	31	28	45	27
Big Rideau	#	10	26	13	12	25	21
	%	20	53	27	21	43	36
Lower Rideau	#	3	20	9	4	18	10
	%	9	63	28	13	56	31
Devil	#	5	38	22	17	35	29
	%	8	58	34	21	43	36

## CONCLUSIONS

1. Angling for nesting bass was high across the Rideau Lakes pre and post COVID (2019 and 2020) but very low during the COVID years (2020 and 2021). Concomitantly, LMB and SMB year classes were very weak pre and post COVID (2019 and 2020) but very strong during the COVID years (2020 and 2021).
2. Angling nesting bass has negatively impacted bass recruitment and likely the size and age structure for bass populations in many/most of the lakes in the Rideau system.
3. The COVID-induced low angling levels during the bass reproductive periods in 2020 and 2021 have resulted in two excellent year classes, which have provided a short-term reprieve in the recent decline in bass populations across the Rideau system.
4. Replacing the current, ineffectual closed season regulation for protecting bass recruitment with one that uses bass spawning sanctuaries (areas of the lake designated no fishing for all species, but just until the reproductive season for bass is complete) would provide long-term benefits for both the bass populations and the bass fisheries in the Rideau System.