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ARTICLE

Spring and Summer Distribution and Habitat Use by Adult Threatened Spotted Gar in Rondeau Bay, Ontario, Using Radiotelemetry

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Abstract
The spotted gar *Lepisosteus oculatus* is designated as threatened in Canada under the federal Species at Risk Act. Identification and protection of critical habitat is an important component of recovering species at risk. To understand the habitat utilization of the adult life stage of the spotted gar in Rondeau Bay, a shallow coastal wetland of Lake Erie, external radio transmitters were surgically attached to 37 specimens in May 2007. These individuals were tracked at 224 discrete locations throughout the spring and summer of 2007. Aquatic macrophytes were present at 201 (90%) of these sites. Habitat and water chemistry data were collected at all tracked locations occupied by spotted gars. On the basis of electivity indices, in spring spotted gars showed a strong preference for shallow (<0.5-m) and deep (>2.5-m) waters with pH values <8.5. In summer, strong preference was shown for areas with mixed macrophyte beds. Spotted gars were found to relate to specific depths and cover rather than to shoreline features in Rondeau Bay. The study results are being used by the spotted gar Recovery Team to identify critical habitat in Rondeau Bay. This critical habitat designation will be used to ensure the protection of habitat needed to preserve the species in Canada, in part by curtailing the removal of aquatic vegetation in Rondeau Bay.

Preservation of the habitat that is used by a species at risk is paramount to the long-term survival of the species (Rosenfeld and Hatfield 2006). The Canadian Species at Risk Act defines this critical habitat for aquatic species as "spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes" (Species at Risk Act 2002, s. 2[1]). Rosenfeld and Hatfield (2006) outlined four key information needs to identify critical habitat, including basic organism life history (and habitat associations), habitat availability, recovery targets, and habitat–abundance relationships.

Habitat associations may not be known for rare or at-risk species, and thus an effective means of determining which habitat is used by the species is needed. By definition, species at risk are rare, so that defining their critical habitat may be difficult (Naumann and Crawford 2009). One method of determining the habitat used by a specific life stage of a species is to monitor the movements of individuals using radio telemetry. In this manner, the feeding, spawning, nursery, and other important habitats can be determined for a species. This method has been used on a wide variety of species at risk, including lesser horseshoe bats *Rhinolophus hipposideros* (Bontadina et al. 2002), giant barred river frogs *Mixophyes iterates* (Lemckert and Brassil 2000), and lake sturgeon *Acipenser fulvescens* (Auer 1999). Radio-tagging and tracking in this manner have no negative effect on the behavior and swimming performance of fish (Cooke 2003; Thorstad et al. 2001). Once habitat use by the species is determined, comparisons with the availability

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of habitat types are made using an electivity index (Jacobs 1974) to show whether certain habitat intervals are preferred or avoided (Moyle and Baltz 1985; Luttrell et al. 2002).

The spotted gar *Lepisosteus oculatus* is designated as threatened under the Canadian Species at Risk Act. This species is at the northern edge of its range in Canada, inhabiting three coastal wetlands of Lake Erie: Point Pelee; Long Point Bay; and Rondeau Bay, the largest of the Canadian populations (COSEWIC 2005). Spotted gars range as far south as the Gulf of Mexico, from eastern Texas in the west to the Florida panhandle in the east and are generally common south of the Great Lakes region (COSEWIC 2005). The threatened designation in Canada is due to its limited distribution and the threats posed by pollution, turbidity, and habitat loss (COSEWIC 2005) and means that the spotted gar is likely to become endangered if steps are not taken to reverse the factors leading to its extirpation in Canada (COSEWIC 2010).

Although the movement and habitat use of the spotted gar was reported by Snedden et al. (1999) for a southern population in the Atchafalaya River basin of Louisiana, there has yet to be any characterization of habitat use by the species in Canada. The objectives of our study were to perform a radio-tracking survey of the spotted gar in Rondeau Bay, to describe the spring and summer distribution and critical habitat of this species in Canada, and to compare that habitat use with that of the Atchafalaya River basin population studied by Snedden et al. (1999).

METHODS

Study site.—Our study was conducted in Rondeau Bay, a shallow (maximum depth of 3 m) coastal wetland on the north shore of the central basin of Lake Erie (Figure 1). Rondeau Bay is characterized by abundant submerged macrophyte growth, and its area (approximately 37 km^2) is nearly enclosed. The bay is bounded by Rondeau Provincial Park on the east and by the town of Erieau in the south, with the remainder of the area being bordered by agricultural land with some residential development (Figure 1). There is a navigational channel in the southern portion of the bay at Erieau that provides connectivity to the central basin of Lake Erie.

