J. Helminthol. Soc. Wash.
66(2), 1999 pp. 115–122

Nematode Parasites of Yellow Perch, *Perca flavescens*, from the Laurentian Great Lakes

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ABSTRACT: Yellow perch, *Perca flavescens* (Mitchill), from 4 localities in the Laurentian (North American) Great Lakes were examined for nematodes: from eastern Lake Michigan in 1990; from southern Lake Michigan in 1991; from The Black Hole, Saginaw Bay, Lake Huron in 1991; and from Oak Point, Saginaw Bay, Lake Huron in 1996. *Dichelyne cotylophora* (Ward and Magath) infected perch from each location and had the highest prevalence, mean intensity, and mean abundance at Oak Point. *Eustrongylides tubifex* (Nitzsch) Jägerskiold was a common parasite of perch from Saginaw Bay, but it infrequently infected Lake Michigan perch. *Philometra cylindracea* (Ward and Magath) Van Cleave and Mueller was found in perch only from Saginaw Bay. *Contracaecum* sp. infrequently infected perch from Lake Michigan and The Black Hole. A comparative summary of the literature on nematodes infecting yellow perch from the Great Lakes is presented, listing 27 studies published since 1917. Four nematode genera utilize perch as intermediate hosts, and 5 genera utilize them as definitive hosts. Information on the life cycles and pathology caused by nematodes infecting yellow perch is presented.

KEY WORDS: Yellow perch, *Perca flavescens,* Percidae, Pisces, parasites, nematodes, Laurentian Great Lakes, Lake Michigan, Lake Huron, Saginaw Bay.

Several nematodes have been reported from yellow perch, *Perca flavescens* (Mitchill, 1814) (Percidae), in the Laurentian (North American) Great Lakes. In recent years, federal and state fisheries personnel, aquaculturists, and anglers have asked me to identify nematodes infecting yellow perch from the Great Lakes and to answer questions about them. Declines in the catch rates of perch have been reported in southern Lake Michigan; Saginaw Bay, Lake Huron; and western Lake Erie (Francis et al., 1996). The present study reports on the occurrence of *Dichelyne cotylophora* (Ward and Magath, 1917); *Eustrongylides tubifex* (Nitzsch, 1819) Jägerskiold, 1909; *Philometra cylindracea* (Ward and Magath, 1917) Van Cleave and Mueller, 1934; and *Contracaecum* sp. in yellow perch from Lake Michigan and Saginaw Bay, Lake Huron. A summary of the nematodes infecting yellow perch from the Great Lakes is presented, with accompanying information on their life cycles and pathology. The possible relationship between the decline of yellow perch populations in some areas of the Great Lakes and the occurrence of parasitic nematodes is also discussed.

Materials and Methods

A total of 364 yellow perch was collected by beach seine and trawl from southern Lake Michigan (Michigan City, Indiana) in 1991; eastern Lake Michigan (Ludington, Michigan) in 1990; Saginaw Bay, Lake Huron (The Black Hole) in 1991; and Saginaw Bay, Lake Huron (Oak Point) in 1996. Ludington is approximately 247 km north of Michigan City. Fish were sampled from the open water in Lake Michigan and also along the shore at Ludington. Saginaw Bay, a large shallow eutrophic bay divided into inner and outer areas, is the southwestern extension of Lake Huron located in east central Michigan. The inner area is shallower and warmer than the outer area, and is enriched with domestic, agricultural, and industrial inputs from the Saginaw River. The Black Hole in the Inner Saginaw Area and Oak Point in the Outer Saginaw Area are approximately 50 km apart.

Perch were put on ice in the field, frozen at the laboratory, and measured and sexed at necropsy when the abdominal cavity, viscera, muscle, gastrointestinal tract, and head were examined. *Dichelyne cotylophora, Eustrongylides tubifex,* and *Contracaecum* sp. were preserved in 70% alcohol and later cleared in glycerin for identification. *Philometra cylindracea* were broken during necropsy and pieces were placed in glycerin on a glass slide, allowed to clear, and examined with a light microscope; specimens were not kept. Prevalence is the percentage of fish infected in each sample, mean intensity is the mean number of nematodes of a species per infected fish, and mean abundance is the mean number of worms per examined fish. Voucher specimens have been deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland 20705: *Dichelyne cotylophora* (USNPC 88506) and *Eustrongylides tubifex* (USNPC 88507).

