THE JOURNAL OF PARASITOLOGY
Vol. 55, No. 5, October 1969, p. 1063–1066

CHANGES IN THE PARASITE FAUNA OF THE WHITE PERCH, *ROCCUS AMERICANUS* (GMELIN), COLONIZING NEW HABITATS

Shibru Tedla and C. H. Fernando
Department of Biology, University of Waterloo, Waterloo, Ontario, Canada

ABSTRACT: The white perch, *Roccus americanus* (Gmelin), of the Atlantic coastal plain has recently colonized Oneida Lake, New York, and Lake Ontario. The fish has lost some members of its parasite fauna during the process. It has acquired new parasites, namely the larval forms of *Apophallus venustus* (Ransom), *Diplostomulum huronense* (LaRue), and *Contracaecum spiculigerum* (Rud.) and the adult forms of *Proteocephalus pearsei* LaRue and *Ergasilus confusus* Bere, all of which have been recorded from the yellow perch, *Perca fluviatilis* L., an abundant fish in both habitats.

The white perch, *Roccus americanus* (Gmelin), an estuarine species, has colonized some lakes in eastern Canada and the USA over the last 20 years (Scott and Christie, 1963). This gave us an opportunity to study the effect of this colonization on the parasite fauna of the fish.

The natural range of *Roccus americanus* prior to 1950 was the Atlantic coastal plain from Canada's Maritime Provinces southward to South Carolina (Sheri, 1968). Scott and Christie (loc. cit.) have given details of its invasion of Lake Ontario. They stated "The white perch used Mohawk Valley-Oneida Lake and the Erie Barge Canal Systems in New York and is presumed to have entered Lake Ontario via the Oswego River in New York State." Their evidence suggested that the fish invaded Lakes Oneida and Ontario in 1950 and 1952, respectively. The white perch is now the dominant fish in the Bay of Quinte, an arm of Lake Ontario (Sheri and Power, 1968).

MATERIALS AND METHODS

The white perch were collected by using trawls, gill nets, angling, and Windermere traps. The latter is a cylindrical apparatus. Each trap was 4 ft long and 2 ft in diameter, with an opening on one side tapering to 4 inches, and a door on the other side through which fish could be removed. The traps were made of 0.5-inch wire gauze or 0.5-inch nylon mesh. Samples were taken bimonthly from the Bay of Quinte for 1.5 years. Two samples were obtained from Oneida Lake, one in October 1967 and one in July 1968. A total of 220 specimens, 198 from the Bay of Quinte and 22 from Oneida Lake, respectively, were examined. In addition, the stomach contents of 131 pike, *Esox lucius* L. (the main predator of perch), collected from the Bay of Quinte between 1958 and 1964, were analyzed using the "number method" as reviewed by Hynes (1950).

The examination of fish and the subsequent treatment of parasite specimens are those used by Tedla and Fernando (1969a).

Throughout the present account the terms "incidence" and "intensity" are used to denote the percentage of infected hosts in a sample and the average number of parasites recovered per infected host, respectively.

RESULTS

The species of parasites recovered from the white perch are shown in Table I. Sindermann's (1953) data on the parasites of the white perch in its natural habitat are included for comparison. The percentage composition of the identified food items of the pike are shown in Table II.

Contracaecum spiculigerum (Rud.), *Apophallus venustus* (Ransom), *Diplostomulum huronense* (LaRue), and immature adults of *Ergasilus confusus* Bere, all new to the host, were recovered from the white perch in the Bay of Quinte. Immature adult specimens of *Proteocephalus pearsei* LaRue, which is also new to the host, in addition to *E. confusus* (immature), were found in the white perch in Oneida Lake.

DISCUSSION

Twenty-one species of parasites are known to infect the white perch (Hoffman, 1967); whether some of this infection is atypical is not certain. Sindermann (1953) recorded 11 species of parasites from the same host in Massachusetts (Table I) within its natural range and considered it a lightly parasitized host.

Our findings and those of Sindermann's (loc. cit.) are distinctly different (Table I).

Received for publication 15 April 1969.

TABLE I. *The parasite fauna of the white perch,* Roccus americanus *(Gmelin), in north central Massachusetts, "A," the Bay of Quinte, Lake Ontario, "B," and Lake Oneida, New York, "C." Data of Column "A" is that of Sindermann (1953).*

