

Bull trout in western Washington

Introduction

Bull trout (*Salvelinus confluentus*) are a native salmonid in Washington State and the Pacific Northwest (PNW). They are a remnant post-glacial cold-water char currently distributed in the colder drainages of the PNW.

Coastal-Puget Sound bull trout were listed as “threatened” under the Endangered Species Act (ESA) in November 1999 due to alterations in ecosystem integrity and function. Dolly Varden (*Salvelinus malma*) also coexist sympatrically with bull trout in several major northwest Washington watersheds; however, Dolly Varden do exist allopatrically without bull trout in a few watersheds. Due to their similarities in morphology and appearance, Dolly Varden are by default also protected by the ESA under the ‘similarity of appearance’ clause. Despite the abundant research and literature on bull trout in the intermountain regions of western North America, there has been little research conducted on Coastal-Puget Sound native char populations.

Appearance

Char have dark-colored bodies with light spots, while trout and salmon (such as rainbow and chinook) have dark spots on lighter-colored bodies. Bull trout typically have olive green bodies and cream to pale yellow spots; yellow and red or orange spots cover the sides of larger fish. The pelvic, pectoral and anal fins typically have white or cream-colored margins. Spawning males display bright spots, red-orange bellies, and glowing white fin edges. Juvenile fish under 100 cm lack cream-colored spots; they typically have dark parr marks irregular in shape and pattern. Both adult and juvenile fish lack spotting on their fins. Bull trout, Dolly Varden and eastern brook trout (introduced char) can all interbreed, resulting in hybrids. Brook trout can be identified by the presence of vermiculations (worm tracks) on their back and red spots encircled by blue halos. Hybridization with brook trout can dilute the genetic integrity of bull trout populations; however, most hybrid offspring are sterile, which depresses local populations through unsuccessful reproductive effort. Competition with introduced brook trout can also negatively affect bull trout populations. While bull trout/Dolly Varden hybrids are typically viable (not sterile), the effects on either species are relatively unknown.



Bull trout juveniles and adult.

Distribution

Historically, the distribution of bull trout was more widespread in the PNW, with less fragmented populations in more diverse aquatic habitat. Several distinct population segments have become extinct (e.g., McCloud River, northern California; Lake Chelan, Washington), while other populations have retreated to isolated prime habitat relatively unaltered by modern human influence.

Life history

In western Washington, bull trout can express numerous complex life history patterns. Four main life history patterns exist (see below); however, there can be considerable overlap spatially, temporally, and genetically between the forms, making bull trout one of the most plastic salmonid species in terms of life history and adult habitat use. Anadromous, potamodromous (migration wholly within freshwater, fluvial, and adfluvial), and resident forms all exist in western Washington.

- ▣ **Anadromous** Spawning and early rearing in coldwater streams. Major growth occurs in saltwater. Frequent migration into and out of mainstem rivers, estuaries, and saltwater. Adults are piscivorous and are 400–600+ mm (found in Snohomish River)
- ▣ **Fluvial** Spawning and early rearing in coldwater streams. Major growth occurs during migrations up and down mainstem rivers. Adults piscivorous. 300-500+ mm (e.g., S.F. Skokomish River)

- ▣ **Adfluvial** Spawning and early rearing in coldwater streams. Major growth occurs in lakes or reservoirs. Adults piscivorous. 400-600+ mm (e.g., Cedar River above Chester Morse Lake)
- ▣ **Resident** All life stages occur in smaller, coldwater streams. Adults mostly non-piscivorous insectivores. 150–300+ mm (e.g., Troublesome Creek, N.F. Skykomish).
- ▣ **Residual** Some populations may be residual, a result of stream network fragmentation or altered stream productivity, leading to the suppression of alternate life history forms.

Basic biology

Temperature is a major factor influencing bull trout distribution, especially for spawning and early rearing. Bull trout require temperatures below 8–9° C for spawning initiation, 2–4° C for optimal egg incubation and 4–10° C for juvenile rearing. Optimal adult rearing temperatures range from 10–12° C; however, migrating adults may tolerate temperatures much higher than this for short periods of time if local refugia exist.

Streams with abundant cover (cut banks, root wads, debris jams, boulders) and clean gravel and cobble beds provide the best habitat for bull trout. Bull trout are opportunistic feeders, eating aquatic insects, shrimp, snails, leeches, fish eggs, and fish, depending on their size and location. Bull trout are iteroparous (repeat spawners) and may spawn on consecutive or alternate years. They mature late (5–7 years), but can be quite long lived (7–20+ years). Most bull trout streams are not closed to general fishing; angling pressure, hooking mortality, misidentification, and poaching can be serious concerns, even though it is typically illegal to keep bull trout.

Bull trout spawn in the fall in western Washington (peak October–November), and their eggs require exceptionally long gravel residence times—up to 220 days until emergence. Redd (nest) construction usually occurs in clean gravel 20–50 mm in size, in which eggs are deposited within the spaces of larger rocks below. Egg burial depth ranges from 3–20 cm with an average range of 10–15 cm, depending on the length of fish and gravel size. This range is significantly shallower than other larger-bodied salmonids in the PNW. Bull trout alevins and fry are also highly associated with the substrate of streambeds and are known to utilize interstitial spaces as cover. These factors make bull trout egg pockets highly susceptible to late-fall and winter flood events in western Washington. Redd site selection and habitat availability at all spatial scales may strongly influence the susceptibility of bull trout egg pockets to scour events.

Factors leading to population decline

- ▣ Degradation of complex structural habitat
- ▣ Temperature alterations and loss of refugia
- ▣ Non-native species competition and inter-breeding (e.g., brook trout)
- ▣ Altered streamflow regimes
- ▣ Sedimentation of spawning grounds
- ▣ Redd scouring
- ▣ Loss of habitat connectivity (fragmentation) (e.g., dams, culverts, levees)
- ▣ Harvest (including poaching)
- ▣ Altered food webs and marine derived nutrients (e.g., loss of juvenile salmon prey)

Further reading

- Goetz, F. 1989. Biology of Bull Trout, *Salvelinus Confluentus*: a Literature Review, USDA Forest Service, Willamette National Forest. Eugene, OR.
- Shellberg, J.G. 2002. Hydrologic, Geomorphic, and Biologic Influences on Redd Scour in Bull Char (*Salvelinus confluentus*) Spawning Streams. Master's thesis, University of Washington. Available online at: <http://depts.washington.edu/cwvs/Theses/shellberg.pdf>
- U.S. Fish and Wildlife Service. 1998. Bull Trout Interim Conservation Guidance, USFWS. Lacey, Washington.



Autumn (top) and winter (bottom) bull trout spawning habitat.