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Research Note

Metazoan Parasites of Young-of-the-Year Paddlefish from Lewis and Clark Lake, Nebraska, U.S.A.

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ABSTRACT: Young-of-the-year paddlefish, *Polyodon spathula* (Polyodontidae), from Lewis and Clark Lake, an impoundment of the Missouri River in Nebraska, U.S.A., were surveyed for parasites. In 2001 and 2002, 28 and 48 fish were examined for parasites, respectively. Only the nematode *Rhabdochona decaturensis* infected fish collected in 2001, but 8 parasite taxa (*R. decaturensis*, *Spinitectus* sp., *Camallanus* sp., *Contracecum* sp., *Marsipometra* sp., *Diclybothrium hamulatum*, *Ergasilus elongatus*, and 1 unidentified leech) infected fish collected in 2002. *Rhabdochona decaturensis* was the most common parasite, occurring in 21.4% of fish in 2001 and 79.2% of fish in 2002. Prevalence of other parasite species infecting fish from 2002 was 33% or less. The helminth community of young-of-the-year paddlefish in both years was dominated by nematodes. This study is the first report on parasites of young-of-the-year paddlefish and documents a new host record for *R. decaturensis*.

KEY WORDS: *Polyodon spathula*, paddlefish, parasites, *Camallanus*, *Contracecum*, *Diclybothrium hamulatum*, *Ergasilus elongatus*, Hirudinea, *Marsipometra*, Piscicolidae, *Rhabdochona decaturensis*, *Spinitectus*, Lewis and Clark Lake, Missouri River, Nebraska, United States.

The paddlefish, *Polyodon spathula* (Walbaum, 1792), is among the most ancient species of freshwater bony fishes in the United States and occurs in large rivers of the Mississippi River drainage (Bemis et al., 1997). Although adult paddlefish have been the subject of considerable parasite survey (Linton, 1898; Cooper, 1918; Pearse, 1924; Simer, 1929, 1930; Meyer, 1940; Bangham and Venard, 1942; Wilson, 1956; Causey, 1957; Meyer, 1960: unpublished thesis, Iowa State University, Ames, Iowa; Huggins, 1972; Schmidt et al., 1974; Lockard and Parsons, 1975; Suppes and Meyer, 1975; Raikova et al., 1979; Robinson and Jahn, 1980; Miyazaki et al., 1988; Holloway et al., 1991), there is no published survey of parasites of young-of-the-year paddlefish. This study reports the parasites of young-of-the-year paddlefish

from Lewis and Clark Lake, Nebraska, U.S.A., and briefly characterizes their helminth community.

Lewis and Clark Lake is an impoundment of the Missouri River on the border of Nebraska and South Dakota, U.S.A., measuring ca. 40 by 4 km with a maximum depth of ca. 17 m. Young-of-the-year paddlefish were collected from this lake, using a 7.9-m (headrope) semiballoon otter trawl fished on the bottom of the old river channel (42°50'5"N; 97°34'2"W). Collections were made weekly 5–19 July 2001 and 26 June–24 July 2002. (In 2002, only 5 fish were collected in June: 48 were collected in July.) Fish were fixed in 10% formalin for 2 mo and stored in 70% alcohol.

On necropsy, the entire fish was examined for parasites. Monogenean and copepod prevalences reported in this study may differ from those found on fish examined at fresh necropsy but still represent minimum prevalence values for monogenean and copepod infections on young-of-the-year paddlefish in Lewis and Clark Lake. Parasites were processed using conventional parasitological techniques. Voucher specimens have been deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland as follows: *Rhabdochona decaturensis* Gustafson, 1949 (USNPC 096440); *Diclybothrium hamulatum* Simer, 1929 (Price, 1942) (USNPC 096441); and *Ergasilus elongatus* Wilson, 1916 (USNPC 096439). Specimens of the remaining species are retained by the senior author (B.M.P.).

Use of prevalence, mean intensity, and mean abundance is consistent with that recommended by Bush et al. (1997). Species richness is the number of parasite species in an examined fish. Values for Brillouin's index for use in diversity and evenness (Pielou, 1975; Magurran, 1988) and Simpson's dominance were calculated using common logarithms for all parasites irrespective of their sites of infection. Only prevalence was recorded for monogeneans and copepods, and they are not included in diversity, evenness, and dominance values. Values are reported as mean \pm SD

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Table 1. Prevalence, mean abundance, and mean intensity of parasites in young-of-the-year paddlefish, *Polyodon spathula*, from Lewis and Clark Lake, Nebraska, U.S.A.*

Parasite	Prevalence (%)	Mean abundance \pm SD	Mean intensity \pm SD
<i>Dicelybothrium hamulatum</i> †	12.5	0.3 \pm 0.7	2.0 \pm 1.1
<i>Marsipometra</i> sp.†	6.3	0.1 \pm 0.2	1.0 \pm 0.0
<i>Camallanus</i> sp.‡	8.3	0.1 \pm 0.3	1.0 \pm 0.0
<i>Contracaecum</i> sp.‡	14.6	0.2 \pm 0.4	1.1 \pm 0.4
<i>Rhabdochona decaturensis</i> *‡	21.4	0.6 \pm 1.6	2.7 \pm 2.7
<i>Rhabdochona decaturensis</i> †	79.2	10.0 \pm 13.7	12.6 \pm 14.2
<i>Spinitectus</i> sp.‡	33.3	0.5 \pm 0.9	1.6 \pm 0.9
<i>Ergasilus elongatus</i> †	8.3	0.1 \pm 9.9	18.0 \pm 33.3
Pisicolididae gen. sp.†	2.1	<0.1 \pm 0.2	2.0 \pm 0

* Values from fish collected in 2001. All other values from fish collected in 2002.