	"A"	"B"		"C"	
	Incidence	Incidence	Intensity	Incidence	Intensity
Henneguya sp.	–	4.0	–	–	–
Cleidodiscus sp.	–	76.8	26.8	–	–
Tetraonchinae	30–69	–	–	–	–
**Diplostomulum huronense*	–	3.0	2.3	–	–
**Apophallus venustus*	–	10.1	1.0	–	–
**Clinostomum marginatum*	1–9	4.0	1.0	–	–
Crepidostomum cooperi	30–69	–	–	–	–
C. cornutum	1–9	–	–	–	–
Bunodera sacculata	1–9	–	–	–	–
**Triaenophorus nodulosus*	–	21.7	1.6	–	–
**Proteocephalus ambloplitis*	30–69	–	–	–	–
P. pearsei	–	–	–	3.8	1.0
Eubothrium crassum	1–9	12.1	1.1	–	–
**Contracaecum spiculigerum*	–	8.6	1.0	–	–
Dacnitoides cotylophora	10–29	5.1	1.0	–	–
Spinitectus carolini	10–29	–	–	–	–
Lernaea cruciata	10–29	–	–	–	–
Ergasilus confusus	–	4.0	1.0	7.7	1.0
**Lampsilis radiata* (glochidia)	–	30.8	5.8	–	–
Glochidia	1–9	–	–	–	–
Piscicolidae	1–9	–	–	–	–

* Larval forms.

Composition of the parasite fauna of a species of fish may vary in different water bodies and even in different parts of the same body of water (Van Cleave and Mueller, 1934; Bangham and Hunter, 1939) but the differences have not been so great as shown here between the fish of Massachusetts and Lake Ontario.

Six of the parasites recorded by Sindermann (loc. cit.), namely *Crepidostomum cooperi* Hopkins, *C. cornutum* (Osborn), *Bunodera sacculata* Van Cleave and Mueller, *Proteocephalus ambloplitis* (Leidy), *Spinitectus carolini* Holl, and *Lernaea cruciata* (Le Sueur), were not recorded by us from the white perch in the Bay of Quinte or in Oneida Lake. Of these *B. sacculata* and *C. cooperi* were found in the yellow perch examined concurrently in the Bay of Quinte (Tedla and Fernando, 1969a). Van Cleave and Mueller (1934) recorded *Proteocephalus ambloplitis* in addition to *B. sacculata* and *C. cooperi* from the yellow perch in Oneida Lake. The absence of the latter three parasites in the white perch could not be accounted for, since the yellow perch

TABLE II. *Stomach contents of the pike,* Esox lucius *L., in the Bay of Quinte, Lake Ontario.*

Calendar year	1958	1959	1960	1961	1962	1963	1964
No. of pike examined	29	13	24	61	41	47	4
No. of pike with fish in their stomachs	14	4	14	33	28	36	2
Identified food items	Percentage composition of identified food items						
Roccus americanus (Gmelin)	18.2	–	7.1	34.8	48.0	84.1	100.0
Perca fluviatilis (Linnaeus)	27.3	–	35.7	4.3	8.0	5.3	–
Percopsis omiscomaycus (Walbaum)	–	75.0	21.4	34.8	16.0	5.3	–
Alosa pseudoharengus (Wilson)	54.5	25.0	14.3	17.4	28.0	–	–
Osmerus mordax (Mitchill)	–	–	21.4	–	–	–	–
Ambloplites rupestris (Rafinesque)	–	–	–	8.7	–	5.3	–

which has large populations in both habitats (Sheri, 1968; Noble, pers. comm.) would maintain the circulation of these parasites. The loss of the remaining parasites, which need intermediate hosts in their developmental history, may be due to the absence of the intermediate hosts in the new habitats invaded by the white perch. The possibility that these parasites were absent from the stocks invading the two habitats could not be discounted.

The white perch in the Bay of Quinte and Oneida Lake have acquired new parasites as mentioned above. The plerocercoid *Triaenophorus nodulosus* has also been recovered from the white perch in the Bay of Quinte (Tedla and Fernando, 1969c). None of these parasites show strict host specificity to their fish hosts (Hoffman, 1967), hence it is not surprising to find them in the white perch. All the parasites which are new to the white perch in the Bay of Quinte have been recovered from the yellow perch examined concurrently in the same habitat (Tedla and Fernando, 1969a).

Our data from Oneida Lake were not extensive. It is natural that the greater the number of specimens examined, the higher the chances of encountering parasites. Allowance should be made for this fact in interpreting the observations as well as the fact that the data obtained were those of summer and early fall.

Sindermann (loc. cit.) recorded a monogenean belonging to the subfamily Tetraonchinae from the white perch. We recovered a monogenean species belonging to the genus *Cleidodiscus* whose specific status is yet uncertain. It appears to be closely related to *Cleidodiscus principalis* (Mizelle) and *C. mulleus* (Mueller). Since most of the parasites belonging to the genus are strictly host specific, we assume that Sindermann's and our specimens belong to the same species. This parasite has a high incidence and intensity of infection on the white perch in the Bay of Quinte but was not recovered from this host in Oneida Lake. Its absence in Oneida Lake cannot be accounted for.

Unspecified glochidia were recovered by Sindermann (loc. cit.) from the white perch. We found the glochidia of *Lampsilis radiata* (Gmelin) on the gill filaments of this fish. The parasite did not undergo metamorphosis on this host (Tedla and Fernando, 1969b); hence this fish must be an unsuitable host for this parasite.

