PREVALENCE OF THE PARASITE *CYSTOOPSIS ACIPENSERI* (NEMATODA) IN JUVENILE WHITE STURGEONS IN THE LOWER COLUMBIA RIVER

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Prevalence of the Parasite *Cystoopsis acipenseri* (Nematoda) in Juvenile White Sturgeons in the Lower Columbia River

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Abstract.—Juvenile white sturgeons *Acipenser transmontanus* in the lower Columbia River (downstream from the lowermost dam) of Oregon and Washington were examined for the nematode parasite *Cystoopsis acipenseri* from 1987 through 1991. Prevalence of the parasite in juvenile white sturgeons varied annually, ranging from 1% in 1989 to 14% in 1987. Fork lengths of infected white sturgeons ranged from 240 to 452 mm.

The white sturgeon *Acipenser transmontanus* is the largest species of North American sturgeons. The white sturgeon, an anadromous species, is distributed from the Aleutian Islands of Alaska to Monterey, California (Scott and Crossman 1973). In the Columbia River system, some white sturgeon populations have become effectively landlocked as a result of dam construction (Cochnauer et al. 1985; Beamesderfer et al. 1990).

From 1987 through 1991, spawning characteristics, early life history, and habitat use of white sturgeons were studied in the lower Columbia River. Numerous juvenile white sturgeons were collected during the 5-year study and examined for the nematode parasite *Cystoopsis acipenseri*. The parasite is contained in blisterlike cysts located just under the skin of affected fish (Wagner 1867; Chitwood and McIntosh 1950; Markevich 1951; Figure 1).

Cystoopsis acipenseri was first observed in the sterlet *Acipenser ruthenus* in the former USSR (Wagner 1867) and for a long time was thought to be a specific parasite of sterlets. In the mid-1900s, the parasite was found in Russian sturgeon *A. gueldenstaedti* (Nechaeva 1953) and in stellate sturgeon *A. stellatus* and Amur sturgeon *A. schrencki* (Saidov 1954). In North America, *C. acipenseri* was first reported in white sturgeon from the Columbia River, Oregon (Chitwood and McIntosh 1950), and later in white sturgeon from the Fraser River, British Columbia (Margolis and McDonald 1986; McDonald et al. 1989).

Little is known about *C. acipenseri* in wild populations of white sturgeons. This paper describes the prevalence of *C. acipenseri* infection in juvenile white sturgeons from the lower Columbia River (downstream from Bonneville Dam; Figure 2) and the size range of white sturgeons infected with *C. acipenseri*.

Methods

Five bottom trawls were used to sample the lower Columbia River for juvenile white sturgeons: a 3.1-m plumb staff beam trawl, a 3.0-m beam trawl, a standard 4.9-m semiballoon shrimp trawl, a modified 4.9-m semiballoon shrimp trawl, and a 7.9-m shrimp trawl (see McCabe and McConnell [1988] and McCabe and Hinton [1991] for more detailed descriptions of the trawls). The 7.9-m shrimp trawl was the principal trawl used in the study. Mesh size in the 7.9-m trawl was 38 mm (stretched measure) in the body; a 10-mm-mesh liner was inserted in the cod end of the net. Trawl efforts with the 7.9-m trawl were usually 5 min in duration in an upstream direction.

Bottom trawling was conducted from late March or early April through September or October of each year at selected locations from river kilometer 29 to km 231 (range for the entire study, not necessarily the range for each year; Figure 2); km 0 is located at the mouth of the Columbia River. In 1987 and 1989, some sampling was conducted in November. Trawling effort and geographic range of sampling varied among years. In 1987–1989, more trawling was done in the river upstream from km 120 than in the river downstream from km 120. However, in 1990–1991,

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FIGURE 1.—A juvenile white sturgeon infected with the nematode parasite *Cystoopsis acipenseri*; the fish was collected in the lower Columbia River.

much more trawling was done in the river between km 46 and km 120 than in previous years.

White sturgeons captured in bottom trawls were measured for fork length in millimeters and examined for the blisterlike cysts typical of *C. acipenseri* infection (Chitwood and McIntosh 1950). Examination of parasites contained in the cysts (taken from white sturgeons collected in the lower Columbia River prior to this study) confirmed their identity as *C. acipenseri* (T. C. Coley, U.S. Fish and Wildlife Service, Office of Columbia River Coordinator, personal communication). White sturgeons shorter than 175 mm were not routinely examined for *C. acipenseri*. No attempt was made

