Technical Report 99-4

EFFECTS OF A SHAD FISHERY ON PASSAGE OF ADULT CHINOOK SALMON THROUGH THE OREGON-SHORE FISHWAY LADDER AT THE DALLES DAM - 1996

A report for Project MPE-P-95-1

by

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Abstract

A fishery for American shad *Alosa sapidissima* at the exit of the Oregon-shore ladder at The Dalles Dam in the spring of 1996 had the potential to disrupt passage of adult chinook salmon *Oncorhynchus tshawytscha* through the ladder. We evaluated the effects of the shad fishery on passage by monitoring chinook salmon with radio transmitters as they passed through the Oregon-shore fishway. Passage times for 54 radio-tagged chinook salmon that exited the ladder during the period the shad fishery occurred were compared to passage times for 62 radio-tagged chinook salmon that passed the dam prior to the shad fishery. We found no differences in median times for chinook salmon to pass through and exit the ladder before and during the shad fishery using this simple comparison.

Introduction

A fishery for American shad *Alosa sapidissima* was conducted by members of the Yakima Tribe at The Dalles Dam in 1996. Shad were collected in a net as they exited the Oregon-shore ladder at The Dalles Dam (Figure 1). The trap was positioned across one of the two exits of the fish ladder and collected fish moving in the upper half of the water column. Chinook salmon *Oncorhynchus tshawytscha* that exited the ladder low in the water column could pass under the trap (Figure 2). There was a concern that activity associated with the fishery (unusual odors, sounds, etc.) would inhibit the passage of salmon through the ladder. We monitored adult chinook salmon outfitted with radio transmitters to determine if passage through the Oregon-shore fishway ladder at The Dalles Dam was affected by the shad fishery. Times for chinook salmon with transmitters to pass through the Oregon-shore ladder during the shad fishery were compared to times prior to operation of the fishery.

Methods

Effects of operating the shad fishery at The Dalles Dam in 1996 on adult chinook salmon passage were evaluated by comparing passage of radio-tagged chinook salmon prior to and during the fishery. The Dalles Dam, at river kilometer (rkm) 308.2 on the Columbia River, has a 23-bay spillway adjacent to the Washington shore and a 22-turbine powerhouse adjacent to the Oregon shore (Figure 1). The dam is in an L-shaped configuration with the powerhouse situated parallel to the Oregon shore. There are two fishways at the dam, one on the Washington shore adjacent to the spillway (north ladder) and one on the Oregon shore (east ladder) adjacent to the powerhouse. The Oregon-shore ladder connects to the powerhouse collection channel. Shad were fished using a net trap positioned at one of the two outlets of the Oregon-shore ladder (Figure 1). The trap was designed to fish the upper half of the water column, thus allowing salmon to pass under the trap and exit the ladder (Figure 2).