Results

Yellow perch from 2 locations in Lake Michigan and 2 locations in Saginaw Bay, Lake Huron, were examined for nematodes (Table 1).

Table 1. Number, collection time, and mean total length (mm) of *Perca flavescens* examined from Lake Michigan and Saginaw Bay, Lake Huron.

Location	Month(s), year	Mean total length ± SD (range, 95% confidence interval)
Michigan City, Indiana, southern Lake Michigan (100)*	August 1991	154 ± 67 (50–280, 141–168)
Ludington, Michigan, eastern Lake Michigan (64)*	May–September 1990	136 ± 23 (105–177, 131–142)
The Black Hole, inner Saginaw Bay, Lake Huron, Michigan (100)*	September 1991	172 ± 36 (110–278, 164–178)
Oak Point, outer Saginaw Bay, Lake Huron, Michigan (100)*	August 1996	202 ± 23 (170–287, 197–206)

* (Number of yellow perch examined.)

There was a significant difference in the lengths of perch between locations (analysis of variance, $F = 35.9$, $P < 0.0001$) with those from Oak Point being larger. Forty-eight percent (48) of yellow perch from Michigan City in 1991, 26% (17) from Ludington in 1990, 96% (96) from The Black Hole in 1991, and 98% (98) from Oak Point in 1996 were infected with 1 or more nematodes.

Gravid *Dichelyne cotylophora* infected the intestines of yellow perch from each location (Table 2). It was significantly more prevalent in perch from Michigan City than from Ludington, Michigan (chi-square, $\chi^2 = 26.6$, $P < 0.005$); intensities were not significantly different, but abundances were (Mann–Whitney test, $U = 9{,}187$, $P < 0.0001$). In Saginaw Bay, prevalence (chi-square, $\chi^2 = 128.6$, $P < 0.005$) and abundance (Mann–Whitney test, $U = 6{,}064$, $P < 0.0001$) of *D. cotylophora* were significantly higher in perch from Oak Point than from The Black Hole. *Contracaecum* sp. infrequently occurred encysted on the surface of the heart, in the liver, and associated with the mesentery of perch from Lake Michigan and The Black Hole.

Eustrongylides tubifex was most common in perch from Saginaw Bay. The intensity (Mann–Whitney test, $U = 9{,}773$, $P < 0.0001$) and abundance (Mann–Whitney test, $U = 12{,}798$, $P < 0.0001$) of *E. tubifex* were significantly higher in perch from The Black Hole than from Oak Point. Larvae occurred in capsules associated with the mesentery on the surface of the ovaries, testes, liver, spleen, and gastrointestinal tract and free in the body cavity, viscera, and muscle. Of the 303 *E. tubifex* found in perch from Oak Point in 1996, 92% of the worms or capsules with worms were seen with the unaided eye, whereas 8% were detected only with a dissecting microscope. Small and large *E. tubifex* were found in perch from both Saginaw Bay locations.

Philometra cylindracea, some of which were larvigerous, occurred free in the body cavity of perch only from Saginaw Bay, and was most common at Oak Point. Remains of crenulated and hardened masses of nematodes, probably dead *P. cylindracea* from past infections, were found in the body cavities and viscera of yellow perch from The Black Hole and Oak Point. All perch from Saginaw Bay in 1991 and 69% of them in 1996 that were infected with *P. cylindracea* were concurrently infected with *E. tubifex.* Ninety-six percent of Oak Point perch harbored at least 1 *E. tubifex* or *P. cylindracea* or remains of dead *P. cylindracea.*

There were no significant differences in the prevalence (chi-square analysis, $P > 0.05$) and intensity or abundance (Mann–Whitney test, $P > 0.05$) of *D. cotylophora, E. tubifex, P. cylindracea,* and *Contracaecum* sp. between female and male perch at any location. There were no significant correlations between the intensities of each nematode species and host length.

