Parasites (Cnidaria, Trematoda, Cestoda, Nematoda, Crustacea) of Select Fishes (Lepisosteidae, Catostomidae, Hiodontidae, Cyprinidae, Ictaluridae) of Lake Texoma, Oklahoma

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Abstract: Twenty-seven fishes, including a Longnose Gar (*Lepisosteus osseus*), a Shortnose Gar (*L. platostomus*), three Goldeye (*Hiodon alosoides*), eight Highfin Carpsucker (*Carpiodes velifer*), a Bigmouth Buffalo (*Ictiobus cyprinellus*), four Smallmouth Buffalo (*I. bubalus*), a Common Carp (*Cyprinus carpio*), five Blue Catfish (*Ictalurus furcatus*), two Channel Catfish (*Ictalurus punctatus*), and a Flathead Catfish (*Pylodictus olivaris*) were collected in February 2017 and February 2018 from several sites on Lake Texoma, Oklahoma, and examined for parasites. Thirteen taxa of parasites were found, including two myxozoans (*Henneguya* spp.), seven cestodes (*Proteocephalus ambloplitis, Essexiella fimbratum, Megathylacoides* sp., *Pseudoglaridacris confusa*, *Promonobothrium currani, Khawia* sp., and *Bothriocephalus* sp.), two digeneans (*Crepidostomum illinoiense* and *Macroderoides* sp.), a larval nematode (*Contracaecum* sp.), and a copepod (*Ergasilus cerastes*) were harbored by these hosts. We document several new host and distributional records for these parasites, including new state records for Oklahoma.

Introduction

Lake Texoma, Oklahoma and Texas, is one of the largest reservoirs in the United States, with a total water volume of 3.115242 km^3 (2,525,568 acre-ft). The U.S. Army Corps of Engineers built Lake Texoma in the mid-1940s, and it is stocked with various game fishes. Denison Dam, located between Oklahoma and Texas on the Red River, impounded the lake with the primary outflow being the Red River and primary inflows include the Red and Washita rivers.

Over much of the last half-century or more, the lake has been a mecca for several studies on parasites of various fishes (Sneed 1950; Self 1954; Self and Timmons 1955; Self and Campbell 1956; Roberts 1957; McDaniel 1963; Hopkins 1966; Mackiewicz 1964, 1968, 1969, 1970). We are not aware of studies conducted in recent years on the parasitic fauna of fishes of Lake Texoma. Here, we include additional information on some parasites of select fishes, including new host and distributional records and the first report of a *Henneguya* from the lake.

Methods

On 22 February 2017 and 28 February 2018, 27 fishes were collected with gill nets placed by members of the Oklahoma Department of Wildlife Conservation in Bryan and Marshall counties at the Red River near Cardinal Cove, the Washita Arm near Bridgeview Marina, the mouth of Catfish Bay (west of the Willow Springs boat ramp), and 0.8 km south of the railroad bridge. Fishes collected included: one Longnose Gar (*Lepisosteus osseus*), one Shortnose Gar (*L. platostomus*), three Goldeye (*Hiodon alosoides*), eight Highfin Carpsucker (*Carpiodes velifer*), four Smallmouth Buffalo (*I. bubalus*), one Bigmouth Buffalo (*Ictiobus cyprinellus*), one Common Carp (*Cyprinus carpio*), five Blue Catfish (*Ictalurus furcatus*), two Channel Catfish (*Ictalurus punctatus*), and one Flathead Catfish (*Pylodictus olivaris*). Specimens were donated to CTM, stored briefly on ice, and examined for internal parasites within 24 hr. Fishes were measured for total length (TL) and those still alive were killed by immersion in a concentrated tricaine methanesulfonate solution following accepted guidelines (Use of Fishes in Research Committee 2014), and preserved in 10% formalin after initial examination. Gills were removed from the hosts previously preserved in 10% formalin and examined for parasites under a stereomicroscope at 20–30×. Parasites were picked directly from the gills with small forceps or needles. Myxozoan (*Henneguya*) plasmodia and myxospores were placed in a drop of water on microscope slides and observed as wet mounts. Measurements (to the nearest 0.5 µm) and attempts to identify *Henneguya* were according to criteria in Kudo (1929), Griffin et al. (2009), Wagner (2016), and Leis et al. (2017). Crustaceans (*Ergasilus*) were cleared briefly in a drop of lactic acid on slides and then mounted in Grey and Wess medium, and coverslip ringed with fingernail polish. Specimens of *Ergasilus* were identified using Roberts (1970). A mid-ventral incision was made from the mouth to the anus of host fishes to expose the viscera, and the entire gastrointestinal tract and organs placed in Petri dishes containing 0.9% saline were examined for helminths under a stereomicroscope at 20–30×. Trematodes and cestodes were 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 and preserved in 70% (v/v) ethanol. They were later 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.