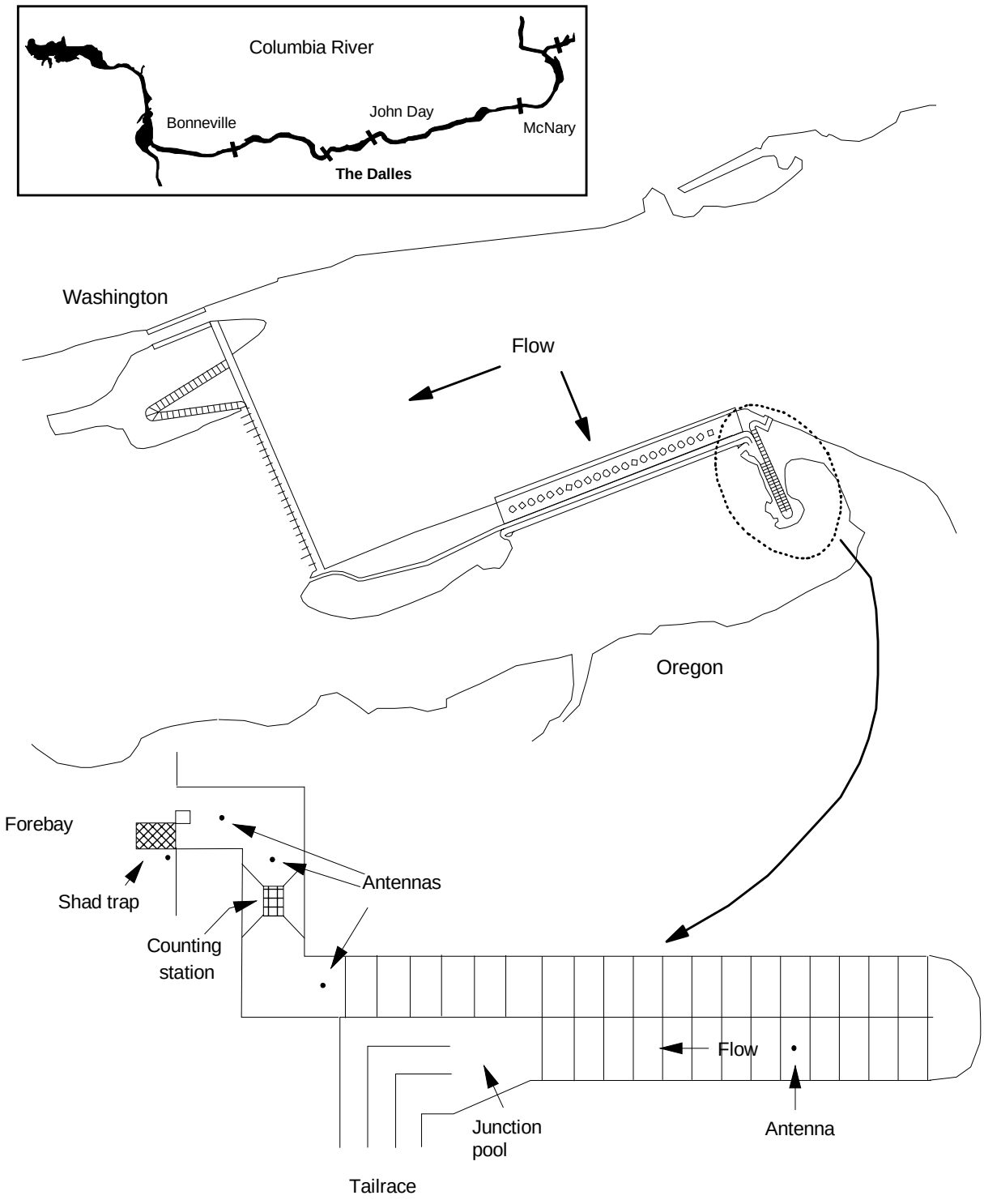

Figure 1. The Dalles Dam and diagram of Oregon-shore fishway ladder (not to scale) with locations of underwater radio antennas, counting station, and shad trap used during 1996. Inset contains locations of dams in the lower Columbia River.