Specimen collection and tagging.—Individual spotted gar specimens were collected from May 17 to May 23, 2007. Thirty-seven specimens were captured using 1.2-m fine-mesh fyke nets (6.35-mm bar mesh) set for approximately 24 h and retrieved in the morning. Nets were set in shallow areas adjacent to shore, targeting spawning-related movements (Figure 1b). After specimens were weighed (kg) and measured for total length (mm), fish were anesthetized in a 0.015% clove oil solution (3 mL clove oil emulsified with 5 mL ethanol, in 20 L water). Radio tags with unique frequencies (Table 1) were attached externally to the dorsal musculature immediately behind the posterior insertion of the dorsal fin, following the procedure of Snedden et al. (1999). Tagged specimens ranged in length from 515 to 745 mm and weighed from 0.53 to 1.94 kg. The radio tags, manufactured by Holohil Systems Limited (model PD-2), measured 23 × 12 × 6 mm, with an antenna 24 cm long; battery life was approximately 4 months. Tag weight (3.8 g) was <1% of the body weight of the smallest specimen. Small tag size and attachment at the base of the dorsal fin ensured that the swimming

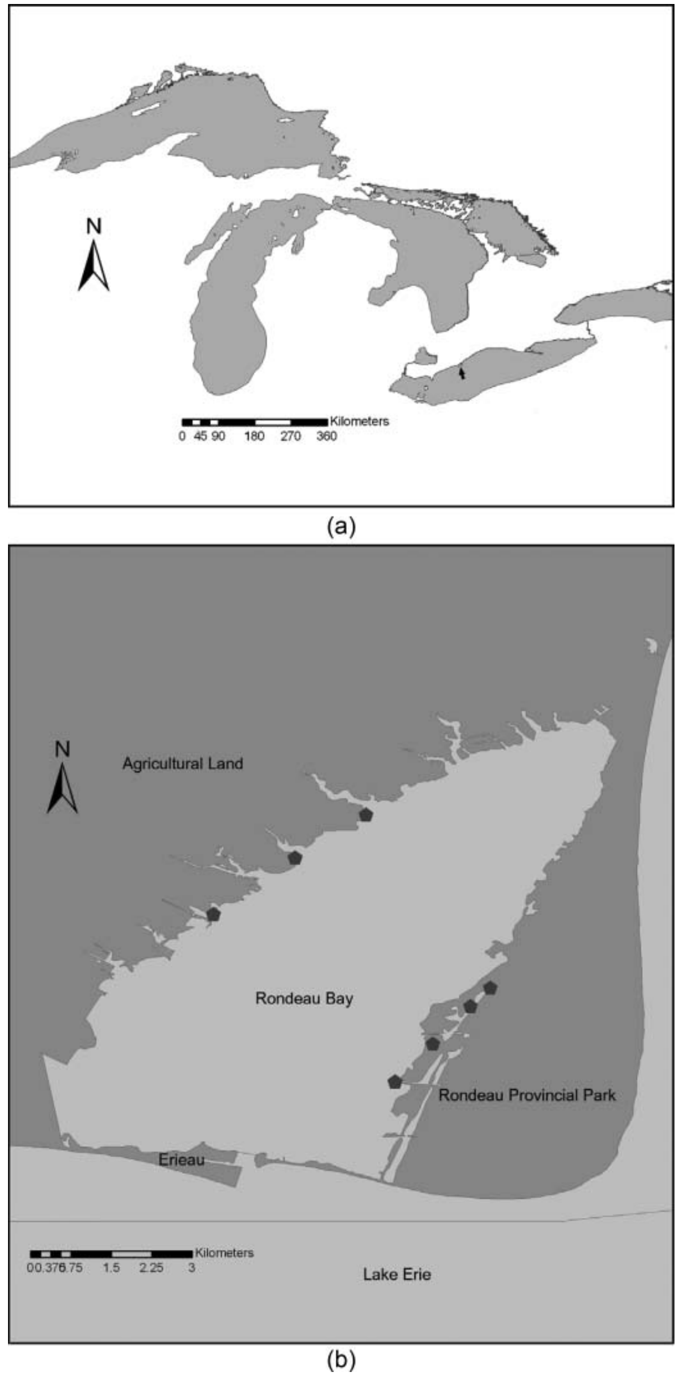

FIGURE 1. Maps showing (**a**) the location of Rondeau Bay on the north shore of Lake Erie and (**b**) the sites within Rondeau Bay where spotted gar were captured, tagged, and released.

TABLE 1. Capture date, time at liberty, and number of times located for spotted gar specimens in Rondeau Bay in spring 2007.

Radio tag frequency	Date tagged	Days at liberty	Days located	Total locations
151.242	May 23	130	1	1
151.270	May 23	130	13	15
151.299	May 23	130	9	9
151.320	May 23	130	1	1
151.340	May 23	130	7	7
151.360	May 23	130	2	2
151.380	May 24	129	10	11
151.400	May 24	129	8	9
151.420	May 24	129	2	2
151.440	May 24	129	7	7
151.460	May 17	136	2	29
151.481	May 17	136	9	9
151.500	May 17	136	10	10
151.521	May 17	136	2	2
151.541	May 17	136	7	7
151.560	May 17	136	0	0
151.579	May 17	136	4	4
151.600	May 17	136	6	6
151.620	May 17	136	4	4
151.637	May 17	136	0	0
151.661	May 17	136	2	2
151.680	May 17	136	2	2
151.700	May 17	136	7	7
151.720	May 17	136	9	9
151.740	May 17	136	7	7
151.762	May 17	136	3	3
151.780	May 17	136	2	2
151.800	May 18	135	6	6
151.820	May 31	122	20	24
151.840	May 23	130	5	5
151.860	May 23	130	12	14
151.880	May 23	130	15	16
151.900	May 23	130	4	4
151.921	May 23	130	3	3
151.942	May 23	130	2	2
151.961	May 23	130	3	3
151.980	May 23	130	7	7

ability of specimens would not be impeded. Handling, surgeries, and recovery were conducted immediately at the site of capture.

