

Nesting habitat selection and reproductive biology of smallmouth bass in Rainy Lake

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Introduction

Today, smallmouth bass are one of the most important game fish in North America. In addition to being a popular game fish, they have a relatively unique reproductive system, where it is solely the male that cares for developing offspring for a period of up to 6 weeks (Ridgway 1988). In the spring when temperatures reach approximately 15°C, male bass move into the littoral zone where they sweep out a nest in the substrate with their caudal fin, court females, spawn, and then provide parental care to the brood until the offspring become independent (Scott and Crossman 1973). Taken together, the reproductive biology of smallmouth bass in areas where its fishery is important to the community can be interesting to document and examine. Particularly relevant is the documentation of critical spawning habitats which can then be protected. Although affected by annual variation (Ridgway and Friesen 1992), information such as spawn dates and nesting habitat quality can be important to document for managers and anglers, particularly those who wish to conserve these particular habitats in order to sustain the future of smallmouth bass populations. Much work concerning the reproductive biology of smallmouth bass has been examined in the southern or flowing water (lotic) systems, and little work has described the reproductive biology of smallmouth bass in its northern range. Our goal was to assess

smallmouth bass nesting habitat quantity and quality in a subset of Rainy Lake in northwestern Ontario.

Methods

Study site and habitat assessment

In the spring of 2007, we performed shoreline snorkeling surveys in the northeast arm of Rainy Lake. During the study period snorkelers assessed 30 x 100 m transects. When a male was located a number of habitat characteristics were noted (Table 1). For each nest found, the snorkeler also estimated total male length and determined the presence or absence of a hook wound.

Table 1 Nest characteristics measured for smallmouth bass nests (n = 103)

Nest characteristics	Units
Depth	M
Distance to shore	M
Distance to cover	M
Cover type	boulder, log or other
Substrate type	cobble, chunk rock, sand, silt or boulder (%)
Overhanging vegetation	presence or absence
Shoreline description	% natural

	vegetation
Disturbance potential (anthropogenic)	low (unlikely to be destroyed), med or high (very likely to be destroyed)

Random sites

In order to compare nesting habitat selection of smallmouth bass it was also necessary to assess the above habitat characteristics at random sites. For a subset of the above transects (n = 11), we generated random nest locations (n = 10 for each transect), where the snorkeler made the same habitat measurements as above. We then compared the random nest sites to nest sites that smallmouth bass selected.



Photo 1. Male smallmouth bass guarding eggs in Rainy Lake Ontario on June 12th 2007

Results

Male characteristics and spawn dates

Of the 30 sites we visited, 19 had nesting smallmouth bass. In 3000 m of shoreline, we found 103 nesting male smallmouth bass.

Nesting densities were thus relatively low, at 3.43 bass/ 100 m of shoreline. Mean male size was 34 ± 0.46 cm (13.4 ± 0.17 inches) and 36.6 % of males had evidence of recent hook wounds. Spawn dates ranged from June 1st to June 24th 2007 (proportions shown in Fig.1), with the mean date of spawn occurring on June 12th 2007.

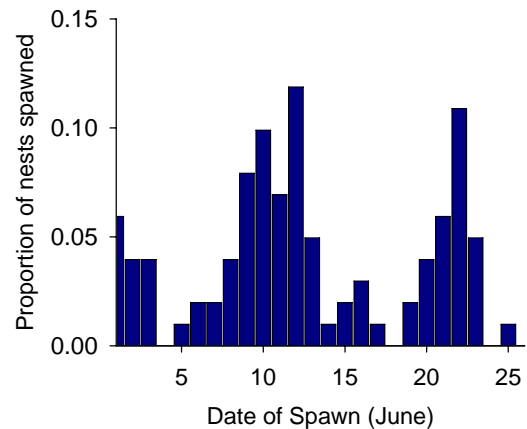


Figure 1. Proportion of new smallmouth bass nests found throughout the study period (June 1st to June 24th 2007)

Nest characteristics

Smallmouth bass nests and random nest sites differed in mean depth, distance to cover and distance to shore (Table 2).

Table 1 Mean depth, distance to shore and distance to cover for sampled smallmouth bass nests (n = 103) and random nest sites (n = 110)

Mean nest characteristics	Mean ± std error for sampled nests (m)	Mean ± std error for random nest sites (m)	P-value
Depth	1.28 ± 0.06	1.62 ± 0.06	< 0.0001
Distance to shore	7.28 ± 0.8	10.67 ± 0.8	0.0031
Distance to cover	0.74 ± 0.17	1.29 ± 0.16	0.0168

Over 90 % of the smallmouth bass nested near a boulder (Fig.3a) while the nearest cover to random nest sites were more variable (Fig.3b).