Discussion

At least 27 studies mentioning the nematode parasites of yellow perch from the Great Lakes have been published since 1917. The number of studies (in parentheses) performed in each Great Lake and associated connecting waters are: Lake Michigan (5), Lake Superior (1), St. Marys River (1), Lake Huron (7), Lake St. Clair (1), Lake Erie (12), and Lake Ontario (3) (Table 3). Many of these investigations did not report the number, length, and age of perch. Rosinski et al. (1997) reported that the nematode fauna of yellow perch in Saginaw Bay, Lake Huron, and Lake Huron proper are similar.

Table 2. **Prevalence (P), mean intensity (MI), maximum number (max.), and mean abundance (MA) of nematodes infecting *Perca flavescens* from Lake Michigan and Saginaw Bay, Lake Huron.**

Nematode	LM, MC* (100)†			LM, L* (64)†			SB, BH* (100)†			SB, OP* (100)†		
	P	MI ± SD (max.)	MA ± SD	P	MI ± SD (max.)	MA ± SD	P	MI ± SD (max.)	MA ± SD	P	MI ± SD (max.)	MA ± SD
Contracaecum sp.	3	1	0.03 ± 0.2	8	2.00 ± 1.2 (4)	0.15 ± 0.6	4	1	0.04 ± 0.2	—	—	—
Dichelyne cotylophora	47	4.60 ± 4.4 (19)	2.15 ± 3.8	19	4.20 ± 4.7 (18)	0.78 ± 2.6	4	1.30 ± 0.5 (2)	0.05 ± 0.3	84‡	5.50 ± 4.6 (23)‡	4.26 ± 4.6‡
Eustrongylides tubifex	3	1	0.03 ± 17	—	—	—	95	9.10 ± 7.4 (27)	8.60 ± 7.5	74	4.10 ± 3.4 (13)	3.05 ± 3.4
Philometra cylindracea	—	—	—	—	—	—	10	1	0.11 ± 0.3	16	1.60 ± 1.4 (6)	0.26 ± 0.8

* LM, MC = Lake Michigan, Michigan City; LM, L = Lake Michigan, Ludington; SB, BH = Saginaw Bay, The Black Hole; SB, OP = Saginaw Bay, Oak Point.
† (Number of yellow perch examined.)
‡ Values calculated from 87 fish.

A total of 15 nematode taxa has been reported from yellow perch in the Great Lakes (Table 3). Of these, *Agamonema* sp., *Contracaecum* sp., *E. tubifex, Eustrongylides* sp., *Hysterothylacium brachyurum* (Ward and Magath, 1917) Van Cleave and Mueller, 1934, *Raphidascaris acus* (Bloch, 1779) Railliet and Henry, 1915, and *Raphidascaris* sp. are represented by larval or immature stages. Of the 10 nematodes identified to species, 6 mature in the intestine of perch. Prevalence data from the literature indicate that *D. cotylophora* is the most common nematode infecting perch from Lake Michigan, *R. acus* is most common in Lake Superior perch, and *D. cotylophora* and *E. tubifex* are most common in perch from Lakes Huron and Erie. The nematodes of perch from Lake Ontario have prevalences of 8% or less. The report of Bangham and Hunter (1939) of *Agamonema* sp. from perch in Lake Erie refers to an unidentified larval form, an immature nematode (J. Crites, pers. comm.), and will not be considered further.

In the present study, *Contracaecum* sp. is reported for the first time from perch in Lakes Michigan and Huron; all other nematodes found have been reported infecting perch from these lakes. Four nematode taxa were found in perch in the present study compared to the 15 nematode taxa reported in the literature. There are several possible reasons for this, including 1) I only examined perch from 2 Lake Michigan locations and Saginaw Bay, 2) more parasitological studies have been done on perch in Lakes Erie and Huron, and 3) it is difficult to determine if fish were collected from different habitats. It is pointless to discuss whether some nematodes of yellow perch have disappeared in the Great Lakes, because so few studies have been done in the past to which I can compare this study.