Specimens were held in a recovery bin after surgery until they were able to maintain equilibrium. They were then released back into the bay at the capture site. All animal handling and surgeries were approved by the animal care committees of the University of Windsor and the Canada Centre for Inland Waters.

Tracking of specimens and distribution mapping.—The movement and subsequent location of specimens were tracked from a boat using a Lotek tracking receiver set to cycle through the tag frequencies. Once a specimen's signal was located, its position was homed in on and a handheld GPS unit was used to determine the coordinates. Water depth (m), surface temperature (°C), pH, and conductivity (μS/cm) were measured using a Hydrolab Surveyor 4a with Datasonde 5. Additionally, aquatic macrophyte samples were taken when present and brought back to the laboratory for identification to the genus level. Once fish were located, their tag frequency was removed from the cycle list in the receiver so that specimens were located a maximum of once per tracking bout.

Tracking of specimens was conducted from the end of May through September 2007 on at least 3 d per week and up to 5 d per week. Multiple tracking bouts were conducted over a 24-h period on July 11 and 25, 2007. Tracking effort was concentrated within Rondeau Bay; however, several attempts were made to locate fish outside the bay, without success. Once tracking was completed, ARCMap GIS software was used to map all location coordinates for each individual (Figure 2a). All the locations where spotted gars were tracked in Rondeau Bay were noted (Figure 2b). We employed a modification of the technique used by McGrath and Austin (2009) to determine whether the number of times a specimen was located was sufficient to describe its distribution. A series of minimum convex polygons that enclosed all these points was created (confer Winter 1977). Minimum convex polygons were built after each tracking point was sequentially added to the map (instead of daily tallies, as in McGrath and Austin 2009). The area of the polygons was calculated using ARCMap. Once all points had been mapped and the area of each polygon measured, we plotted the area of the cumulative minimum convex polygon against the number of times a specimen was located. The leveling out of the curve for an individual specimen indicates that there are sufficient data points to describe its distribution.

Several individuals exhibited a distinct clustering of points (four or more points in proximity) where they were located several times in the summer. To determine whether specimens were associated with nearshore or offshore habitats, the distance from shore to the closest of these clustered points was measured for each individual. Also, the farthest linear distance between two tracking locations and the maximum distance from point of capture were measured for each specimen as a surrogate for home range. Regression analysis was used to determine the relationships between (1) fish size (total fish length, weight) and distance from shore to the clustered points; (2) fish size and the maximum distance from capture; and (3) fish size and the maximum distance between points.

Habitat variables.—Tracking locations were divided into two groups based on season: spring (May and June, which includes the spawning period for this species) and summer (July to September). ARCMap was used to interpolate habitat values for the entire area of Rondeau Bay by inverse distance weighting based on the values collected at tracking locations. Habitat