† Gravid adults.

‡ Immatures.

followed parenthetically by range values where appropriate.

Paddlefish length measurements are reported as mean eye-to-fork length (Ruelle and Hudson, 1977). In 2001, the mean length of 28 fish sampled was 67.9 mm \pm 24.5 (35–108 mm), and in 2002, the mean length of 48 fish sampled was 93.5 mm \pm 27.7 (28–135 mm). Paddlefish in the 2002 sample were significantly larger than those in the 2001 sample (Student's *t*-test, $t = -4.3$, $P < 0.001$, 74 df). Because fish length between years was significantly different, species richness, prevalence, mean intensity, and mean abundance of *R. decaturensis* were compared between years in fish of similar length (75–108 mm) ranging from the minimum length of fish from either year infected with a parasite to the maximum fish length recorded in 2001. Gonads were not well developed, and sex could not be determined for most fish.

Paddlefish examined in 2001 were infected only with *R. decaturensis*, whereas fish from 2002 were infected with 8 parasite taxa including 1 monogenean, *D. hamulatum*; 1 cestode, *Marsipometra* sp.; 4 nematodes, *R. decaturensis*, *Camallanus* sp., *Contracaecum* sp., and *Spinitectus* sp.; 1 species of pisicolid leech; and 1 copepod, *E. elongatus* (Table 1). No gravid parasites were found in the paddlefish collected in 2001, but gravid individuals of *D. hamulatum*, *Marsipometra* sp., *R. decaturensis*, and *E. elongatus* occurred in paddlefish collected in 2002.

Mean parasite species richness for 2001 and 2002 was 0.2 \pm 0.4 and 1.7 \pm 1.3, respectively. Mean

species richness values were significantly different between years overall (Student's *t*-test on natural log-transformed data, $P < 0.001$, 74 df) and between years for fish of similar length (Student's *t*-test on square-root transformed data, $P < 0.001$, 49 df). Prevalence ($\chi^2 = 22.3$, $P < 0.001$, 1 df), natural log-transformed mean abundance (Student's *t*-test, $P < 0.001$, 74 df), and natural log-transformed intensity (Student's *t*-test, $P = 0.012$, 42 df) of *R. decaturensis* were significantly higher in 2002 than in 2001 overall, but in fish of similar size, there was no significant difference in prevalence (χ^2 , $P > 0.05$, 1 df), natural log-transformed mean abundance (Student's *t*-test, $P > 0.05$, 25 df), or natural log-transformed mean intensity (Student's *t*-test, $P > 0.05$, 32 df) between years. Intensity of *R. decaturensis* and fish length were significantly correlated in 2002 (Spearman's rank correlation, $r_s = 0.53$, $P < 0.05$) but not in 2001 (Spearman's rank correlation, $P > 0.05$).

With the exception of *Rhabdochona*, all parasite genera reported in this study are previously known from adult paddlefish. The paddlefish is a new host record for *R. decaturensis*. *Spinitectus carolini* was tentatively identified in cultured paddlefish by an employee with the Missouri Department of Conservation (Hoffman, 1999), but there are no other reports on *Spinitectus* sp. infecting paddlefish in the literature. Individuals of *Spinitectus* sp. found in this study were immature females.

Several factors including diet and fish age and size may be contributing to the between year differences in prevalence, intensity, and abundance of *R. decaturensis* and also to the between-year difference in parasite species richness values. For the first months of life, young-of-the-year paddlefish prey on a variety of macroinvertebrates such as *Daphnia* and *Hexagenia* spp. (Michaletz et al., 1982). As fish become older, they eat a wider variety of food items and filter feed on planktonic crustaceans such as copepods (Meyer, 1960: unpublished thesis, Iowa State University, Ames, Iowa; Ruelle and Hudson, 1977). Although the precise age of each fish was not determined in this study, it follows that the overall larger fish collected in 2002 were older, had a more diverse diet, and ate greater quantities of food than the overall smaller fish collected in 2001. Thus, the fish sampled in 2002 were probably exposed to both a greater diversity and absolute number of potential intermediate hosts.

Overall prevalence of young-of-the-year paddlefish from Lewis and Clark Lake in 2001 and 2002 was 21.4% and 85.4%, respectively. The internal helminth community in both years was dominated by nema-

todes. Among fish collected in 2002, there was a significant correlation between parasite species richness and fish length (Spearman's rank correlation, $r_s = 0.66$, $P < 0.05$). The mean diversity, evenness, dominance, and species richness values for the internal parasites of infected paddlefish collected in 2002 were 0.075 ± 0.129 , 0.202 ± 0.260 , 0.846 ± 0.253 , and 1.7 ± 1.3 , respectively. High relative intensities of *R. decaturensis* produced these high dominance, low diversity, and low evenness values.

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