Noteworthy Records of Helminth (Monogenoidea, Cestoda, Nematoda) and Crustacean (Copepoda) Parasites from Pealip Redhorses, *Moxostoma pisolabrum* (Catostomidae), from Oklahoma

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Abstract: Parasitic examination of two Pealip Redhorses, *Moxostoma pisolabrum* collected in March 2017 from the Illinois River, Cherokee County, Oklahoma, yielded a variety of taxa. Found were a new species of monogene, *Dactylogyrus* sp., a plerocercoid of the tapeworm, *Proteocephalus ambloplitus*, a nematode, *Rhabdochona milleri*, and a copepod, *Ergasilus megaceros*. We document four new host and three new geographic distributional records for these parasites, and the first time, to our knowledge, that this fish has been reported as a host.

The Pealip Redhorse, *Moxostoma pisolabrum* Trautman and Martin is a large catostomid that occurs in the Ozark uplands and adjacent areas of southeastern Kansas, Missouri, Oklahoma, and Arkansas (Robison and Buchanan 1988; Cross and Collins 1995; Pflieger 1997; Miller and Robison 2004). In Oklahoma, *M. pisolabrum* is found in the northeastern third of the state with two disjunct populations further west and south where it inhabits clear, gravel-bottomed large streams and rivers, often in riffle areas (Miller and Robison 2004). To our knowledge, nothing is known about the parasites of the Pealip Redhorse. We recently had the opportunity to examine *M. pisolabrum* for parasites and the results are reported herein.

On 12 March 2017, two adult *M. pisolabrum* (350 and 390 total length [TL]) were collected using a boat electrofisher from two sites in the Illinois River, Cherokee County (35.958345°N, 94.869452°W and 35.942909°N, 94.912282°W). They were placed on ice and necropsied within 24 hr. Gills were removed, fixed in 10% formalin, and examined under a stereomicroscope for monogeneans and crustaceans. When found, they were picked with minuten nadeln directly from the gills. Monogeneans and copepods were mounted in Gray and Wess medium, stained with Gomori's trichrome, and coverslip ringed with fingernail polish. A mid-ventral incision was made to expose the viscera and the entire gastrointestinal (GI) tract and other organs were placed in Petri dishes containing 0.6% saline, and examined for helminths. The GI tract was split longitudinally and its contents examined under a stereomicroscope. A single cestode was fixed in near boiling tap water without coverslip

pressure, stained with acetocarmine, dehydrated in a graded ethanol series, cleared in methyl salicylate, and mounted in Canada balsam. Nematodes were fixed in a similar manner, preserved in 70% (v/v) ethanol. Nematodes were cleared by placing them in a mixture of 5% or 10% glycerin in 70% ethanol in an uncovered dish, and allowing the ethanol (and water) to evaporate. Cleared nematodes were studied as temporary mounts in glycerol.

Voucher specimens of select parasites were deposited in the Harold W. Manter Laboratory of Parasitology (MWML), University of Nebraska, Lincoln, Nebraska. A host photovoucher specimen was deposited in the Henderson State University Collection (HSU), Arkadelphia, Arkansas, as HSU 3620.

Results and Discussion

Both fish harbored parasites, including a monogenean, tapeworm, nematode, and a copepod. The parasites found are presented below in annotated format.

Monogenoidea: Monopisthocotylea: Dactylogyridae

***Dactylogyrus* sp.**

One *M. pisolabrum* (390 mm TL) was found to harbor four specimens of an undescribed species of *Dactylogyrus* on its gills. This unknown species morphologically resembles *Dactylogyrus apos* Mueller, 1938, *D. atripinnei* Timmons and Rogers, 1977, *D. duquesnei* Mueller, 1938, and *D. niger* Rogers and Mizelle, 1966, all parasitizing species of catostomids (Hoffman 1999), by possessing a robust, sickle-shaped male copulatory organ. It differs from these and all other North American species of *Dactylogyrus* by possessing two unique wing-like projections opposite each other on the proximal portion of the accessory piece. A description of this new species is forthcoming in a separate report.

Cestoda: Proteocephalidea: Proteocephalidae

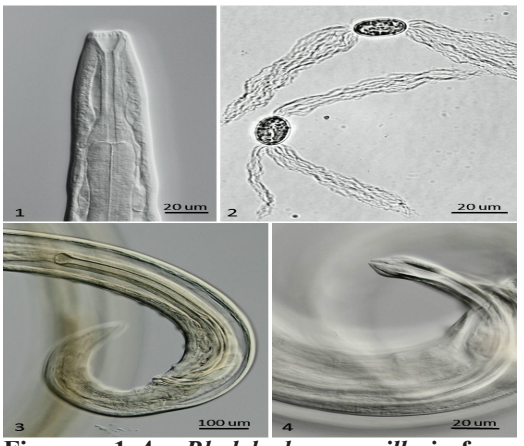
***Proteocephalus ambloplitis* (Leidy, 1887) Benedict, 1900**