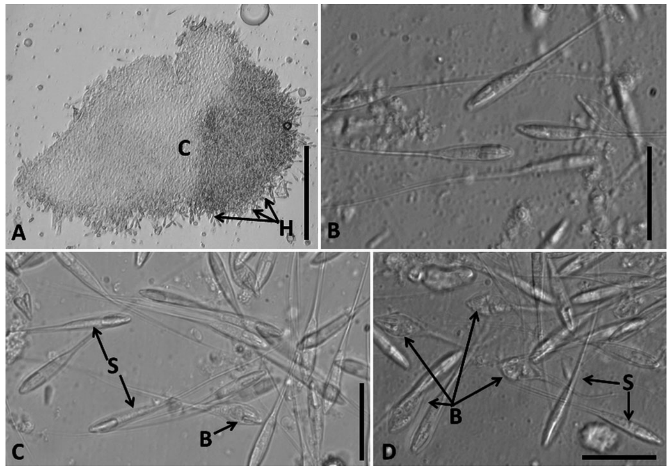
Prevalence, intensity, and range of infection were calculated according to Bush et al. (1997). Voucher specimens of parasites were deposited in the Harold W. Manter Laboratory of Parasitology (HWML), University of Nebraska, Lincoln, Nebraska. Photovouchers of the hosts or those preserved in 10% formalin were deposited in the Henderson State University Museum (HSU), Arkadelphia, Arkansas.

Results and Discussion

Thirteen taxa of parasites were found, including two myxozoans, seven cestodes, two digeneans, a nematode, and a copepod. An annotated list of the parasites found and the host data follows.

Cnidaria: Myxosporea: Myxidiidae

***Henneguya exilis* Kudo, 1929 –** An 850 mm TL *I. furcatus* possessed a myxozoan, *H. exilis* (HWML 139857, Figs. 1A–D) on its gills. A description of this myxozoan follows: plasmodia (cyst) spherical, 280 diameter (*n* = 1). Myxospores with long caudal process,



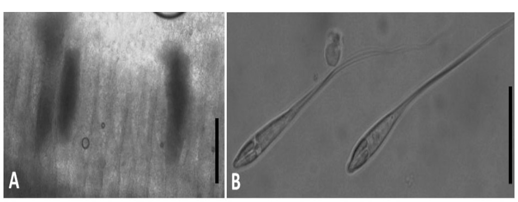
Figures 1A–D. *Henneguya exilis* from the gills of *Ictalurus furcatus*. A. Ruptured plasmodia showing hundreds of *H. exilis* (H) along the edge of cyst; scale bar = 200 µm. B. Mostly frontal view of slender myxospores; scale bar = 20 µm. C. Mostly lateral views of slender spores (S) and frontal view of a broad morph (B); scale bar = 20 µm. D. Slender (S) and broad (B) morphs of spores; scale bar = 20 µm.

variable, with two morphs present in the same cyst, one with slender spore body and long caudal process, the other with broad spore body and shorter, usually separated caudal process. Slender morph (*n* = 20): total length of spore 59.5 (54.5–71.5). Spore body fusiform, widest in region near tips of polar capsules, length 17.1 (16.0–18.5), width 3.2 (3.0–3.5). Caudal process separated or not, length 42.4 (24.5–55.5). Two polar capsules, one usually slightly longer than the other; length of longest polar capsule 6.7 (6.0–7.5), width 1.2 (1.0–1.5); length of shorter polar capsule 6.3 (6.0–7.0), width 1.2 (1.0–1.5). Broad morph (*n* = 9): total length of spore 40.9 (33.5–45.0). Spore body ovoid to rhomboid, widest in region near tips of polar capsules, length 12.4 (10.0–15.0), width 5.2 (4.0–6.0). Caudal process usually separated, length 28.5 (23.0–32.0). Two polar capsules, one usually slightly longer than the other; length of longest polar capsule 5.5 (4.5–6.5), width 1.9 (1.5–2.5); length of shorter polar capsule 5.2 (4.0–6.0), width 1.8 (1.5–2.5).

