INLAND FISHES OF WASHINGTON

Second Edition, Revised and Expanded

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and 114,700 fish weighing between 6,300 and 1.64 million pounds. No seasons for spring chinook salmon have been allowed on the Columbia River since 1977. The commercial harvest of summer chinook salmon from the Columbia River between 1938 and 1974 was between 100 and 172,300 fish weighing between 2,000 and over 3.4 million pounds. Since 1992, the commercial harvest has been less than 1.0 million pounds (except for 1996 when slightly over 1.0 million pounds were harvested).

Summer chinook runs in the Columbia River have remained at record low levels since the 1980s. In 1992, the wild Snake River summer chinook salmon was combined with the spring chinook salmon as an Evolutionarily Significant Unit and listed as Threatened under the Endangered Species Act. In 1992, wild Snake River fall chinook salmon were also listed as Threatened under the Endangered Species Act.

While fall chinook in the Snake River are listed as endangered, other upriver stocks of fall chinook, particularly the Hanford Reach stock, are healthy enough to support commercial, recreational, and treaty tribal fisheries. Commercial landings amounted to a little over 1 million pounds in the year 2000. The sport catch of chinook salmon in Washington during 1995 was 13,662 fish from the Columbia River, 8,767 from coastal rivers, and 5,922 from Puget Sound rivers. In addition, the sport catch during 1995 included 5,171 jack chinook salmon from the Columbia River, 854 from coastal rivers, and 980 from Puget Sound rivers.

Chinook salmon were introduced into Lake Michigan in 1966 and provided an excellent sport fishery. However, a record catch of nearly 622 thousand chinook salmon declined to a low of about 42.5 thousand fish in 1994 and fluctuated between 42.5 and 159.5 thousand fish between 1989 and 1998. Several reasons explain the decline in sport catch: (1) a pathogen (bacterial kidney disease) caused mortality in the late 1980s, and (2) the forage base of alewives was decimated, possibly from stocking too many salmon. Catch rates for chinook salmon in Lake Michigan were between 6.4 and 8.6 fish per 100 angler-hours of effort in 1985–1988. Catch rates declined to between 1.3 and 1.6 fish per 100 angler-hours of effort during 1992–1995. However, catch rates rebounded to 4.6 fish in 1997 and 4.8 in 1998. Naturally reproducing landlocked populations of chinook salmon occur in Lake Superior, where wild fish comprised 75 percent of the total in Michigan waters, 68 percent in Wisconsin, 43 percent in Minnesota, and 94 percent in Ontario. Hatchery-reared fish made up the remainder.

Interactions between fish species are often important factors in survival. For example, redside shiners have been documented to displace Age 0 spring chinook salmon from preferred habitat in some situations. When fish are displaced in this way higher mortality is to be expected.

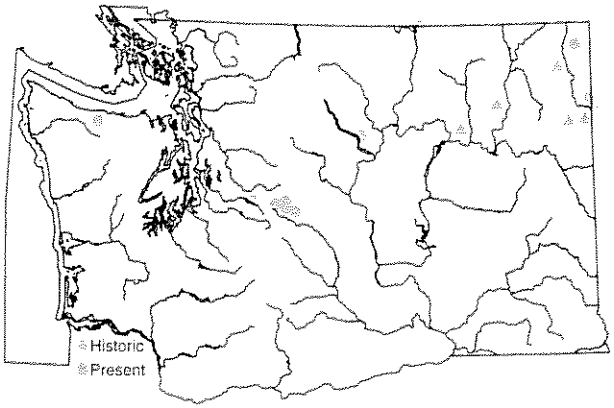
REFERENCES. Allen and Hassler 1986; Beacham and Murray 1993; Beckman et al. 1998; Berman and Quinn 1991; Bjornn 1978; Brodeur and Pearcy 1990; Burner 1951, 1964; Dahlberg and Phinney 1967; Dauble et al. 1999; De La Cruz-Aquero 1999; Edmundson et al. 1968; French and Wahle 1959; Fulton 1968; Galbreath and Ridenhour 1964; Gibbons 1977; Gray 1965; Groot et al. 1995; Hankin et al. 1993; Haw and Bergman 1972; Haw and Buckley 1962; Healey 1991; Heg and Van Hyning 1951); Hunt et al. 1999; Hillman 1989a; James et al. 1999; Landingham et al. 1997; Manning et al. 1999; Mathews and Meekin 1971; McAfee 1966; McIsaac and Quinn 1988; Meyers et al. 1998; Mullan et al. 1992; National Research Council 1996; Nelson et al. 1994; Oregon and Washington Dep. Fish Wildl. 1998; Pascual et al. 1995; Pearcy 1992; Peck et al. 1999; Quinn and Fresh 1984; Rakoczy 2000; Reimers 1968; Reimers and Loeffel 1967; Robertson 1957; Roni 1992; Roni and Quinn 1995; Scholz 2000; Seelye 2000; Slater 1963; Taylor 1990; Thorpe 1987; U.S. Fish and Wildlife Service 1970; Waknitz et al. 1995; Warner 2000; Washington Dep. Fish. 1967; Washington Dep. Fish Wildl. 1993, 1994a,b,c,d,e; Wright 1968.