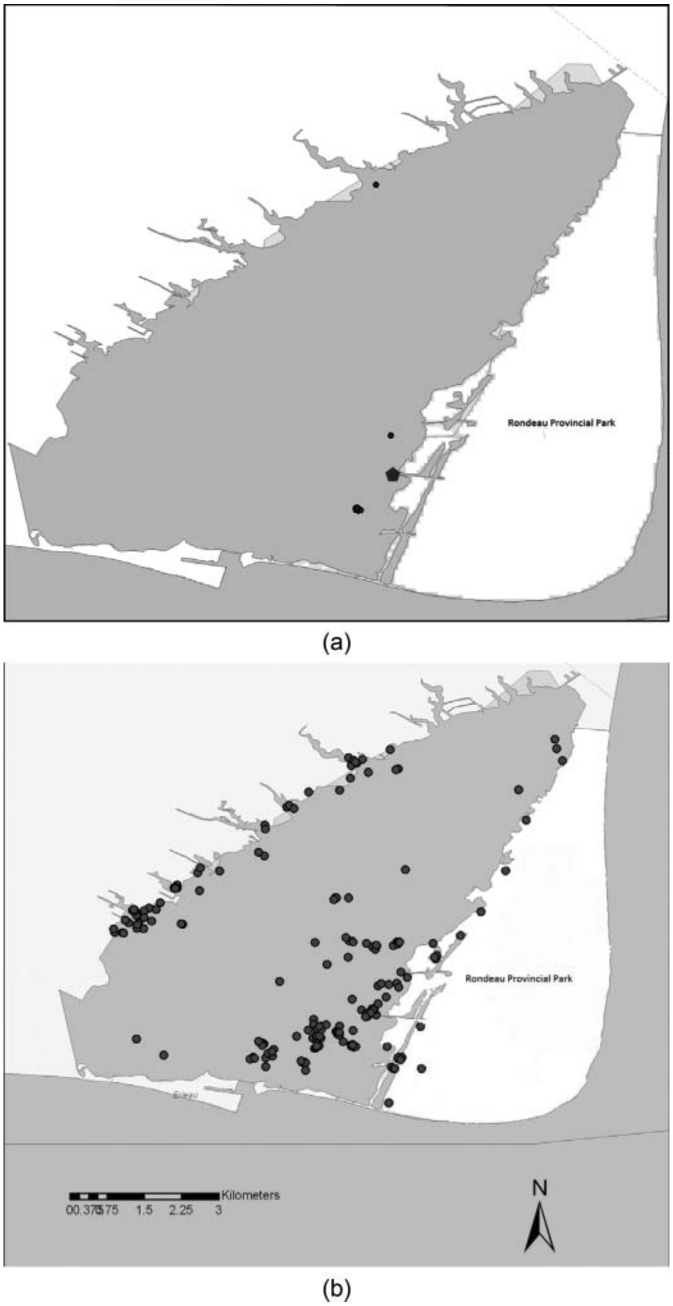

FIGURE 2. **(a)** Locations of a single spotted gar specimen (tag number 151.270), as determined by radio-tracking in Rondeau Bay during spring and summer 2007, and **(b)** all tracking locations of radio-tagged spotted gar specimens in Rondeau Bay during spring and summer 2007.

layers were created for each of the measured variables separately by season. These habitat layers were then compared with the observed habitat variables at all spotted gar locations to calculate electivity indices (Jacobs 1974). The electivity index (D) for each interval of a variable's distribution is calculated as follows:

$$D = [r - p]/[(r + p) - 2rp],$$

where r is the proportion of individuals using the interval and p is the proportion of the overall habitat that has this value (Luttrell et al. 2002). These electivity indices are interpreted according to Moyle and Baltz (1985), whereby a value from –1.00 to –0.50 indicates strong avoidance, a value from –0.49 to –0.26 indicates moderate avoidance, –0.25 to +0.25 indicates neutral selection, 0.26 to 0.49 indicates moderate selection, and 0.50 to 1.00 indicates strong selection.

Population size and area of suitable habitat.—In May 2009 a mark–recapture study was conducted in Lake Pond, a marsh at Point Pelee National Park. The Point Pelee marsh is a coastal wetland of Lake Erie with habitat similar to Rondeau Bay. The contiguous surface area of the marsh is approximately 220 ha, and the marsh has no connection to the main basin of Lake Erie. Spotted gars were captured using 1.2-m fine-mesh fyke nets (6.35-mm mesh) set overnight. Captured specimens (n = 93) were marked using PIT tags and released immediately after handling. A total of 99 spotted gars were captured and released, of which 6 were recaptured during the sampling. Based on this sampling, the total population of spotted gars in the Point Pelee marsh was estimated to be 483 individuals, with a density of 2.2 individuals/ha.

To estimate the population size of spotted gars in Rondeau Bay, we used the population density estimate for the Point Pelee marsh and, assuming similar habitat and population density at the locations, multiplied it by the area of Rondeau Bay.

RESULTS

Tracking and Distribution Mapping

Of the 37 radio-tagged individuals, 35 were located at least once (Table 1). One tag was presumed lost when the individual was tracked on consecutive days to the same location in very shallow water and no fish was evident. All subsequent locations for this tag were removed from the analysis. The fate of the second tag that was not located is unknown. Each individual was located a mean ± SD of 6.19 ± 4.96 occasions, for a total of 224 discrete locations.

When the cumulative area of the minimum convex polygon was plotted against the number of times a fish was located, the curve appeared to level off for 10 individuals, (Figure 4) indicating that the tracking effort was sufficient to describe the overall distribution for these specimens.

There was no significant relationship between fish length and the offshore distance of clustered points (P = 0.17). The mean ± SD offshore distance of these clusters was 1.77 ± 1.58 km. There was a significant negative relationship between the $\log_e$-transformed weight of specimens and the offshore distance of the clusters ($\log_e$[offshore distance] = –0.68 $\log_e$[weight] + 5.02; $R^2 = 0.36$, $P = 0.02$).

When all specimens were considered, the mean ± SD farthest distance from capture and mean ± SD farthest distance between two points were 2.95 ± 1.76 km and 3.47 ± 2.25 km, respectively. Regression analysis revealed no significant