Henneguya exilis was originally described from *I. punctatus* from the Rock River, Illinois (Kudo 1929). This myxozoan has also been reported from cultured *I. punctatus* in México (Rábago-Castro et al. 2013). It has been reported in other ictalurids, including Black Bullhead (*Ameiurus melas*) from Iowa (Kudo 1920) and Brown Bullhead (*A. nebulosus*) in North Carolina (Iwanowicz et al. 2008). Other localities for *H. exilis* include Arkansas, Mississippi, Nebraska, sites in lakes Erie and Michigan, and Ontario, Canada (see Hoffman 1999). Interestingly, only two *Henneguya* spp. have been previously reported from Oklahoma, *H. gambusi* Parker, Spall, and Warner, 1971 from Western Mosquitofish, *Gambusia affinis* (Parker et al. 1971) (Spall et al. 1971) and an unknown *Henneguya* sp. from *A. melas* (McAllister and Trauth 2015).

Due to generally high host and organ specificity (with some exceptions, e.g., *H. exilis*), species of *Henneguya* from ictalurid catfishes (see Wagner 2016) have been separated into "working forms," i.e., interlamellar, intralamellar, visceral, cutaneous, adipose, and gall bladder (Minchew 1977). Three species of *Henneguya* have been reported from *I. furcatus*: *M. limatula* Meglitsch, 1937, in the gall bladder (Meglitsch 1937; Minchew 1977); *H. exilis* in the gills (Rice and Jahn 1943); and *H. pellis* Minchew, 1977, in the dermis (Minchew 1977). The slender morph found in this study conforms closely with *H. exilis*. Our identification as *H. exilis* is tentative, as it is confounded by the presence of a broad morph. The broad morph does not conform to any descriptions of *Henneguya* reported from ictalurids (Minchew 1977; Griffin et al. 2009; Wagner 2016; Leis et al. 2017). Spores of *Henneguya* are sometimes indistinguishable from others based on morphology (McAllister and Trauth 2015). The most definitive approach to identifying species of myxozoans is utilization of small-subunit ribosomal DNA (SSU rDNA) gene sequences. Such sequences are needed to confirm our identification.

***Henneguya* sp. –** A 610 mm TL *P. olivaris* had cysts and spores of an unknown *Henneguya* sp. (HWML 139858 photovoucher, Figs. 2A–B) on its gills. A description of this myxozoan follows: cyst (*n* = 30) intralamellar, cylindrical, length 266 (96–582), width 94 (56–194). Myxospores (*n* = 30) with long caudal process. Total length of spore 78.2 (65.0–92.0). Spore body fusiform, widest in region near tips of polar capsules, length 17.8 (14.0–22.5), width 4.1 (3.5–4.5). Caudal process often not separated, but occasionally separated, especially near tip, length 60.4 (57.0–77.0). Two polar capsules, one usually slightly longer than the other, length of longest polar capsule 5.8 (5.0–6.5), width 1.1 (1.0–1.5); length of shorter polar capsule 5.5 (4.5–6.0), width 1.1 (1.0–1.5).



Figures 2A–B. *Henneguya* sp. from the gills of *Pylodictis olivaris*. A. Plasmodia (dark bodies), *in situ* within gills; scale bar = 200 µm. B. Frontal views of myxospores; scale bar = 20 µm.

Leis et al. (2017) described *Henneguya laseeae* from the gills of *P. olivaris* from the upper Mississippi River, Wisconsin and Iowa. Until now this was the only report of a myxozoan from *P. olivaris*. Our specimens from Lake Texoma differ from those of *H. laseeae* by the shape of the cyst (cylindrical versus spherical to ovoid) and length of the spore body (17.8 (14.0-22.5) versus 16.2 (15.1-17.0), respectively. The spore body of *Henneguya* sp. is proportionately longer in relation to width than that of *H. laseeae* (Figs. 2A–B, present paper; Leis et al. (2017). Based on the total length of spores, our specimens also resemble *H. longicauda* Minchew, 1977, previously reported from the gills of *I. punctatus*, and *H. pellis* Minchew, 1977, previously reported on the dermis of *I. furcatus* (Minchew 1977). Although there is slight overlap, the spore body of *Henneguya* sp. reported here is generally shorter (78.2 [65.0–92.0]) than that of *H. longicauda* (108.3 [91–127]) (Minchew 1977; Griffin et al. 2009; Wagner 2016). The spore body of *Henneguya* sp. is longer in relation to width (Fig. 2B) than that of *H. pellis* (Minchew 1977). This is the second report of a species of *Henneguya* from *P. olivaris* and it is likely a new species, but we withhold a description pending SSU rDNA studies.