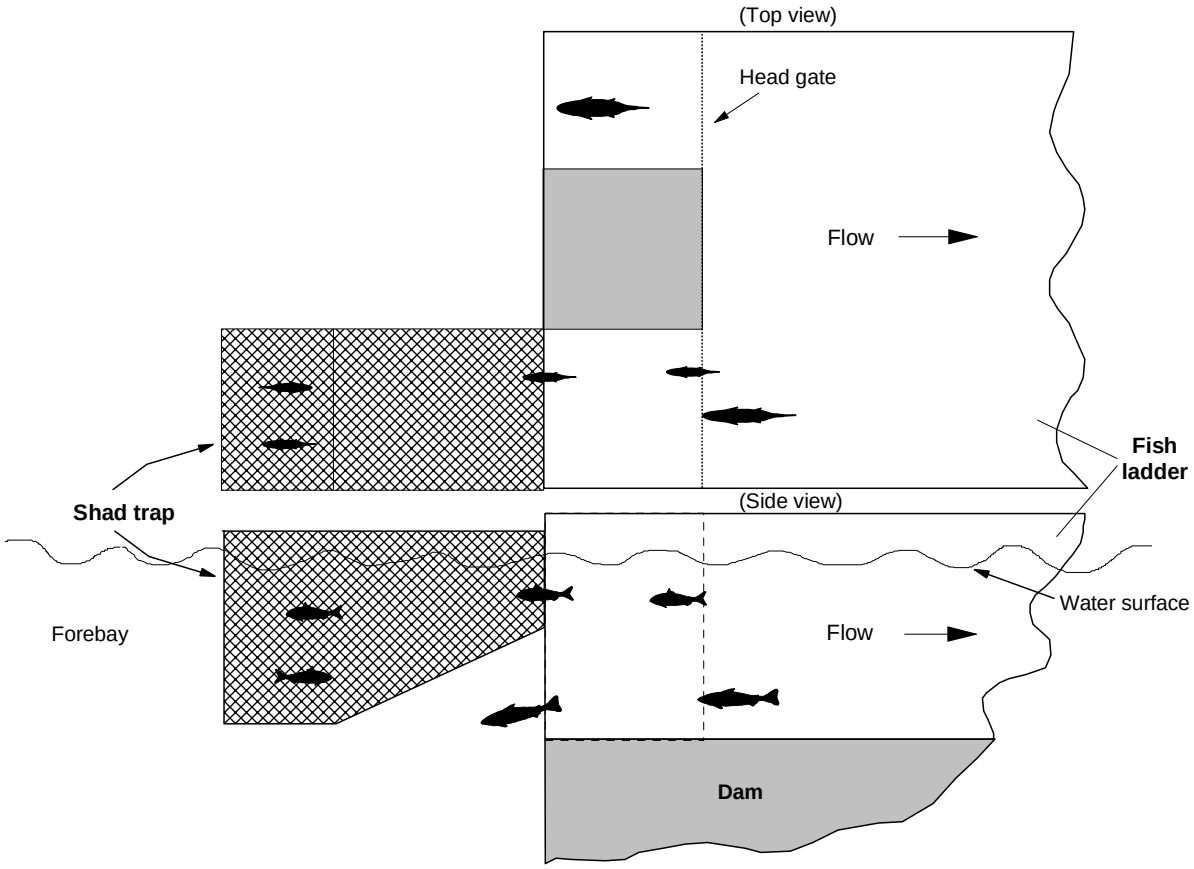

Figure 2. Top and side views of the exit to Oregon-shore fishway ladder at The Dalles Dam with shad trap. Trap dimensions were 6 m long, 3 m wide, and from 1.8 to 3.7 m depth.

Radio transmitters and receivers used in this study were manufactured by Lotek Engineering, Inc[1]. of Newmarket, Ontario, Canada. Transmitters were 83 mm long x 16 mm diameter with a 43 cm wire antenna. Transmitters emitted a digitally coded signal every 5 seconds. Transmitter signals were interpreted by radio receivers as a unique numerical code on the transmitted channel (frequency). Transmitter frequencies ranged from 149.480 (channel 9) to 149.740 MHz (channel 22) in 0.02 MHz increments. SRX-400 sequentially scanning receivers, set to scan for 6 seconds on each channel, were connected to 9-element yagi antennas placed 4.0 km (Washington shore) and 4.8 km (Oregon shore) downstream from the dam to record when fish entered the tailrace.

[1] Provided for information only, does not signify endorsement.

Three SRX receivers linked with digital-spectrum processors (DSP/SRX), that scanned all channels simultaneously, were connected to underwater antenna to monitor passage through the Oregon-shore ladder and to determine when fish exited from the top of both ladders. Underwater antennas were in place in the ladder about 10 weirs upstream from the junction pool, downstream of the counting station, one pool upstream from the counting station, and in the last pool just downstream from the ladder exit (top of ladder) (Figure 1). An additional antenna was placed outside the ladder exit near the shad trap and its coverage included the trap, but not the second exit. Fishway entrances were not monitored at The Dalles Dam in 1996.