Dichelyne cotylophora infects yellow perch from all the Great Lakes and is commonly found in the anterior intestine. Visible lesions were not observed at the sites of adult attachment. I have found worms up to 8 mm in length. Based on experimental evidence, Baker (1984b) suggested that prey fish (cyprinid minnows) are intermediate hosts for *D. cotylophora.* This parasite is not host-specific to perch, since it has been reported from several fish species in Lake Michigan, St. Marys River, Lake Huron, Lake St. Clair, Lake Erie, and Lake Ontario (Ward and Magath, 1917; Pearse, 1924; Bangham, 1933, 1955; Bangham and Hunter, 1939; Muzzall,

Table 3. Reported nematodes of *Perca flavescens* from the Laurentian Great Lakes.

Species	Lake*	Prevalence†	Locality	Reference
Agamonema sp.‡	E	2 (2/128)	OH	Bangham and Hunter, 1939
Contracaecum sp.‡	M	3 (3/100)	IN	Michigan City, this study
		8 (5/640)	MI	Ludington, this study
	H	4 (4/100)	MI	The Black Hole, this study
Camallanus oxycephalus	H	—§	MI	Rosinski et al., 1997
	E	2 (1/45)	OH, ONT	Bangham and Hunter, 1939
		5 (5/93)	OH	Bangham, 1972
		—§	OH	Stromberg and Crites, 1972
		6 (45/735)	OH	Cooper et al., 1977
		7 (27/408)	ONT	Dechtiar and Nepszy, 1988
Dichelyne cotylophora	M	—§	WI	Pearse, 1924
		9 (1/11)	WI, IL	Amin, 1977
		47 (47/100)	IN	Michigan City, this study
		19 (12/64)	MI	Ludington, this study
	S	42 (10/24)	ONT	Dechtiar and Lawrie, 1988
	SMR	33 (24/73)	MI	Muzzall, 1984
	H	—§	ONT	Smedley, 1934
		55 (110/201)	ONT	Bangham, 1955
		2 (3/134)	ONT	Dechtiar et al., 1988
		—§	MI	Rosinski et al., 1997
		4 (4/100)	MI	The Black Hole, this study
		68 (68/100)	MI	Oak Point, this study
	LSC	—§	—	Ward and Magath, 1917
	E	—§	ONT	Smedley, 1934
		65 (45/69)	OH, ONT, NY, PA	Bangham and Hunter, 1939
		10 (76/735)	OH	Cooper et al., 1977
		—§	ONT	Baker, 1984a
		50 (6/12)‖	ONT	Baker, 1984b
		6 (25/408)	ONT	Dechtiar and Nepszy, 1988
	O	—§	ONT	Tedla and Fernando, 1969
		—§	ONT	Tedla and Fernando, 1970
		5 (7/150)	ONT	Dechtiar and Christie, 1988
Eustrongylides tubifex‡	M	2 (4/374)	MI	Allison, 1966
		3 (3/100)	IN	Michigan City, this study
	H	35 (293/831)	MI	Allison, 1966
		2 (3/134)	ONT	Dechtiar et al., 1988
		80 (193/240)	MI	Rosinski et al., 1997
		95 (95/100)	MI	The Black Hole, this study
		74 (74/100)	MI	Oak Point, this study
	E	38 (19/50)	OH	Measures, 1988b
	E	41 (304/735)	OH	Cooper et al., 1977
		—§	OH	Cooper et al., 1978
		—§	OH	Crites, 1982
		50 (204/408)	ONT	Dechtiar and Nepszy, 1988
	O	8 (5/150)	ONT	Dechtiar and Christie, 1988
Eustrongylides sp.‡	E	8 (8/98)	OH	Bangham, 1972
Hysterothylacium brachyurum†	S	33 (8/24)	ONT	Dechtiar and Lawrie, 1988
	E	4 (16/408)	ONT	Dechtiar and Nepszy, 1988
	O	8 (5/150)	ONT	Dechtiar and Christie, 1988
Philometra cylindracea	H	1 (2/201)	ONT	Bangham, 1955
		4 (5/134)	ONT	Dechtiar et al., 1988
		—§	MI	Salz, 1989
		24 (57/240)	MI	Rosinski et al., 1997
		10 (10/100)	MI	The Black Hole, this study
		16 (16/100)	MI	Oak Point, this study

Table 3. Continued.