Cestoda: Caryophyllidea: Caryophyllaeidae

Pseudoglaridacris confusa (Hunter, 1929) **Oros, Uhrovič and Scholz, 2018. –** Adult worms (HWML 139881) were found in the intestines of a 560 mm TL *I. cyprinellus*, and the tapeworm has been previously reported from Lake Texoma in *I. bubalus* and Black Buffalo, *I. niger* (Self and Campbell 1956). The finding in our study extends the host range of this tapeworm to *I. cyprinellus*. Type hosts of this tapeworm include *Ictiobus* spp. from Mississippi, and the species appears to be widely distributed in North America, including Arizona, Connecticut, Idaho, Iowa, New York, North Dakota, Wisconsin, and Canada (Hoffman, 1999). *Pseudoglaridacris confusa* was previously known in the literature as *Glaridacris confusus* Hunter, 1927, but a review by Oros et al. (2018) showed that species in North America do not belong in the genus *Glaridacris*.

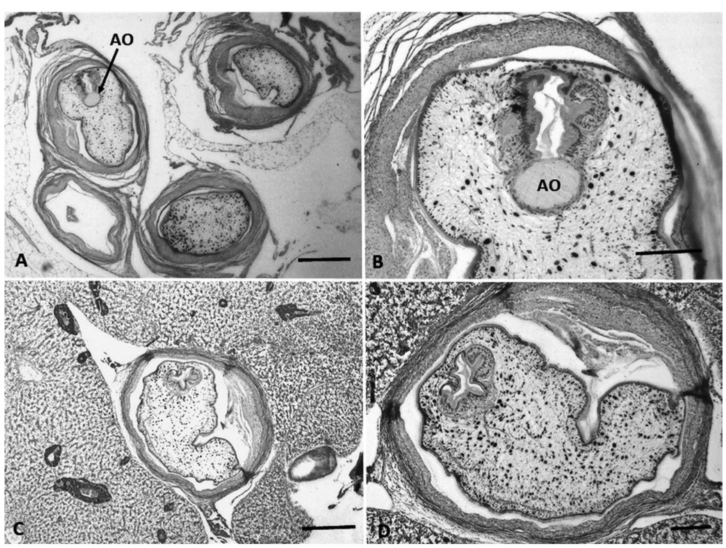
Promonobothrium currani **Oros, Brabec, Kuchta, Choudhury, and Scholz, 2016. –** These caryophyllidean tapeworms (HWML 139880) were collected from the intestines of a 560 mm TL *I. cyprinellus* and a 370 mm TL *I. bubalus*. This tapeworm was first described by Oros et al. (2016) from *I. bubalus* and *I. niger* from Chotard Lake, Mississippi. Records from this study represent the second report of this parasite, and extend its geographic and host range. We document the first report of this parasite from Oklahoma and *I. cyprinellus* is a new host record. One other species of *Promonobothrium*, *P. ingens* (Hunter, 1927) Scholz, Oros, Choudhury, Brabec and Waeschenbach, 2015, was reported from *I. bubalus* in Lake Texoma (Self and Campbell 1956) as '*Monobothrium ingens*', the former name of the species (Scholz et al. 2015). We collected a single, somewhat contracted specimen from *I. bubalus* that also likely belongs to this species.

***Khawia* sp. (Yamaguti, 1934) Hsü, 1935**. – One adult worm (HWML 110617) was found in the intestine of a 650 mm TL *C. carpio*. Hoffman (1999) mentions two species in North America, *K. iowensis* Calentine and Ulmer, 1961, and *K. sinensis* Hsü, 1935 (Calentine and Ulmer 1961; Williams and Sutherland 1981). Scholz et al. (2011b) determined that *K. iowensis* is actually *K. japonensis* (Yamaguti, 1934), and therefore an introduced species, as is its host, *C. carpio* in North America. The tapeworm in our collection resembles *K. japonensis*. To our knowledge, this is only the second record of a *Khawia* species in Oklahoma from *C. carpio* (Spall 1969) but the first from a Common Carp in Lake Texoma.