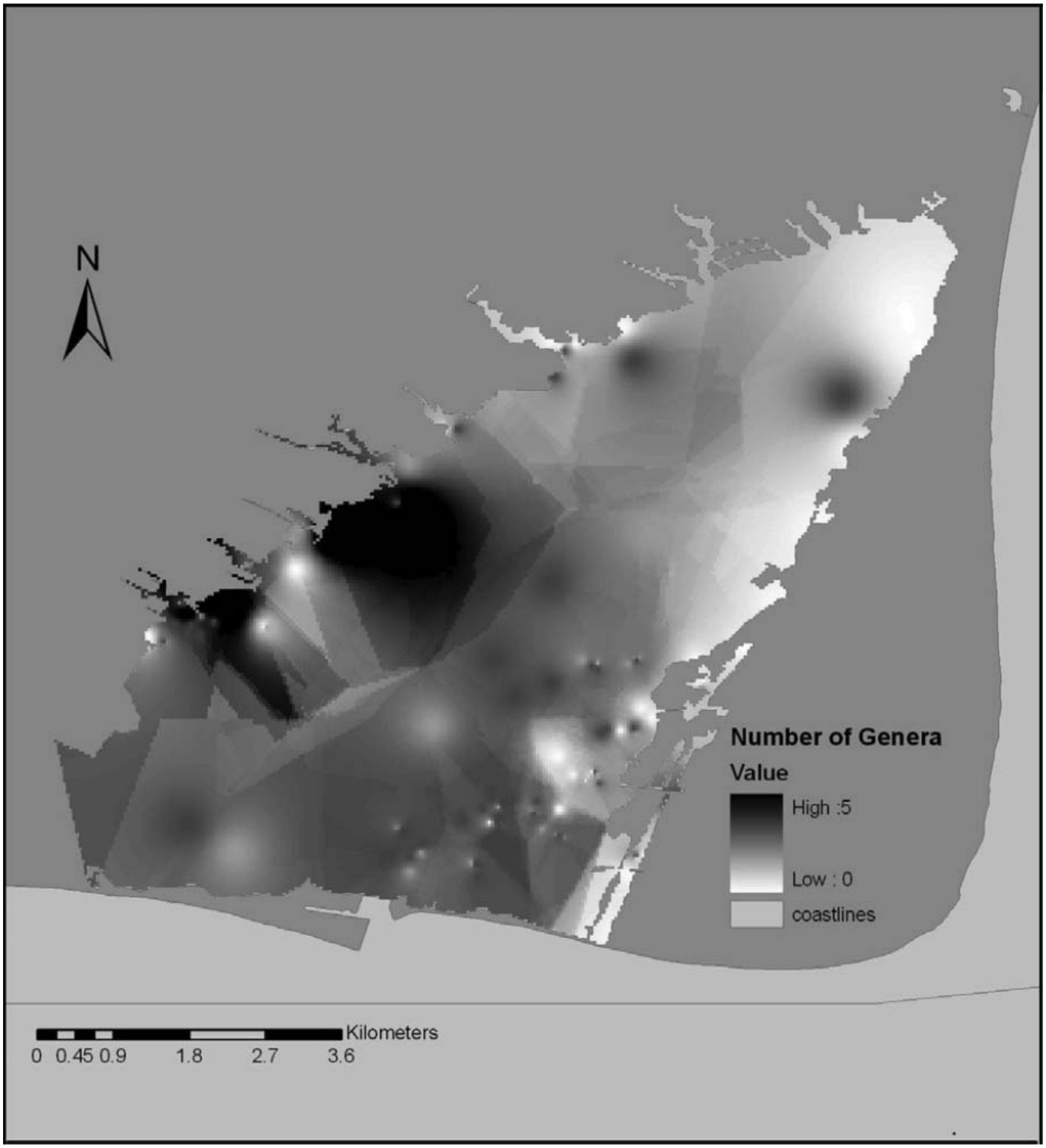

FIGURE 3. Interpolated raster of the number of aquatic macrophyte genera present in Rondeau Bay.

relationship between the $\log_e$-transformed length and the farthest distance from capture ($P = 0.17$) or between length and the farthest distance between points ($P = 0.19$). There was, however, a marginally significant relationship between $\log_e$-transformed weight and the farthest distance from capture and between weight and the farthest distance between locations. These relationships were $\log_e$(distance from capture) = $1.02 \cdot \log_e$(weight) − 5.94 ($R^2 = 0.13$, $P = 0.033$) and $\log_e$(distance between points) = $1.08 \cdot \log_e$(weight) − 6.18 ($R^2 = 0.13$, $P = 0.036$).

Habitat Variables

Interpolated raster layers were created for each habitat variable (e.g., Figure 3). The electivity indices showed strong positive selection by the spotted gar for several habitat intervals in spring (Table 2) and summer (Table 3). In spring, spotted gars exhibited a preference for both the shallowest (<0.5-m) and the deepest (>2.5-m) waters, areas with no macrophyte growth, waters with conductivity levels >325 μS/cm or <225–249.9 μS/cm, pH values <8.5, and pH values ≥9.50.