Species	Lake*	Prevalence†	Locality	Reference
	E	1 (1/128)	OH, ONT	Bangham and Hunter, 1939
		8 (62/735)	OH	Cooper et al., 1977
		—§	OH	Crites, 1982
		10 (40/408)	ONT	Dechtiar and Nepszy, 1988
	O	5 (8/150)	ONT	Dechtiar and Christie, 1988
Raphidascaris acus‡	S	63 (15/24)	ONT	Dechtiar and Lawrie, 1988
	H	2 (3/134)	ONT	Dechtiar et al., 1988
Raphidascaris sp.‡		—§	MI	Rosinski et al., 1997
Rhabdochona canadensis Moravec and Arai, 1971	E	8 (32/408)	ONT	Dechtiar and Nepszy, 1988
Rhabdochona ovifilamenta Weller, 1938	M	1 (1/136)	MI	Weller, 1938
	S	8 (2/24)	ONT	Dechtiar and Lawrie, 1988
Spinitectus carolini Holl, 1928	E	9 (6/69)	OH	Jilek and Crites, 1981
	S	8 (2/24)	ONT	Dechtiar and Lawrie, 1988
Spinitectus gracilis Ward and Magath, 1917	O	1 (2/150)	ONT	Dechtiar and Christie, 1988
Spinitectus sp.	E	5 (5/98)	OH	Bangham, 1972

* E, Lake Erie; M, Lake Michigan; H, Lake Huron; S, Lake Superior; SMR, St. Marys River; LSC, Lake St. Clair; O, Lake Ontario.

† Percent infected (number of fish infected/number of fish examined).

‡ Larval stage.

§ Parasite present but prevalence not given.

‖ Prevalence calculated from winter 1984 sample.

1984; Dechtiar and Christie, 1988). Cooper et al. (1977) demonstrated that the prevalence of *D. cotylophora* in perch in the western basin of Lake Erie decreased from 1927–1929, to 1957, to 1974.

Rhabdochona spp. and *Spinitectus* spp. infrequently occur in yellow perch from Lakes Michigan, Superior, and Erie, and Lakes Superior, Erie, and Ontario, respectively. Both genera are found in the intestine of several fish species and do little or no damage to their hosts. They utilize mayfly larvae and other arthropods as intermediate hosts.

Species not found as adults in the intestine of yellow perch are: *H. brachyurum, R. acus, Raphidascaris* sp., *Contracaecum* sp., *P. cylindracea, E. tubifex,* and *Eustrongylides* sp. Larval *H. brachyurum* have been reported in perch from 3 of the Great Lakes. Dechtiar and Lawrie (1988) found *H. brachyurum* and *R. acus* larvae in the liver of perch from Lake Superior and suggested that moderate to heavy liver damage occurred with fibrosis. Similarly, encysted *H. brachyurum* caused liver damage to perch in Lake Ontario (Dechtiar and Christie, 1988). Piscivorous fishes serve as definitive hosts for *H. brachyurum* and *Raphidascaris* spp. *Contracaecum* spp. mature in piscivorous birds and mammals.

The redworm nematode complex of yellow perch in the Great Lakes is composed of *Camallanus oxycephalus, P. cylindracea,* and *E. tubifex.* The term "redworm" was coined by anglers asking the question, "What are these red worms in my fish?" (J. Crites, pers. comm.). *Camallanus oxycephalus* has been reported from yellow perch in 2 of the Great Lakes. Stromberg and Crites (1974) found that during July and August in Lake Erie, female *C. oxycephalus* protrude from the anus of white bass, *Morone chrysops,* and rupture, releasing infective larvae that are ingested by copepods. The life cycle is completed when infected copepods or small paratenic forage fish hosts are eaten by larger fish. Cooper et al. (1977) found that the prevalence of *C. oxycephalus* in yellow perch in western Lake Erie increased from 1927–1929, to 1957, to 1974.

In the present study, *P. cylindracea* only occurred in yellow perch from Saginaw Bay. Copepods are intermediate hosts for *P. cylindracea* (see Molnar and Fernando, 1975; Crites, 1982). It is not known if *P. cylindracea* utilizes a trans-

port host in its life cycle. *Philometra cylindracea* has been found in perch from 3 of the Great Lakes, occurring unencysted in the body cavity. This nematode matures in, and is host-specific to, yellow perch, since it has been reported from no other fish species. Mature females are about the same length as males (4 mm) or longer. Larvigerous females, which are delicate and have a thin transparent cuticle, may exceed 100 mm in length and are easily broken during host necropsy.