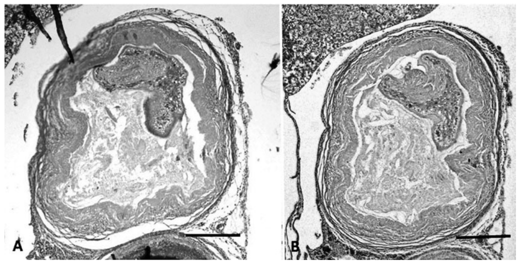
Onchoproteocephalidea: Proteocephalidae

***Proteocephalus ambloplitis* (Leidy, 1887) Benedict, 1900. –** Plerocercoids of *P. ambloplitis* (HWML 139890–139892, Figs. 3A–D, 4A–B) were observed in liver tissue of a 310 mm TL *I. punctatus*, a 500 mm TL *I. furcatus*, and a 610 mm TL *P. olivaris*. The "bass" tapeworm is known to cause pathologies to various second intermediate hosts (Hoffman 1999) and some fibrosis is observed in our histological samples (Figs. 3C–D). McDaniel and Bailey (1974) reported *P. ambloplitis* in centrarchids from the Little River (Cleveland County) and from Lake Texoma. Although the cestode has been previously reported in *I. punctatus* and *P. olivaris* (Hoffman 1999), to our knowledge, it has not been documented in *I. furcatus*. Here, we provide a new host record for *P. ambloplitis*.

***Essexiella fimbriatum* (Essex, 1927) Scholz, de Chambrier, Mariaux and Kuchta, 2011**. – This tapeworm (HWML 110615) was found



Figures 3A-D. *Proteocephalus ambloplitis* plerocercoids in liver tissue of *Ictalurus punctatus*. A. Four plerocercoids in liver tissue with one showing large glandular apical organ (AO); scale bar = 500 µm. B. Close-up of same plerocercoid in A showing AO; scale bar = 500 µm. C. Another view of different plerocercoid showing encapsulation and extensive fibrosis; scale bar = 500 µm. D. Higher magnification of plerocercoid in C; scale bar = 500 µm.



Figures 4A-B. *Proteocephalus ambloplitis* plerocercoids from liver tissue of catfishes. A. Plerocercoid from *Ictalurus furcatus*. B. Plerocercoid from *Pylodictis olivaris*; scale bars = 500 µm.

in the intestine of a 375 mm TL *I. punctatus*. It is widely distributed in this fish host (Hoffman, 1999). The genus is closely related to two other proteocephalidean genera in ictalurid catfishes, namely *Megathylacoides* Jones, Kerley and Sneed, 1956, and *Corallotaenia* (Freze, 1965) (Rosas Valdez et al. 2004). *Essexiella fimbriatum* is well known in the fish parasitology literature by its former name, *Corallobothrium fimbriatum* Essex, 1927, but a phylogenetic analysis that included the type species from Africa showed that North American *Corallobothrium* spp. belong in a separate genus, and *Essexiella* was established (Scholz et al. 2011a); this required a name change to *E. fimbriatum*. This species was previously reported from this host in Lake Texoma (Sneed, 1950) and in Lake Carl Blackwell (Spall 1969; Spall and Summerfelt 1969). In addition, McAllister et al. (2016) reported *E. fimbriatum* in a Yellow Bullhead (*Ameiurus natalis*) and Black Bullhead (*Ameiurus melas*) from the Red River drainage of the state.

Megathylacoides **sp.** – A strobilate, but immature specimen of this tapeworm (HWML 110616), was found in the intestine of a 310 mm TL *I. punctatus*. Species of *Megathylacoides* Jones, Kerley and Sneed, 1956, have been widely reported in ictalurid catfishes (Hoffman 1999; Pérez-Ponce de León and Choudhury 2002; Scholz et al. 2003). *Megathylacoides giganteum* (Essex, 1928) Freze, 1965, appears to be the most widely reported species (Hoffman 1999) in a variety of ictalurid catfishes, but the Channel Catfish seems to be its most common host (Hoffman 1999). Two other species, *M. procerum* Sneed, 1950 and *M. thompsoni* Sneed, 1950 were described from *I. furcatus* and *I. punctatus* respectively, from Lake Texoma (Sneed 1950) but the descriptions are incomplete, there are no illustrations, and no type specimens were deposited (Sneed 1950). A fourth species, *Megathylacoides tva* Jones, Kerley and Sneed, 1956 was described from *P. olivaris* in Tennessee (Jones et al. 1956); this fish host is also present in Lake Texoma but the scolex is distinctly different from the worm we collected in this study and, thus, can be ruled out. A fifth species, *Megathylacoides lamothei* (García-Prieto, 1990) Scholz, Rosas, Pérez-Ponce de León, Choudhury and de Chambrier, 2003, was described from *I. furcatus*, in México (García-Prieto, 1990) and this ictalurid is common in the U.S., including Lake Texoma. The scolex of the immature form collected in this study appears to resemble that of *M. lamothei*. Further studies, based on freshly collected mature specimens and molecular data, are necessary to clarify the taxonomy of this group of tapeworms.