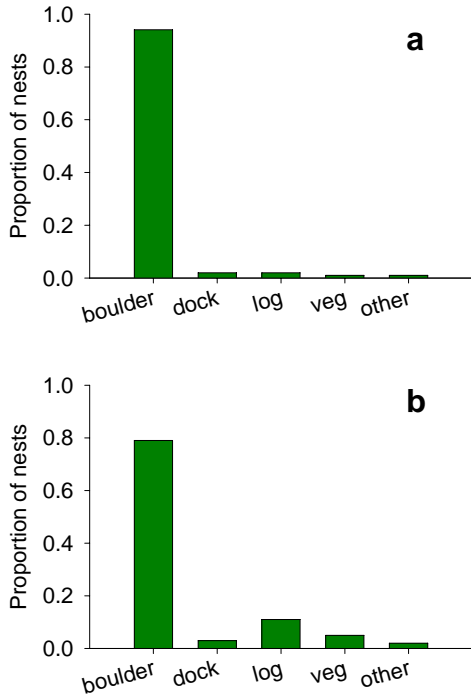


Figure 3 Proportion of smallmouth bass nests (n = 103) (a) and proportion of random nest sites (b) in the proximity of different cover types, different letters indicate significant differences between groups

The substrate types most used by nesting smallmouth bass in this study were chunk rock (c.r.) and gravel (Fig.4a), while random nest sites were most often found on boulders, bedrock and sand (Fig.4b).

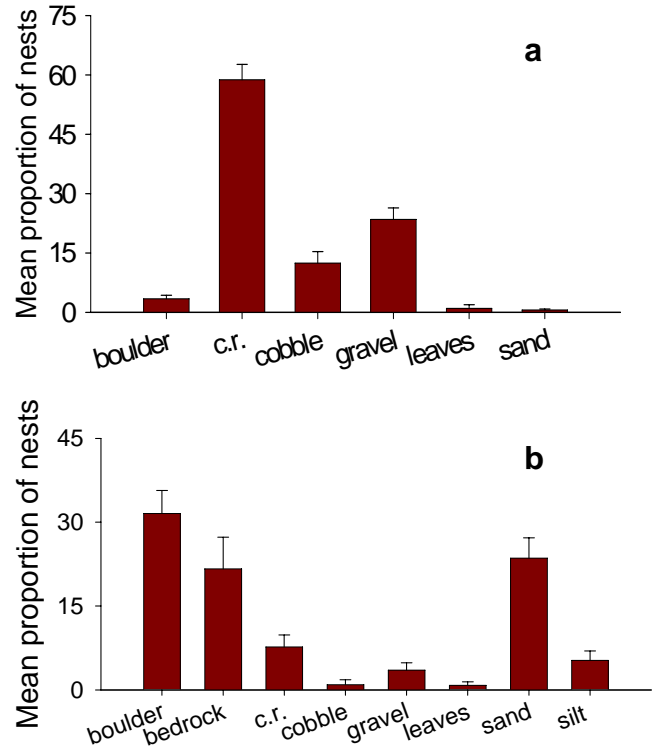


Figure 4. Mean proportion of smallmouth bass nests (n = 103) (a) and random nest sites (b) for each substrate type



Photo 2 Amanda O'toole measuring habitat characteristics at a smallmouth bass nest

Shoreline characteristics

Most smallmouth bass nests were found in areas where the shoreline was over 75 % natural (Fig.5). Smallmouth bass most often chose to nest in areas where the anthropogenic disturbance potential was intermediate (Fig.6a) while random sites showed greater availability of low anthropogenic disturbances (Fig.6b).