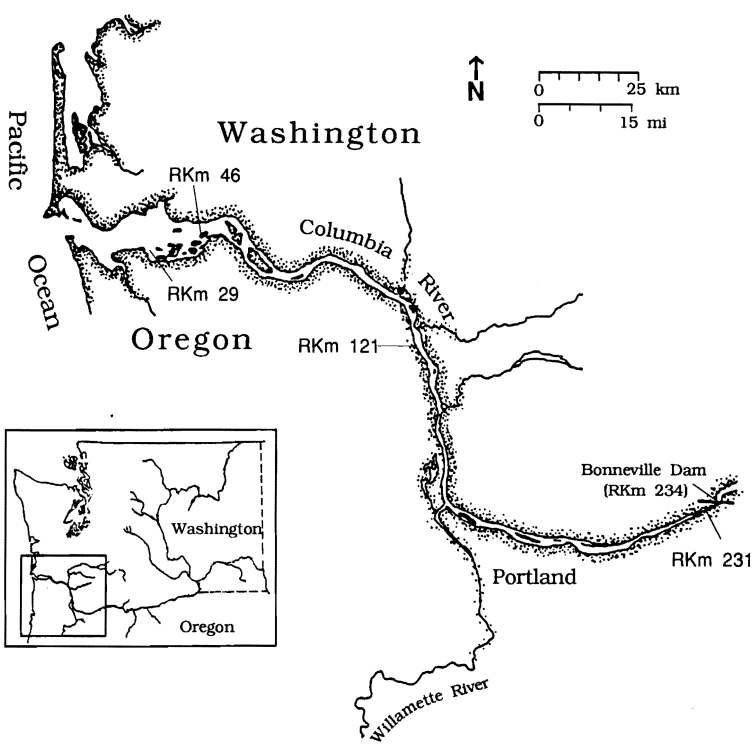

FIGURE 2.—The lower Columbia River. RKm = river kilometers, measured from the river's mouth.

TABLE 1.—Prevalence of *Cystoopsis acipenseri* infection in white sturgeons of the lower Columbia River, 1987–1991. Capture location is the geographic range in river kilometers (measured from the river's mouth).

Year	Number of fish examined	Number of infected fish (% infected)	Fork lengths of infected fish (range, mm)	Capture location of infected fish (river km)
1987	1,534	217 (14%)	240–442	49–217
1988	1,824	148 (8%)	252–433	121–212
1989	1,822	24 (1%)	294–405	46–212
1990	903	31 (3%)	291–379	50–212
1991	726	60 (8%)	252–452	45–212

to quantify the number of blisterlike cysts on infected white sturgeons.

Results

Prevalence of *C. acipenseri* infection in juvenile white sturgeons in the lower Columbia River during the 5-year study ranged from 1% (in 1989) to 14% (in 1987; Table 1). The length range of infected white sturgeons was similar throughout the study. During the 5-year study, the smallest infected white sturgeon was 240 mm long and the largest was 452 mm long (fork length). White sturgeons longer than 452 mm (up to 1,030 mm) were routinely examined; however, no parasites were observed. In 1988, infected white sturgeons were found over a smaller geographic range in the lower Columbia River (Table 1).

Discussion

Cystoopsis acipenseri is not confined to white sturgeons in the lower Columbia River. The parasite has also been observed in white sturgeons collected in the lower Fraser River, British Columbia (Margolis and McDonald 1986; McDonald et al. 1989). In 1986, McDonald et al. (1989) examined 189 white sturgeons collected in the lower Fraser River and found that 11% were infected with *C. acipenseri.* This parasite has also been observed in juvenile white sturgeons collected in three impoundments immediately upstream from Bonneville Dam (Duke et al. 1990). In 1989, prevalence of *C. acipenseri* infection in white sturgeons in the three impoundments ranged from 1 to 10%, whereas in the lower Columbia River the prevalence was 1%. In yearling and 2-year-old sterlets collected in the former USSR, the prevalence of *C. acipenseri* infection was 27.4% (Skorikov 1903).

It is not known how white sturgeons in the Columbia River are infected by *C. acipenseri,* but it is likely that the parasite enters the fish's digestive tract via an intermediate host. In experiments with sterlets, Janicki and Rašin (1929) determined that amphipods were the intermediate hosts for *C. acipenseri.* After entry into the sterlet's intestine, the larval parasite burrows through the intestine and surrounding tissues until it reaches the subcutaneous fatty tissue, where it encysts and grows to sexual maturity (Bauer 1959; Cheng 1986). If amphipods are the intermediate hosts for *C. acipenseri* in the lower Columbia River, juvenile white sturgeons could be exposed to the parasite frequently. McCabe and Hinton (1990) found that the amphipod *Corophium salmonis* was a very important prey for juvenile white sturgeons shorter than 726 mm in fork length. Additional research should be conducted to determine if *Corophium salmonis* is an intermediate host for *C. acipenseri.*

If *C. acipenseri* affects white sturgeons in a fashion similar to the way it affects sterlets, it probably does not kill the fish. Skorikov (1903) concluded that infected sterlets were not killed by the parasite. Bauer (1959) also suggested that sterlets develop postinvasion immunity from previous infection. No information was available on how the parasite affected the growth rate of sterlets (Bauer 1959).

Cystoopsis acipenseri appears to infect only smaller sturgeons. In this study, the maximum fork length of an infected white sturgeon was 452 mm. The fork length range of infected white sturgeons in the lower Fraser River study was 243–798 mm (McDonald et al. 1989). The fork length range of infected white sturgeons collected in the three impoundments immediately upstream from Bonneville Dam was 317–765 mm (Duke et al. 1990). Skorikov (1903) reported that, for sterlets, infected individuals ranged in length from 100 to 250 mm, and the highest prevalence of *C. acipenseri* infection was in 140–180-mm fish (i.e., mainly 2-year-old fish). Apparently, the parasite is rare in older sturgeons (Bauer 1959). No *C. acipenseri* were found in marketable acipenserids in the Volga Delta (Dogel' and Bykhovskii 1939).

If white sturgeons in the lower Columbia River are infected by *C. acipenseri* at a size as small as reported for sterlets by Skorikov (1903), it is possible that the prevalence of infection in Columbia River white sturgeons is somewhat higher than reported here. White sturgeons shorter than 175 mm were not routinely examined for *C. acipenseri* during this study.

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