18. Pygmy Whitefish *Prosopium coulteri* (Eigenmann and Eigenmann)

DISTINGUISHING CHARACTERISTICS. Pygmy and mountain whitefish have a single flap between the nostrils, whereas lake whitefish have two flaps. The pygmy whitefish differs from the mountain whitefish in dorsal ray counts (9–12 vs. 11–15), and anal ray counts (8–10 vs. 10–13), head shape (blunt vs. pointed), and lateral-line scale counts (54–70 vs. 74–90).

DISTRIBUTION. Relict populations of pygmy whitefish occur in deep lakes across northern North America as remnants of the last Ice Age during the Pleistocene Period that occurred about 10,000 years ago. This species has been reported from Lake Superior, western Montana, northern Idaho, Washington, western Canada (British Columbia, Northwest Territories, and Saskatchewan), and southwest Alaska. In British Columbia, this species inhabits the Fraser, Skeena, Peace, Liard, and Yukon River drainages. It is also found in Athabaska Lake, Saskatchewan and Great Bear Lake, Northwest Territories. Pygmy whitefish were also reported from the Chukotski Peninsula in Russia in 1992 (Chereshnev and Skopets 1992).

In Washington, this species was first recorded from Diamond Lake (Pend Oreille County) in 1894. In 1909, a fish collected from Crescent Lake on the Olympic Peninsula had the characteristics of pygmy whitefish. However, none were collected during sampling by biologists from Peninsula College, Port Angeles, and the U.S. Fish and Wildlife Service, Olympia, during the 1970s. In 1993, a single specimen collected from Crescent Lake in 1987 was verified by Washington Department of Fish and Wildlife biologists to be a pygmy whitefish. We collected pygmy whitefish from Lake Chester Morse (King County) in the mid-1970s. This lake is the water supply for Seattle and has been closed to fishing since the early 1900s by city ordinance.



Map 19. Distribution of Pygmy Whitefish

An intensive survey by Washington Department of Fish and Wildlife biologists between 1993 and 1997 documented that pygmy whitefish once occurred in at least 15 Washington lakes (Map 19). These lakes are located at the extreme southern edge of their natural range. This species is presently found in 9 Washington lakes: Lakes Bead and Sullivan (Pend Oreille County), Lake Chelan (Chelan County), Lake Chester Morse (King County), Lakes Cle Elum, Kachess, and Keechelus (Kittitas County), Crescent Lake (Clallam County), and Lake Osoyoos (Okanagan County). Pygmy whitefish have been extirpated from 6 Washington lakes: Buffalo Lake (Okanogan County), Diamond, Horseshoe, and Marshall Lakes (Pend Oreille County), Little Pend Oreille Lakes (Stevens County), and North Twin Lake (Ferry County).

HABITS AND HABITAT. Pygmy whitefish most often occupy deep, unproductive (oligotrophic) lakes where water temperatures are 50°F or lower. In a few cases, this species was reported from small shallow, more productive lakes in British Columbia, Montana, and Washington. Pygmy whitefish do not make extended migrations. During the spawning season, local movements occur into streams that may be clear or silty with moderate to swift water velocity. In lakes, these fish usually occur in water deeper than 20 feet. However, in early June we found this species in water from 6 to over 100 feet deep in Lake Chester Morse, but during the winter (December– March), we captured them in frame nets in water less than 6 feet deep. In Lake Superior, this species was reported to inhabit water from 60 to 300 feet deep, with most fish occupying depths from 150 to 234 feet. Pygmy whitefish were captured near the surface in open water to depths of 551 feet in Alaska. Washington Department of Fish and Wildlife biologists collected fish from waters between 23 and 302 feet deep.