An experimental study was not planned prior to initiation of the shad fishery at The Dalles Dam. Rather, evaluations were based on time for chinook salmon with transmitters to pass through the Oregon-shore fishway ladder prior to and during the shad fishery. Median passage times were calculated for each fish from the last record at the lowermost antenna in the ladder to its last record at the top of the ladder, and from the first record on the antenna upstream from the counting station until the last record at the top of the ladder. We also calculated times for fish to pass from the top-of-ladder pool to the last record on the antenna at the ladder exit next to the shad trap, which included about half the fish that exited the ladder. All fish used for this study were collected and outfitted with radio transmitters at Bonneville Dam (Figure 1) and released 8 km downstream from Bonneville Dam as part of the lower Columbia River Adult Passage Study funded by the U.S. Army Corps of Engineers (COE) and Bonneville Power Administration (BPA).

Results and Discussion

The shad fishery at The Dalles Dam occurred from 3 June until 25 June 1996, during which 54 chinook salmon with transmitters passed through the Oregon-shore ladder during daylight hours (0600 to 2000 hours). For comparison, passage times were calculated for 62 chinook salmon outfitted with transmitters that passed through the Oregon-shore ladder during daylight hours from 18 May until 2 June 1996, prior to the shad fishery (Figure 3). We found that passage times for adult chinook salmon

through the Oregon-shore ladder at The Dalles Dam were not affected by the shad fishery in 1996.

Median times for chinook salmon to pass from the lower end of the Oregon-shore ladder until they exited from the top of the ladder were 1.4 h prior to the shad fishery (62 fish) and 1.4 h during the fishery (53 fish), and these values were not significantly different (median test, P = 0.7081) (Figure 4). Three chinook salmon took noticeably longer to pass through the ladder during the shad fishery (Figure 4), but for two of the fish the majority of time was spent moving past the counting station. For the third fish, the majority of time was spent in the ladder downstream from the counting station.

Median times for fish to pass from the counting station until they exited the top of the ladder were 2.1 min prior to the fishery (62 fish) and 1.0 min during the fishery (54 fish) (median test, P = 0.0089). Fish passed through the top pool and out the exit containing the shad trap in median times of 1.0 min both prior to (29 fish) and during (29 fish) the shad fishery (median test, P = 0.5323). This last analysis included only those fish that used the ladder exit containing the shad trap. Chinook salmon that exited the Oregon-shore ladder that used the ladder exit adjacent to the shad trap were not monitored. Some salmon may also have moved rapidly past the exit antenna and so could not have been included in the analysis.

We conclude that operation of the shad fishery, as conducted at The Dalles Dam in 1996 did not affect passage of chinook salmon through the Oregon-shore fishway ladder. Procedures used by fishermen during the fishery, e.g. use of rubber gloves to keep human odors out of water passing into the ladder, exclusion of motor use on boats near the ladder and trap, removal of the trap each evening, and the trap design, were effective and prevented disruption of salmon passage.

No chinook salmon with transmitters entered the shad trap. A fishery monitor for the Yakima Tribe observed a total of 41 untagged chinook salmon, 65 sockeye salmon and 16 steelhead were collected in the shad trap during the fishery. Extrapolating these values to unmonitored periods resulted in an estimated 57 chinook salmon, 90 sockeye salmon, and 22 steelhead, or 2.4% of chinook salmon, 1.8% of sockeye salmon, and 3.1% of the steelhead that moved though the ladder while the shad fishery was conducted (Steve Parker, Yakima Tribe Harvest Manager, draft final report for Fish