Eustrongylides tubifex had significantly higher prevalences, mean intensities, and mean abundances in yellow perch from Saginaw Bay than in those from Lake Michigan. Karmanova (1968) and Measures (1988a, b) reported that tubificid oligochaetes serve as intermediate hosts for *E. tubifex*. Although Brinkhurst (1967) and Schneider et al. (1969) found large numbers of tubificids in Saginaw Bay, Haas and Schaeffer (1992) did not find tubificids in perch stomachs in Saginaw Bay, and Rosinski et al. (1997) found them to be infrequent. The lack of tubificids in stomachs is surprising, since perch from Saginaw Bay and other areas of Lake Huron are heavily infected. Tubificids have been found in the stomachs of yellow perch from Lake Erie (J. Crites, pers. comm.), another lake where *E. tubifex* commonly occurs. The difference in infection values of *E. tubifex* between Saginaw Bay and Lake Michigan may be explained by the large number of tubificids in the bay and by the small numbers of them in Lake Michigan. Piscivorous birds (e.g., mergansers, *Mergus merganser* Linnaeus, 1758; see Measures, 1988c) serve as definitive hosts for *E. tubifex,* and differences in their numbers between these locations may also play a role in this difference.

Eustrongylides tubifex has been reported from yellow perch in 4 of the Great Lakes. It is infrequent in Lake Michigan, and the small number of perch examined from Lake Superior may not reflect its absence. Allison (1966) reported perch from the Detroit River infected with *E. tubifex*. Dechtiar and Christie (1988) found *E. tubifex* in several fish species from Lake Ontario and suggested that it caused damage to perch. This nematode is very common in yellow perch from Lake Erie. Interestingly, Bangham and Hunter (1939) did not report *E. tubifex* in an extensive survey of parasites of Lake Erie fishes, including 128 yellow perch. Bangham (1972) was the first to report the occurrence of *E. tubifex* in yellow perch collected in 1957 from Lake Erie.

Eustrongylides tubifex is pink to red in color and thicker than *P. cylindracea*. Larval *E. tubifex* in fish intermediate hosts can reach 10 cm in length. Cooper et al. (1978) and Crites (1982) demonstrated experimentally that *E. tubifex* can be transferred when a small infected fish is eaten by a larger one. Crites (1982) reported that *E. tubifex* can live in capsules of host origin for at least 1.5 yr and demonstrated that the walls of the capsule have several different tissues and are furnished with capillaries. The larvae are nourished during their development and growth in these capsules. Measures (1988b) reported on the pathology of *E. tubifex* in fishes, including the yellow perch. It appears that *E. tubifex* infections in perch do not give rise to immunity, since larvae of different lengths were found in the same perch in the present study.

Crites (1982) showed that *E. tubifex* and *P. cylindracea* were associated with weight loss in yellow perch. It is not known if this weight loss affected fecundity. In addition, *P. cylindracea* sometimes infected the ovaries of perch, but whether this impairs reproductive capacity was not determined. Allison (1966) and Salz (1989) suggested these *E. tubifex* and *P. cylindracea* play a role in reduced perch growth and high mortality.

Excluding the Salmoniformes, percids are probably the most important group of fishes in the Great Lakes. Based on a review of the literature and the present study, it appears that nematodes do not greatly harm yellow perch, except for *E. tubifex* and *P. cylindracea,* which commonly infect perch in Saginaw Bay, other areas of Lake Huron, and Lake Erie (Allison, 1966; Crites, 1982; Salz, 1989; Rosinski et al., 1997). These are Great Lakes areas where the catch rates of perch have declined (Francis et al., 1996), but the direct effects of *E. tubifex* and *P. cylindracea* on reducing the numbers of perch in these areas are not known.