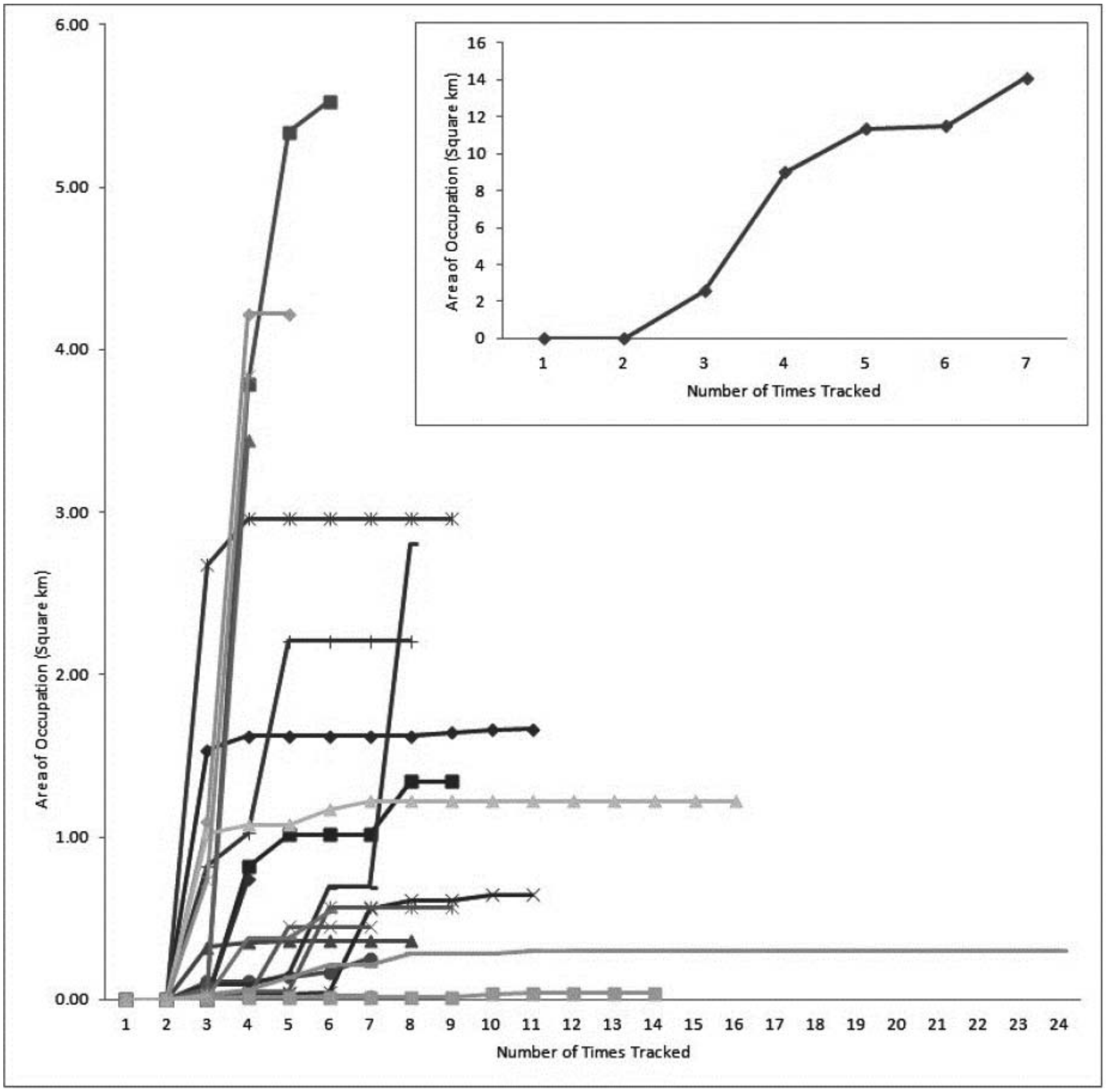

FIGURE 4. Plot of cumulative maximum convex polygon area versus number of times located. The inset shows the data for the individual with tag number 151.541 (see Table 1).

The habitat interval of moderate depths (1.00–1.99 m) was strongly avoided. In summer, habitats strongly selected by the spotted gar were those with the deepest depths (>2.5 m) and the shallowest depths (<0.5 m), areas with two or more macrophyte genera present, and waters with pH values between 8.0 and 8.49.

Of the 224 locations to which spotted gars were tracked, 201 (90%) had some form of aquatic vegetation. Seven sites had emergent vegetation only, nine sites had both emergent and submerged vegetation, and 185 sites had submerged vegetation only. A large proportion of the sites contained complex, or highly branched, vegetation. It was common to have sites represented by several genera of plants (Table 4).

A spawning event was witnessed on June 12. This spawning activity took place in a mixed bed of macrophytes that included *Myriophyllum* spp. and *Ceratophyllum* spp. located 391 m from shore. The spawning event consisted of a single large female surrounded by three smaller males thrashing around in the shallow vegetation.

Population Size and Area of Suitable Habitat

Based on the population density estimate (2.2/ha) from the Point Pelee marsh and the total area of Rondeau Bay (3,215 ha), the population of spotted gars in Rondeau Bay is approximately 8,121 individuals. The area of suitable habitat

TABLE 2. Electivity indices and level of selection for habitat variable intervals for spotted gars in May and June.