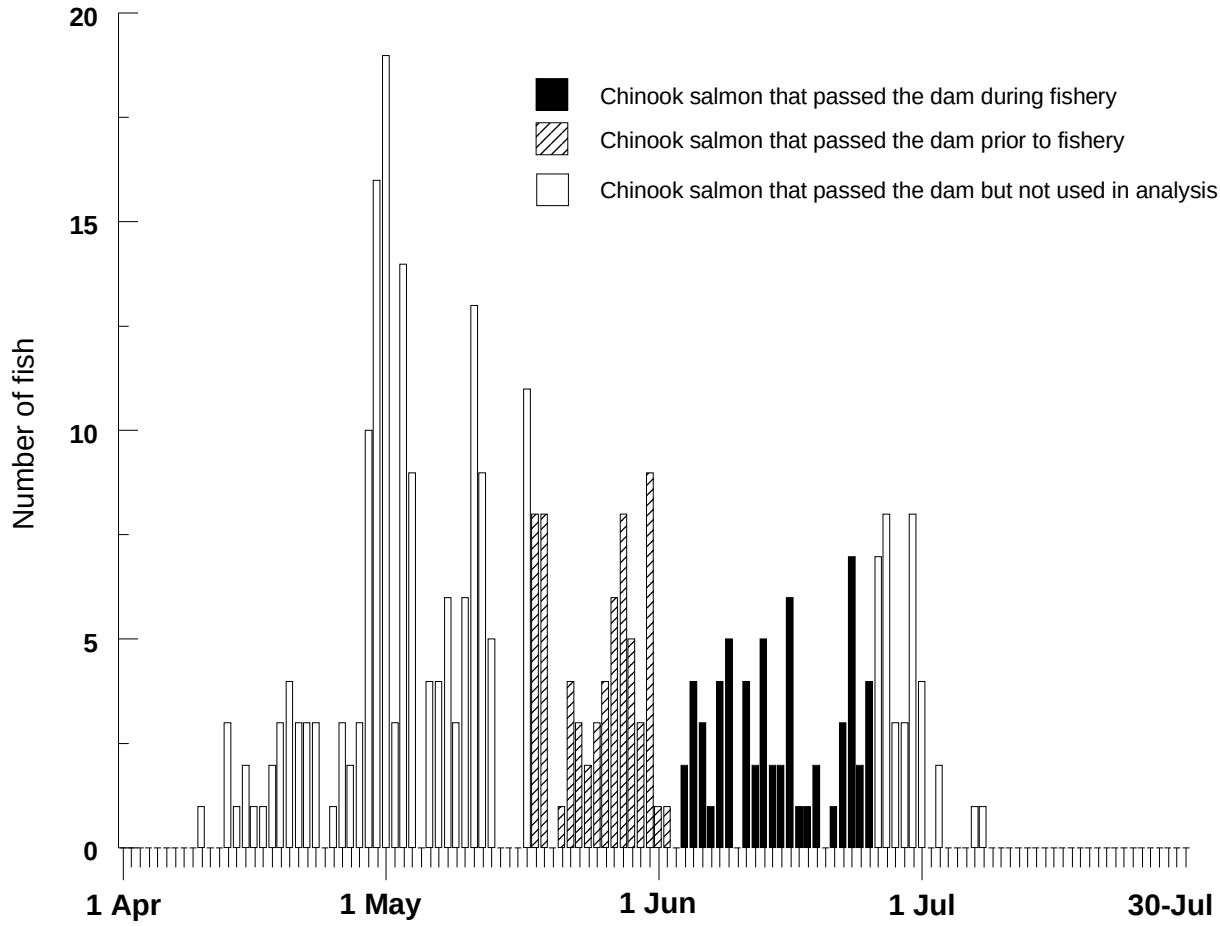

Figure 3. Number of chinook salmon exiting the Oregon-shore fishway ladder at The Dalles Dam spring 1996. Passage times of salmon that passed the dam during the shad fishery (solid bars) were compared to those of salmon that passed the dam prior to shad fishery (crosshatched bars).