Bothriocephalidea: Bothriocephalidae

Bothriocephalus **sp. –** Gravid specimens of a species of *Bothriocephalus* Rudolphi, 1808 were found in the intestines of two (143, 150 mm TL) *H. alosoides*. Self (1954) described *B. texomensis* from Goldeye in Lake Texoma. Scholz (1997) synonymized *B. texomensis* with *B. cuspidatus* Cooper, 1917. The morphology of the species collected in this study is consistent with that of *B. texomensis* but because the specimens were collected from previously frozen fish, we remain circumspect about a more definitive species diagnosis. The status of *B. texomensis* vis a vis its relationship to *B. cuspidatus* is currently being studied using morphological and molecular data (Choudhury and Scholz *pers. comm.*). The material has been retained by one us (AC) for a more detailed taxonomic study on North American *Bothriocephalus* species.

Trematoda: Digenea: Allocreadiidae

Crepidostomum illinoiense **Faust, 1918**. –These trematodes (HWML 110614) were collected from the intestines of a 143 mm TL *H. alosoides*. *Crepidostomum illinoiense* is a common and widely distributed parasite of Goldeye (Hoffman 1999; Choudhury and Nelson 2000). The parasite has been reported from this host in Lake Texoma (Self 1954). Although the species was described based on young mature and immature specimens from White Crappie (*Pomoxis annularis*), hiodontid fishes (Goldeye and Mooneye, *Hiodon tergisus*) appear to be its principal hosts.

Macroderoididae

Macroderoides sp. – Two specimens (HWML 139883) were collected from the intestine of a 1,050 mm TL *L. osseus*. One specimen was stained and the other stored for molecular study. The single stained worm is morphologically most similar to *M. luki* Kusy and Barger, 2017, recently described from the Spotted Gar, *L. oculatus*, from Texas (Kusy and Barger 2017). To our knowledge, our report from a Longnose Gar appears to be the first record of a species of *Macroderoides* from any host in Oklahoma (Hoffman 1999).

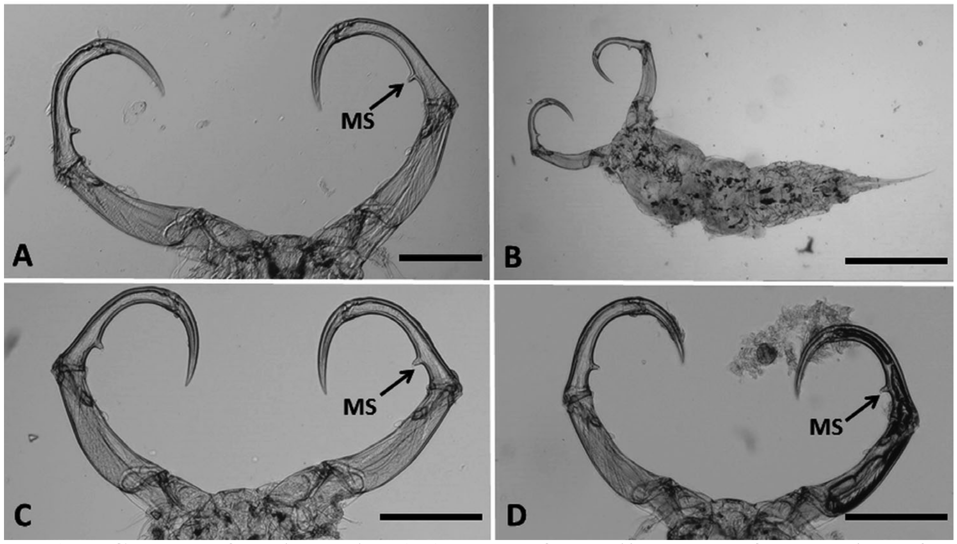
Nematoda: Secernentea: Ascaridida: Anisakidae