A single plerocercoid of *P. ambloplitus* was found in the body cavity of one of the *M. pisolabrum*. In addition, several mature *P. ambloplitus* were found during this survey of other fishes from the same Illinois River locale in the anterior intestine of three Largemouth Bass (*Micropterus salmoides*). In the life cycle, procercoids are found in the hemocoel of copepods, plerocercoids occur in the viscera of small fishes, and basses mainly serve as definitive hosts (Hunter and Hunter 1929). The "bass tapeworm" is a common helminth of many fishes and has been reported from several US states and southern Canada (Hoffman 1999). McDaniel and Bailey (1974) found *P. ambloplitis* in centrarchids from the Little River (Cleveland County) and Lake Texoma, Oklahoma. Concerning other catostomids, Amin (1990) reported *P. ambloplitis* from Common Carp (*Cyprinus carpio*), Lake Chubsucker (*Erimyzon sucetta*), and Golden Redhorse (*Moxostoma erythrurum*) from Silver and Tichigan Lakes, Wisconsin, and Hoffman (1999) documents *P. ambloplitis* from Smallmouth Buffalo (*Ictiobus bubalus*). We report *P. ambloplitis* for the first time from *M. pisolabrum*, and only the second time from the fishes of the genus *Moxostoma*.

Nematoda: Ascaridida: Rhabdochonidae

***Rhabdochona milleri* Choquette, 1951 (Figs. 1–4)**

Nematodes (HWML 110365-110366) closely resembling *R. milleri* were found in the small intestine of both *M. pisolabrum*. In essential (taxonomically relevant) features, such as 14 prostomal "teeth" with paired lateral ones, eggs with conspicuous polar filaments, male papillar pattern, and shape and size of spicules, the species found in *M. pisolabrum* is similar to *R. milleri* of Moravec and Arai (1971) and Moravec et al. (2011). However, the distal end of the long spicule is similar to that illustrated by Moravec and Arai (1971) from *R. milleri*, but different from that in Moravec et al. (2011). It also appears that the distal end of the long spicule



Figures 1–4. *Rhabdochona milleri* from *Moxostoma pisolabrum*. 1. Anterior end of female. 2. Eggs with polar filaments in ribbon form. 3. Long spicule of male in situ. 4. Distal free end of long spicule.

is partially membranous. The membranous folds may remain compressed against the distal end of the spicule or unfurl when needed, which may explain the variability seen in this feature in different descriptions (see also discussions by Moravec and Arai, 1971, and Moravec et al., 2011). This membranous region is also difficult to see when the spicule is retracted, which may further contribute to the apparent differences in the other accounts. *Rhabdochona milleri* appears to be the typical *Rhabdochona* species in *Moxostoma* spp. It was originally described from the Shorthead Redhorse, *Moxostoma macrolepidotum* (as *M. aureolum*) in Québec, Canada (Choquette 1951). It has been reported from *M. macrolepidotum* in Ontario, Canada (Dechtiar 1972), South Carolina (Moravec et al. 2011), Virginia, and elsewhere in the U.S. (Moravec and Arai 1971; Hoffman 1999). It is also common in the same host in Manitoba, Canada (AC, *unpubl*.).

Moravec et al. (2011) synonymized *R. milleri* with two other *Rhabdochona* species described (or redescribed) from catostomids, *R. catostomi* Kayton, Kritsky, and Tobias, 1979 from two *Catostomus* spp. in Alberta, Canada, and Idaho, and *R. ovifilamenta* Weller, 1938, originally described from Yellow Perch, *Perca flavescens* (arguably an incidental host) and later redescribed from two *Catostomus* spp. in Alberta (Moravec and Arai 1971). Moravec et al. (2011) argued that the differences between *R. milleri*, *R. catostomi* and *R. ovifilameta* can be attributed to intraspecific variation, and concluded that *R. milleri* and *R. catostomi* are junior synonyms of *R. ovifilamenta*. However, it is uncertain whether notable differences in the prostomal "teeth" pattern and differences in the egg filaments between *R. milleri* and *R. ovifilamenta* (Moravec and Arai 1971; Moravec et al. 2011) can be accepted as 'intraspecific' variation until *Rhabdochona* spp. from *Moxostoma* and *Catostomus*, from both the same and different locations, are studied using morphological and molecular data. Therefore, we feel it prudent to keep the three nominal species separate for the moment, and assign the nematodes from *M. pisolabrum* to *R. milleri*. The presence of *R. milleri* in *M. pisolabrum* is a new host and geographic record.

Crustacea: Copepoda: Ergasilidae

***Ergasilus megaceros* Wilson, 1916**

Both *M. pisolabrum* were infested on their gill filaments with one each *E. megaceros* (HWML 139374). This copepod has been reported from several hosts in the families Catostomidae, Centrarchidae, Cyprinidae, and Ictaluridae, primarily east of the Mississippi River in Alabama, Florida, Iowa, Massachusetts, Michigan, Mississippi, New York, and North Carolina (Hoffman 1999). The following catostomids have been reported as hosts, including White Sucker (*Catostomus commersonii*), Blue Sucker (*Cycleptus elongatus*), *E. sucetta*, and Blacktail Redhorse (*Moxostoma poecilurum*) from Alabama and Florida (Roberts 1970; Johnson and Rogers 1973). We document a new host and geographic record for *E. megaceros*.

In summary, we have provided four new host and three new geographic distributional records for parasites of *M. pisolabrum* from Oklahoma. As our sample size was limited, additional surveys are warranted on this fish from Oklahoma as well as other parts of its range.

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