Passage Operations and Maintenance Group, Shad Fishery Task Team). Salmonids found in the shad trap were removed using dip nets or were allowed to swim out by lowering one corner of the trap. The observer stated that "...salmonids would have remained in the trap net for at most a few hours before being dipped out."

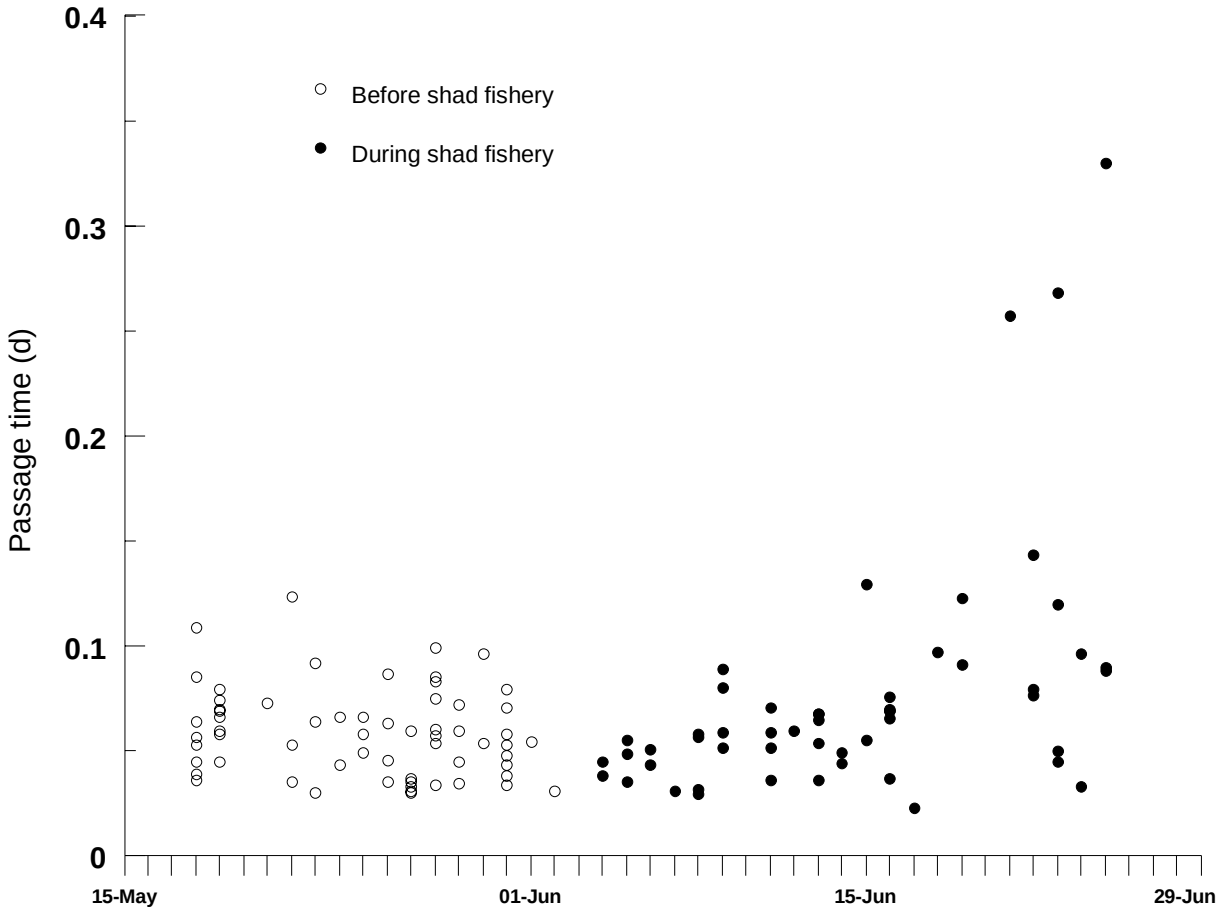

Figure 4. Times for chinook salmon with radio transmitters to pass through the Oregon-shore fishway ladder at The Dalles Dam, spring 1996.