Tedla and Fernando (1969c) found that the plerocercoid of *Triaenophorus nodulosus*, a new acquisition by the white perch, had a higher incidence and intensity of infection in this host than in the yellow perch, which is normally more heavily infected by this parasite than most other species of fish (Tedla and Fernando, 1969c). The white perch has also become an important food item of the pike (Table II), which is the final host of this parasite. Its role as an important second intermediate host in the new habitat should thus be noted.

ACKNOWLEDGMENTS

This investigation was supported by Grant A-3478 made to one of us (C.H.F.) by the National Research Council of Canada and a grant from the National Sportsmen's Show. Thanks are due to Dr. J. Forney and Dr. R. L. Noble of Cornell University and Mr. W. J. Christie of Glenora Fisheries Station for providing us with some of the material from Oneida Lake and the data on the stomach contents of the pike, respectively.

LITERATURE CITED

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

Hoffman, G. L. 1967. Parasites of North American Freshwater Fishes. Univ. California Press, 486 p.

Hynes, H. B. N. 1950. The food of freshwater sticklebacks (*Gasterosteus aculeatus* and *Pygosteus pungitius*), with a review of the methods used in studies of the food of fishes. J. Anim. Ecol. **19**: 36–58.

Scott, W. B., and W. J. Christie. 1963. The invasion of the lower Great Lakes by the white perch, *Roccus americanus* (Gmelin). J. Fish. Res. Bd. Canada **20**: 1189–1195.

Sheri, A. N. 1968. Growth dynamics of white perch, *Roccus americanus* during colonization of Bay of Quinte, Lake Ontario. Ph.D. thesis, Univ. of Waterloo, Waterloo, Ontario, 365 p.

———, and G. Power. 1968. Reproduction of white perch, *Roccus americanus*, in the Bay of Quinte, Lake Ontario. J. Fish. Res. Bd. Canada **25**: 2225–2231.

Sindermann, C. J. 1953. Parasites of fishes of north central Massachusetts. Fisheries Rept. Lakes of North Central Massachusetts, p. 5–28.

Tedla, S., and C. H. Fernando. 1969a. Ob-

servations on the seasonal changes of the parasite fauna of yellow perch, *Perca flavescens* (Mitchill) from the Bay of Quinte, Lake Ontario. J. Fish. Res. Bd. Canada **26:** 833–843.

———, AND ———. 1969b. Observations on the glochidia of *Lampsilis radiata* (Gmelin) infesting yellow perch, *Perca flavescens* (Mitchill) in the Bay of Quinte, Lake Ontario. Can. J. Zool. **47:** 705–712.

———, AND ———. 1969c. Occurrence of plerocercoids of *Triaenophorus nodulosus* (Pallas) in the white perch, *Roccus americanus*. J. Parasit. **55:** 334.

VAN CLEAVE, H. J., AND J. F. MUELLER. 1934. Parasites of Oneida Lake fishes. Part III. A biological and ecological survey of the worm parasites. Roosevelt Wild Life Ann. **3:** 161–334.

RESEARCH NOTE . . .

Haemotoxenus veliferus in Cattle in Uganda and Kenya

In 1964 a new blood-parasite of cattle, associated with the erythrocytes, was described in Madagascar (Uilenberg, 1964, Rev. Elev. Med. Vet. Pays Trop. **17:** 655). Because of the peculiar morphological characteristics of the organism it was named *Haemotoxenus veliferus* g. n.; sp. n. More detailed information on this parasite has since been published by the same author (1965a, Rev. Elev. Med. Vet. Pays Trop. **18:** 429 and 1965b, Bull. Soc. Path. Exot. **58:** 432).

In 1967 the organism was reported to occur also in cattle in Nigeria (West Africa) (Folkers and Kuil, 1967, Bull. Epizoot. Dis. Afr. **15:** 121).

From a few accidental observations it appeared that the parasite is also present in cattle in Uganda and Kenya. The occurrence of the organism in Uganda was revealed during the examination of blood smears from cattle, provided by Dr. C. Terpstra of the Animal Health Research Centre in Entebbe. These Nganda and Nganda × Yersey cattle had been experimentally infected with *Theileria parva*. The presence of the parasite in Kenya was established when examining blood smears collected by Dr. E. Goedbloed of the Medical Research Centre in Nairobi during a trypanosomiasis survey in cattle on Mfangano Island in Lake Victoria. In total 40 thin blood smears were examined of which 31 showed an infection with a *Theileria* sp., 2 an infection with *Trypanosoma vivax*, and 1 an infection with *Haemotoxenus veliferus*.

These observations strongly suggest that *Haemotoxenus veliferus* is a more common parasite of cattle, at least in Africa, than was previously believed.

Jannie Buys and C. Folkers, Department of Parasitology, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, Nigeria, **and N. M. Perié** Institute for Tropical and Protozoan Diseases, Faculty of Veterinary Medicine, State University Utrecht, the Netherlands