Meristic and morphological data demonstrated that at least two forms of pygmy whitefish existed in three Alaska lakes: Aleknagik, Naknek, and Chignik. Most fish (59.4–95.4 percent) with low gill raker counts in Chignik Lake fed primarily on bottom fauna. In contrast, most fish (75.0–86.7 percent) with high gill-raker counts fed primarily on plankton. Growth rates of the different forms in Chignik Lake were comparable (see Appendix 14, Table 10).

AGE AND GROWTH. The maximum recorded age for pygmy whitefish was 9 years in Maclure Lake, British Columbia, Canada, and 8-year-old fish were captured in Lake Superior. In other areas, specimens usually have been less than 5 years old. As the common name implies, this species does not reach a large size and is usually less than 6 inches long. The largest specimen from Washington was captured in Lake Chester Morse and was 9.7 inches in total length. The largest pygmy whitefish ever reported was a 9-year-old female that was 11.4 inches in total length, from Maclure Lake, British Columbia. Growth of pygmy whitefish is variable in different waters, probably related to water temperature and productivity. In general, males mature earlier and die at an earlier age than females. See Appendix 14, Table 10.

REPRODUCTION. In Lake Superior, 50 percent of male pigmy whitefish are sexually mature at Age 2 and 50 percent of the females at Age 3. A few males become mature at Age 1. All females are mature at Age 4. More than 95 percent of Age 2 pygmy whitefish were mature in Brooks and South Bay Lakes, Alaska. In Maclure Lake, British Columbia, 50 percent of the males and 75 percent of the females were mature at Age 3. In two other British Columbia lakes, all fish (both sexes) were mature at Age 2. Spawning occurs from late summer into early winter, depending on the location, when water temperature is between 39°F and 32°F. Pygmy whitefish apparently spawn occasionally in lakes as well as streams. Lake spawning must occur in Bead Lake, Pend Oreille County, Washington, because this lake has no suitable spawning streams. Ripe and spent females were collected from Sullivan Lake (Pend Oreille County) by Washington Department of Fish and Wildlife biologists in early September and again in late October 1994, suggesting that two different spawning populations may exist in that lake. Pygmy whitefish were observed spawning in Priest Lake, Idaho, during late October. In Priest Lake, spawning occurred at night in shallow water during late afternoon, and the fish returned to deep water at daylight. Spawning fish were extremely wary of any movements and retreated to deep water if disturbed.

In Lake Chester Morse (King County), Washington, spawning occurred in late December and early January. In early December, schools of pygmy whitefish were observed by Washington Department of Fish and Wildlife biologists in pools just below riffles in the Cedar and Rex Rivers (tributaries to the lake). Water temperatures in these rivers during the spawning period ranged between 32 and 39°F. Ripe fish were collected near the mouth of the Brooks River, Alaska in November when the water temperature was 39°F and spent fish were collected in December when water temperature dropped to 32.5°F. This period coincides with that in other lakes at a similar latitude.

Egg production varies from 93 to 597 for fish 3.4 to 5.9 inches long from several locations. Egg production varied considerably in Montana, with a mean of about 560 (range 156–918) eggs per female for females between 4.2 and 5.2 inches in standard length in Flathead Lake, and a mean of 1,084 (range 1,027–1,136) eggs for females between 5.1 and 5.3 inches in standard length from Bull Lake. The mean number of eggs from 20 pygmy whitefish from Lake Chester Morse, Washington, was 584 (range 192–1,412) eggs per female that were 7.4 inches (range 5.3–9.7) in mean total length. Spawning occurs in riffles of streams or along the shoreline of lakes. The small eggs (2 mm in diameter) are probably randomly deposited over gravel or rocky areas.

FOOD. Pygmy whitefish feed almost exclusively during daylight hours when they make short distinct darts to consume specific food items. They feed to a large extent on zooplankton. They were reported to eat primarily cladocerans, copepods, and midge larvae in Flathead Lake, Montana, and primarily ostracods and amphipods (also some copepods, midge larvae and pupae, and larval clams) in Lake Superior. In Montana, some pygmy whitefish were also reported to consume their own eggs. In Washington, the diet of Lake Chester Morse fish was composed primarily of chironomids, small clams, amphipods, and zooplankton (Repsys 1973).