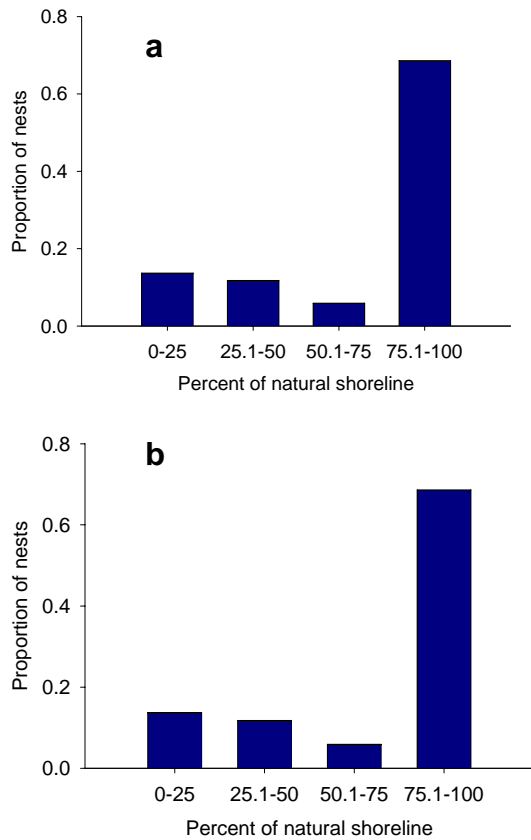


Figure 5. Proportion of smallmouth bass nests as a function of percent of natural vegetation

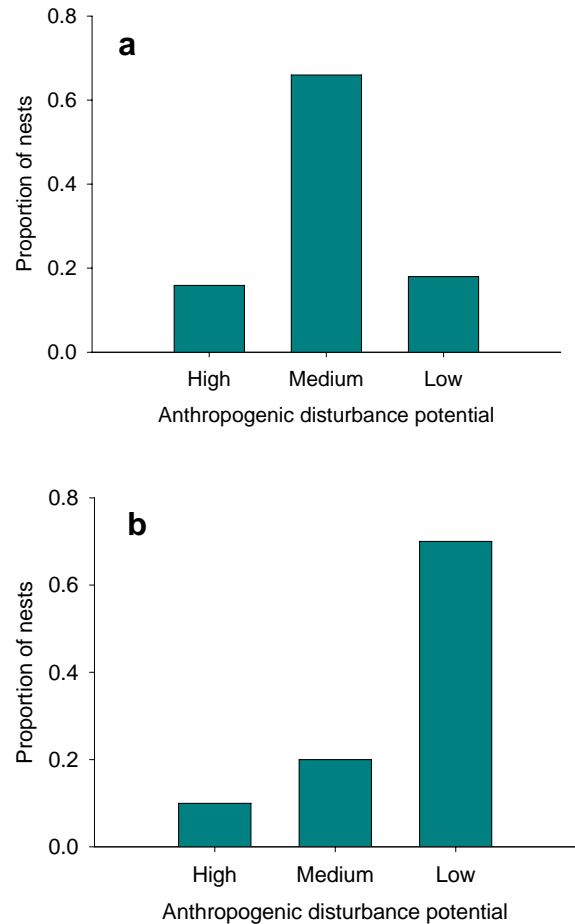


Figure 6. Proportion of smallmouth bass nests (a) and random nest sites (b) within varying degrees of anthropogenic disturbance potential

Discussion

Relative to other smallmouth bass lakes, our study found relatively low nesting densities. This is unlikely an indicator that the smallmouth bass in Rainy Lake are doing poorly, but is most likely representative of the size of Rainy Lake (92 000 ha) and its remarkable quantity of available shoreline, which extends approximately 2 500 km when islands are included (OMNR 2004). Although we have shown in this study that not all shoreline is chosen as spawning area by smallmouth bass, greater shoreline availability may allow the parental

males to disperse and minimize competition for mates. This may be of particular importance to parental males, since aggressive behaviours between same sized-males is well documented (Ridgway et al. 1991).

Our work shows that smallmouth bass in Rainy Lake are selecting particular habitat characteristics. Such as previously reported in other water bodies (Scott and Crossman 1973), smallmouth bass in Rainy Lake are choosing shallow, near shore and near cover areas to build nests (Fig.2). Although most of the available habitat (as shown in Fig 4b) has 75 – 100 % natural shoreline, smallmouth bass choose to nest in much more variable levels of natural shoreline (Fig. 4b). These selected nesting areas also appear to correspond to sites where the potential for anthropogenic disturbances is higher than random nest sites (Fig. 5). Thus the nesting areas that smallmouth bass prefer in Rainy Lake often correspond to areas where the nests have a

relatively high probability of being destroyed by boat traffic, swimmers, etc.

Our spring study was able to assess the timing and nest habitat characteristics of smallmouth bass in the northeast arm of Rainy Lake. If home owners, cottagers and water users are concerned about their impact on nesting smallmouth bass during the spring, we would encourage them to identify these nesting areas near the property and avoid them during the spawning season.

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