Habitat variable	Habitat interval	Electivity index[a]	Selection level
Macrophyte growth	No macrophytes	0.78	Strong selection
	Single macrophyte	–0.36	Moderate avoidance
	Mixed macrophytes	–0.44	Moderate avoidance
Depth (m)	<0.50	0.90	Strong selection
	0.50–0.99	0.29	Moderate selection
	1.00–1.49	–0.67	Strong avoidance
	1.50–1.99	–0.72	Strong avoidance
	2.00–2.49	–0.40	Moderate avoidance
	≥2.50	0.84	Strong selection
Temperature (°C)	17.00–19.99	NA	NA
	20.00–22.99	0.25	Neutral selection
	23.00–25.99	–0.3	Moderate avoidance
	≥26.00	0.24	Neutral selection
Conductivity (μS/cm)	<225.0	NA	NA
	225.0–249.9	0.86	Strong selection
	250.0–274.9	–0.04	Neutral selection
	275.0–299.9	–0.57	Strong avoidance
	300.0–324.9	–0.13	Neutral selection
	325.0–349.9	0.67	Strong selection
	≥350.0	0.97	Strong selection
pH	<8.0	0.99	Strong selection
	8.0–8.49	0.57	Strong selection
	8.50–8.99	–0.50	Moderate avoidance
	9.0–9.49	–0.33	Moderate avoidance
	≥9.50	0.74	Strong selection

[a]Values from –1.00 to –0.50 indicate strong avoidance, those from –0.49 to –0.26 moderate avoidance, –0.25 to +0.25 neutral selection, 0.26 to 0.49 moderate selection, and 0.50 to 1.00 strong selection (Moyle and Baltz 1985). NA indicates that no values were recorded in that range in field observations and thus did not appear in the interpolated layer.

based on our raster interpolation of vegetation complexity (Figure 3), conservatively determined by the proportion of Rondeau Bay with two or more macrophyte genera, is 1,543 ha. A less conservative estimate, the total proportion of the bay with either two or more macrophyte genera or no macrophytes present, is 1,884 ha. These areas were chosen as surrogates for suitable habitat area because spotted gar feeding success has been shown to depend on the macrophyte complexity of the cover present (Ostrand et al. 2004). Additionally, most spotted gars were found in areas with two or more macrophyte genera present (Table 4). Areas with no macrophytes present were strongly selected by spotted gars in the spring (Table 2). Other habitat variables, such as pH, temperature, and conductivity, were not used to identify habitat area because they varied with changing weather conditions.

DISCUSSION

The spotted gar specimens tracked in this study were most often found associated with aquatic vegetation. This association with aquatic macrophytes as cover shows an adaptation to local conditions in Rondeau Bay when compared with the spotted gar population of the Lower Atchafalaya River, Louisiana, where fish were mainly associated with flooded timber (Snedden et al. 1999). In Rondeau Bay, spotted gars were often found in mixed beds of complex macrophytes. Like the timber in the Snedden et al. (1999) study, complex macrophyte beds created a three-dimensional environment in which the spotted gars could hide and forage. This habitat type (specifically vegetation density) has been shown to be important for the feeding success of spotted gars (Ostrand et al. 2004). The potential loss of habitat is one of the limiting factors for the recovery of spotted gar populations in Canada (COSEWIC 2005). Specifically, the removal of aquatic vegetation by both physical and chemical means represents a high-impact activity that disturbs spotted gars in Rondeau Bay (Bouvier and Mandrak 2010). Removal of aquatic vegetation should be curtailed given the finding that the spotted gars in Rondeau Bay are dependent on aquatic macrophytes throughout the spring and summer periods.

There was also strong selection for areas without vegetation in the spring. Interestingly, our findings showed that only 11% of Rondeau Bay lacked vegetation in the spring. These unvegetated areas may be used for postspawn feeding since the spring-spawning minnows (e.g., spottail shiner *Notropis hudsonius*) present in sandy-bottomed areas (Scott and Crossman 1998) provide ample prey for spotted gars.

TABLE 3. Electivity indices and level of selection for habitat variable intervals for spotted gars in July through September.

Habitat variable	Habitat interval	Electivity index[a]	Selection level
Macrophyte growth	No macrophytes	–0.32	Moderate avoidance
	Single macrophyte	–0.46	Moderate avoidance
	Mixed macrophytes	0.50	Strong selection
Depth (m)	<0.50	0.64	Strong selection
	0.50–0.99	0.04	Neutral selection
	1.00–1.49	–0.61	Strong avoidance
	1.50–1.99	–0.08	Neutral selection
	2.00–2.49	0.42	Moderate selection
	≥2.50	0.87	Strong selection
Temperature (°C)	17.00–19.99	0.63	Strong selection
	20.00–22.99	0.05	Neutral selection
	23.00–25.99	–0.40	Moderate avoidance
	≥26.00	0.51	Strong selection
Conductivity (μS/cm)	<225.0	0.65	Strong selection
	225.0–249.9	–0.56	Strong avoidance
	250.0–274.9	0.29	Moderate selection
	275.0–299.9	0.91	Strong selection
	300.0–324.9	NA	NA
	325.0–349.9	NA	NA
	≥350.0	NA	NA
pH	<8.0	NA	NA
	8.0–8.49	0.94	Strong selection
	8.50–8.99	0.34	Moderate selection
	9.0–9.49	–0.25	Moderate avoidance
	≥9.50	0.09	Neutral selection

[a]Values from –1.00 to –0.50 indicate strong avoidance, those from –0.49 to –0.26 moderate avoidance, –0.25 to +0.25 neutral selection, 0.26 to 0.49 moderate selection, and 0.50 to 1.00 strong selection (Moyle and Baltz 1985). NA indicates that no values were recorded in that range in field observations and thus did not appear in the interpolated layer.