For a description of the feeding habits of two forms of pygmy whitefish in Chignik Lake, Alaska, see the last paragraph under *Habits and Habitat*. The growth rates of these sibling forms were similar (see Appendix 14, Table 10).

REMARKS. The pygmy whitefish serves as a main link in the food chain, from zooplankton and insects to forage for game species. In Lake Chester Morse, Washington, even the largest pygmy whitefish were eaten by bull trout.

This species may have been widely distributed across North America during the last Ice Age and remained as isolated populations during the Pleistocene Period (about 10,000 years ago). Some biologists have suggested that the small size and early maturity may have been adaptations to survive during the Ice Age when waters were cold and unproductive. Now only widely scattered relict populations are found in North America. It must be pointed out, however, that sampling in many parts of North America—with gear that can capture this small species, especially in deep water—has not been intensive. Therefore, it might occur more widely than its present reported distribution.

The pygmy whitefish has been classified as a Sensitive Species in Washington since 1998 (Hallock and Mongillo 1998). A Sensitive Species is one that is vulnerable or declining so that it is likely to become endangered or threatened in a significant part of its range without management or removal of threats.

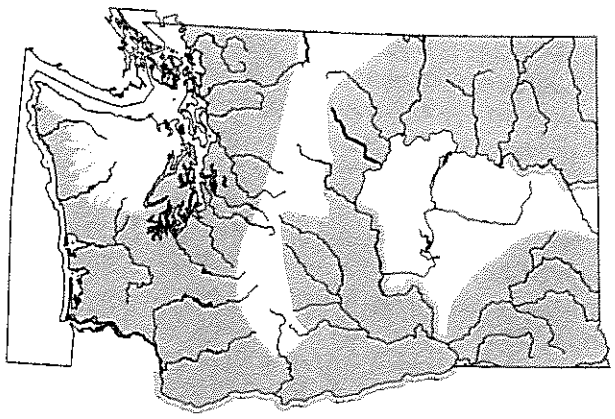
REFERENCES. Bird and Roberson 1979; Brown 1971; Carl et al. 1967; Carlander 1969; Chareshnev and Skopets 1992; Eschmeyer and Bailey 1955; Hallock and Mongillo 1998; Harris 1973; Heard and Hartman 1966; Mackin 1941; McCart 1965, 1970; McPhail and Lindsey 1970; Meyers 1932; Mongillo and Faulconer 1982; Mongillo and Hallock 1995, 1999a; Morrow 1980; Norden 1970; Northcote et al. 1973; Rogers 1963; Simpson and Wallace 1978; Snyder 1917; Weisel and Dillon 1954; Weisel et al. 1973.

19. Mountain Whitefish *Prosopium williamsoni* (Girard)

DISTINGUISHING CHARACTERISTICS. All whitefish have small subterminal mouths and large scales (fewer than 100 along the lateral line), which distinguish them from other members of the Salmonidae. The mountain whitefish, with a single flap between the nostrils, differs from the lake whitefish, which has two flaps. It differs from the pygmy whitefish in dorsal ray counts (11–15 vs. 9–12), anal ray counts (10–13 vs. 8–10), head shape (pointed vs. blunt), and lateral-line scale count (74–90 vs. 54–70).

DISTRIBUTION. The mountain whitefish is abundant in many waters and widely distributed in western North America. In the United States, this species is found along the Rocky Mountain range in Colorado, northeastern Utah, western Wyoming, southcentral and western Montana, throughout Idaho and Washington, south to the Columbia River drainage and the Lahontan Basin in eastern Oregon, and eastward to the Truckee River and Lahontan Basin in northern Nevada. It also occurs along the east slope of the Sierra Nevada Mountains in California. In Canada, mountain whitefish are found in the Saskatchewan River drainage in Alberta, northwesterly to the Yukon border, including the MacKenzie, Liard, and Peace River drainages in British Columbia. This species is widespread in British Columbia, including the Fraser and Columbia River systems, and along the Pacific Coast including the Bella Coola, Skeena, Nass, and Stikine River systems. The mountain whitefish is the most common whitefish in Washington, occurring in numerous coldwater lakes, streams, and rivers throughout the state (Map 20).

HABITS AND HABITAT. Mountain whitefish are found in streams and lakes. In streams, they are found primarily in the riffle areas in summer, but prefer large pools



Map 20. Distribution of Mountain Whitefish