Acknowledgments

I thank Dan Brazo, Indiana Department of Natural Resources, Michigan City, Indiana; Tom McComish, Ball State University, Muncie, Indiana; Rob Elliott and Doug Peterson, Michigan State University, East Lansing, Michigan; and Bob Haas, Jack Hodge, Dave Fielder, and Larry Shubel, Michigan Department of Natural Re-

sources, Mt. Clemens and Alpena, Michigan, for providing the yellow perch; Bernadette Hermann for technical assistance in 1996; and John Crites for reviewing an early draft of the manuscript and sharing information on the nematodes of yellow perch in the Great Lakes.

Literature Cited

Allison, L. N. 1966. The redworm (*Philometra cylindracea*) of yellow perch (*Perca flavescens*) in Michigan waters of the Great Lakes. Michigan Department of Conservation Research and Development Report 53, Institute for Fisheries Report 1712. 8 pp.

Amin, O. M. 1977. Helminth parasites of some southwestern Lake Michigan fishes. Proceedings of the Helminthological Society of Washington 44:210–217.

Baker, M. R. 1984a. Redescription of *Dichelyne* (*Cucullanellus*) *cotylophora* (Ward and Magath, 1917) (Nematoda: Cucullanidae) parasitic in freshwater fishes of eastern North America. Canadian Journal of Zoology 62:2053–2061.

———. 1984b. On the biology of *Dichelyne (Cucullanellus) cotylophora* (Ward and Magath, 1917) (Nematoda: Cucullanidae) in perch (*Perca flavescens*) from Lake Erie, Ontario. Canadian Journal of Zoology 62:2062–2073.

Bangham, R. V. 1933. Parasites of the spotted bass, *Micropterus pseudoalplites* Hubbs, and summary of parasites of smallmouth and largemouth bass from Ohio streams. Transactions of the American Fisheries Society 63:220–227.

———. 1955. Studies on fish parasites of Lake Huron and Manitoulin Island. American Midland Naturalist 53:184–194.

———. 1972. A resurvey of the fish parasites of western Lake Erie. Bulletin of the Ohio Biological Survey 4:1–23.

———, **and G. W. Hunter III.** 1939. Studies on fish parasites of Lake Erie. Distribution studies. Zoologica 24:385–448.

Brinkhurst, R. O. 1967. The distribution of aquatic oligochaetes in Saginaw Bay, Lake Huron. Limnology and Oceanography 12:137–143.

Cooper, C. L., R. R. Ashmead, and J. L. Crites. 1977. Prevalence of certain endoparasitic helminths of the yellow perch from western Lake Erie. Proceedings of the Helminthological Society of Washington 44:96.

———, **J. L. Crites, and D. J. Sprinkle-Fastkie.** 1978. Population biology and behavior of larval *Eustrongylides tubifex* (Nematoda: Dioctophymatida) in poikilothermous hosts. Journal of Parasitology 64:102–107.

Crites, J. L. 1982. Impact of the nematode parasite *Eustrongylides tubifex* on yellow perch in Lake Erie. U.S. Department of Commerce Commercial Fisheries Research and Developmental Project. 3-298-D. Clear Technical Report 258. 84 pp.

Dechtiar, A. O., and W. J. Christie. 1988. Survey of the parasite fauna of Lake Ontario fishes, 1961–1971. Great Lakes Fisheries Commission, Technical Report 51:66–106.

———, **J. J. Collins, and J. A. Reckahn.** 1988. Survey of the parasite fauna of Lake Huron fishes, 1961–1971. Great Lakes Fisheries Commission, Technical Report 51:19–48.

———, **and A. H. Lawrie.** 1988. Survey of the parasite fauna of Lake Superior fishes, 1969–1975. Great Lakes Fisheries Commission, Technical Report 51:1–18.

———, **and S. J. Nepszy.** 1988. Survey of the parasite fauna of selected fish species from Lake Erie, 1970–1975. Great Lakes Fisheries Commission, Technical Report 51:49–65.

Francis, J. T., S. R. Robillard, and J. E. Marsden. 1996. Yellow perch management in Lake Michigan: a multi-jurisdictional challenge. Fisheries 21: 18–20.

Haas, R. C., and J. S. Schaeffer. 1992. Predator–prey and competitive interactions among walleye, yellow perch, and other forage fishes in Saginaw Bay, Lake Huron. Michigan Department of Natural Resources, Fisheries Division, Research Report 1984. 135 pp.