Contracaecum sp. – Third-stage larvae (L_3) of *Contracaecum* Railliet and Henry, 1915 (HWML 110613) were found encapsulated on the stomach and mesenteries in a 310 mm TL *I. punctatus*, each worm ensheathed in a thick connective tissue sleeve. Our specimens seemed intact and showed no signs of necrosis, suggesting that they were viable in their paratenic fish host and infective to their definitive bird hosts, particularly those of the family Phalacrocoracidae (cormorants) (Moravec 2009). *Contracaecum* L_3s are common in fish throughout North America (Hoffman 1999), but species determination at this larval stage is not possible. Furthermore, the precise number of *Contracaecum* species in North America remains unclear (D'Amelio et al. 2007).

Crustacea: Copepoda: Poecilostomatoidea: Ergasilidae

***Ergasilus cerastes* Roberts, 1969 –** Forty copepods (HWML 139478, Fig. 5A) were found on the gills of a single 850 mm TL *I. furcatus*; 45 specimens (HWML 139865, Fig. 5B–C) on the gills of two (310, 375 mm TL) *I. punctatus*; and 70 individuals (HWML 139477, Fig. 5D) on the gills of one 610 mm TL *P. olivaris*. This crustacean was originally described from *Ictalurus* sp. from a fish market in Washington, D. C. (Roberts 1969, 1970; Johnson and Rogers 1973). Other reported hosts and localities include *Ictalurus* spp. from Florida (Mueller 1936), White Catfish, *Ameiurus catus*, *A. nebulosus*, *I. furcatus*, and *I. punctatus* from Alabama and Mississippi (Johnson and Rogers 1973), and Freshwater Eel, *Anguilla rostrata* from South Carolina (Eversole 1981). Our specimens from all three catfish hosts from Lake Texoma conform to the description of *E. cerastes* in Roberts (1969, 1970). With the exception of an undocumented report from *A. rostrata* in South Carolina (Eversole 1981), all previous records of *E. cerastes* have been from species of *Ameiurus* and *Ictalurus* (Roberts 1969, 1970; Johnson and Rogers 1973; Hoffman 1999). Four other species of *Ergasilus* (*E. arthrosis* Roberts, 1969; *E. versicolor* Wilson, 1911; *E. cyprinaceus* Rogers, 1969; and *E. megaceros* Wilson, 1916) have been reported on North American catfishes (Johnson and Rogers 1973; Hoffman 1999), but *E. cerastes* was the only species of *Ergasilus* found in our samples of ictalurids from Lake Texoma. *Ergasilus cerastes* differs from all of these species by possessing a large blunt medial sensillum (Figs. 5A–D) near the midpoint (Roberts 1970). Johnson and Rogers (1973) noted that their records of *E. cerastes* were from mouths of river in estuarine areas. Our specimens from Lake Texoma represent the first *E. cerastes* found far inland and west of the Mississippi River, including Oklahoma, and the first reported from *P. olivaris*.

In conclusion, we document some new host and geographic records for these parasites. Most parasites (seven species) found in our hosts from Lake Texoma were cestodes. Only one nematode was recovered and that is somewhat surprising given that they are common in parasite communities of North American freshwater fishes (see Choudhury and Nadler 2018). Several taxa reported herein require additional study (including molecular approaches) to determine their specific identity. With the diverse



Figures 5A-D. Copepods from ictalurids. A. Antenna of *Ergasilus cerastes* from *Ictalurus furcatus*, showing unique large, blunt medial sensillum (MS) near its midpoint; scale bar = 200 µm. B. Whole mount (dorsal view) of *E. cerastes* from *I. punctatus*; scale bar = 500 µm. C. Antenna of same *E. cerastes* showing unique large, blunt medial sensillum (MS) near its midpoint; scale bar = 200 µm. D. Antenna of *E. cerastes* from *Pylodictis olivaris*, showing unique large, blunt medial sensillum (MS) near its midpoint; scale bar = 200 µm.

fish fauna of 180 species in Oklahoma (Miller and Robison 2004), we expect additional new host and geographic distribution records to be reported with surveys of at least some of the 71 species of Lake Texoma fishes (Riggs and Bonn 1959; Miller and Robison 2004), including the possibility of discovering new taxa.

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