Early in the season, spotted gars were often found near shore. Movement into the shallows was likely due to the spawning behavior of the species. The spotted gar is known to spawn in spring in shallow water among aquatic vegetation (Redmond 1964). In the summer, spotted gars tended to move offshore and several individuals were repeatedly tracked to the same location. Similarly, Snedden et al. (1999) found that spotted gars established defined home ranges in the summer.

In the Atchafalaya River basin, Snedden et al. (1999) found that spotted gars tended to migrate into flooded areas in the spring, followed by the establishment of home ranges for the duration of the high-water stage. The average distance from the shore to the site of repeated location for the spotted gar specimens in Rondeau Bay was much farther (mean $\pm$ SD $=$ 1.77 $\pm$ 1.58 km) than that reported by Snedden et al. (1999), where 48% of all spotted gar movements were within 10 m from

TABLE 4. Composition of submerged macrophytes present at spotted gar tracking locations. Asterisks indicate a complex, or highly branched, macrophyte type.

Genus	Number of sites present	Sites as lone species	Sites dominant species in mixed bed	Sites secondary species in mixed bed
*Chara**	68	21	39	8
*Potamageton**	86	5	34	47
*Myriophyllum**	61	6	25	30
*Ceratophyllum**	20	1	5	14
*Elodea**	4	0	0	4
Valisneria	59	1	2	56
Lemna	1	0	0	1
None present	22	NA	NA	NA

shore. This difference in behavior likely results from habitat differences between the two areas. Rondeau Bay is shallow, with an extended littoral zone and macrophyte cover throughout, while the Atchafalaya River basin is narrower and has depths ranging from 3 to 5 m (low water stage in the Snedden et al. 1999 study area). The Atchafalaya River basin, unlike Rondeau Bay, generally lacks aquatic vegetation (Snedden et al. 1999). Evidently, spotted gars are relating to specific depths and cover rather than the shoreline features in Rondeau Bay.

Our habitat layers were created based on a relatively small number of points compared with the size of Rondeau Bay. The limitations in our method are apparent in cases where there were no observed values in a particular range. In such cases, the interpolated habitat layer also lacks values in the range. The observations on which interpolations were based were well spread throughout the bay. Given the lack of available habitat maps and associated data for our study, we were limited to interpolating habitat values for the entire study area.

The moderate preference for spring surface temperatures (20–23°C) is indicative of the preferred spawning temperature of spotted gars in spring. Snedden et al. (1999) reported that spawning-related movements began when temperatures reached 15°C. Boudreaux (2005) reported spawning activity in a laboratory at a mean temperature of 20.6°C.

The strong selection of the high surface temperature interval (>26°C) in the summer for the specimens in Rondeau Bay likely reflects preferred feeding temperatures. This temperature was much higher than the preferred water temperature of 16°C reported by Coker et al. (2001) for spotted gars in Canada. The physostomous gas bladder, common to all gar species, allows the spotted gar to obtain atmospheric oxygen and thus provides an advantage over many other predatory species in warmwaters and the low oxygen concentrations that often result. Smatresk and Cameron (1982) showed that spotted gars increase their rate of air breathing when temperatures are higher, and the use of the physostomous gas bladder is significantly higher at 30°C than at 20°C. Our study also showed a preference for low temperatures (17–19.9°C) later in the sampling period. This finding was influenced by individuals inhabiting offshore areas in the early fall.

Conservation of the spotted gar, a native top predator, in Canada will hinge on protection of its critical habitat for all life stages. Our study indicates that spotted gars use emergent and submerged aquatic macrophyte beds in both the nearshore and offshore areas of Rondeau Bay for feeding, cover, and spawning. Long-term survival of the species in Canada will require at least 1,400 adult spotted gars (Young and Koops 2010) and at least 360 ha of suitable habitat (DFO 2010). We show that the population of spotted gars in Rondeau Bay is large enough (8,121 individuals) and has sufficient suitable habitat (1,543–1,884 ha) to be viable in the long term. Although this population estimate is based on Point Pelee marsh data, Point Pelee and Rondeau Bay are similar, albeit different in size. Based on the similarity of habitats, the population density should be similar in the two locations.

Our sampling failed to collect any specimens less than 3 years old, which is the presumed age of maturity for spotted gars (Glass et al. 2011). Thus, additional studies are required to identify the critical habitat for the young-of-the-year, juvenile, and subadult life stages. Nevertheless, our current findings will be used by the Spotted Gar Recovery Team to define critical habitat and recovery targets for the spotted gar recovery strategy, leading to the protection of areas with aquatic macrophytes and other critical areas of Rondeau Bay. These actions will assist in the conservation of the species.

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