Jilek, R., and J. L. Crites. 1981. Prevalence of *Spinitectus carolini* Holl, 1928, and *Spinitectus gracilis* Ward and Magath, 1916 (Spirurida: Nematoda) in fishes from Lake Erie. Canadian Journal of Zoology 59:141–142.

Karmanova, E. M. 1968. Dioctophymidea of Animals and Man and Diseases Caused by Them. Fundamentals of Nematology. Vol. 20. Academy of Science of the USSR. Translated and published for U.S. Department of Agriculture. Amerind Publishing, New Delhi, 1985. 383 pp.

Measures, L. N. 1988a. The development of *Eustrongylides tubifex* (Nematoda: Dioctophymatoidea) in oligochaetes. Journal of Parasitology 74:296–304.

———. 1988b. Epizootiology, pathology, and description of *Eustrongylides tubifex* (Nematoda: Dioctophymatoidea) in fish. Canadian Journal of Zoology 68:2212–2222.

———. 1988c. The development and pathogenesis of *Eustrongylides tubifex* (Nematoda: Dioctophymatoidea) in piscivorous birds. Canadian Journal of Zoology 66:2223–2232.

Molnar, K., and C. H. Fernando. 1975. Morphology and development of *Philometra cylindracea* (Ward and Magath, 1916) (Nematoda: Philometridae). Journal of Helminthology 49:19–24.

Muzzall, P. M. 1984. Helminths of fishes from the St. Marys River, Michigan. Canadian Journal of Zoology 62:516–519.

Pearse, A. S. 1924. The parasites of lake fishes. Transactions of the Wisconsin Academy of Sciences, Arts, and Letters 21:161–194.

Rosinski, J. L., P. M. Muzzall, and R. C. Haas. 1997. Nematodes of yellow perch from Saginaw Bay, Lake Huron with emphasis on *Eustrongylides tubifex* (Dioctophymatidae) and *Philometra cylindracea* (Philometridae). Journal of the Helminthological Society of Washington 64:96–101.

Salz, R. J. 1989. Factors influencing growth and survival of yellow perch from Saginaw Bay, Lake

Huron. Michigan Department of Natural Resources, Fisheries Division, Fisheries Research Report 1964. 80 pp.

Schneider, J. C., F. C. Hooper, and A. M. Beeton. 1969. The distribution and abundance of benthic fauna in Saginaw Bay, Lake Huron. Proceedings of the 12th Conference of Great Lakes Research 1969:80–90.

Smedley, E. M. 1934. Some parasitic nematodes from Canadian fishes. Journal of Helminthology 12: 205–220.

Stromberg, P. C., and J. L. Crites. 1972. A new nematode *Dichelyne bullocki* sp. n. (Cucullanidae) from *Fundulus heteroclitus* (Linnaeus). Proceedings of the Helminthological Society of Washington 39:131–134.

———, **and** ———. 1974. The life cycle and development of *Camallanus oxycephalus* Ward and Magath, 1916 (Nematoda: Camallanidae). Journal of Parasitology 60:117–124.

Tedla, S., and C. H. Fernando. 1969. Observations on the seasonal changes of the parasite fauna of yellow perch (*Perca flavescens*) from the Bay of Quinte, Lake Ontario. Journal of the Fisheries Research Board of Canada 26:833–843.

———, **and** ———. 1970. On the characterization of the parasite fauna of the yellow perch (*Perca fluviatilis* L.) in five lakes in southern Ontario, Canada. Helminthologia 11:23–33.

Ward, H. B., and T. B. Magath. 1917 (dated 1916). Notes on some nematodes from freshwater fishes. Journal of Parasitology 3:57–64.

Weller, T. H. 1938. Description of *Rhabdochona ovifilamenta* n. sp. (Nematoda: Thelaziidae) with a note on the life history. Journal of Parasitology 24:403–408.

NOTICE

EFFECTIVE WITH THE JANUARY, 2000 (VOL. 67, NO. 1) ISSUE, THE

JOURNAL OF THE HELMINTHOLOGICAL SOCIETY OF WASHINGTON

WILL BE RENAMED

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