

Appendix 40

Life History of Montana Bull Trout

The following paragraphs on bull trout life history are excerpted from: Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin Montana by the Montana Bull Trout Restoration Team (2000).

Spawning

The majority of migratory bull trout spawning in Montana occurs in a small percentage of the total stream habitat available. Spawning takes place between late August and early November, principally in third and fourth order streams. Spawning adults use low gradient areas (less than 2%) with gravel/cobble substrate and water depths between 0.1 and 0.6 meters (4 to 24 inches; avg. = 0.3 m (12 inches)) and velocities from 0.09 to 0.61 m/sec (0.3 to 2.0 ft./sec; avg. = 0.31 m/sec (1.0 ft./sec)). Proximity of cover for adult fish before and during spawning is an important habitat component. Spawning tends to be concentrated in reaches influenced by groundwater, where temperature and flow conditions may be more stable. The relationship between groundwater exchange and migratory bull trout spawning, and the spawning habitat requirements of resident bull trout requires further investigation.

Incubation

Existing studies suggest that successful incubation of bull trout embryos requires cold water temperatures below 8°C (46 °F), gravel/cobble substrate with high permeability to allow water to flow over incubating eggs, and low levels of fine sediment (sediment particles smaller than 6.35 mm (0.25 inches) in diameter) that smother eggs and fry. Eggs are deposited as deep as 25 cm (10 inches) below the streambed surface, and fry do not emerge until 7 to 8 months later, depending upon water temperature. Spawning adults alter streambed characteristics during redd construction to improve survival of embryos, but conditions in redds often degrade during the incubation period. Mortality of eggs or fry can be caused by scouring during high flows, freezing during low flows, superimposition of redds, or deposition of fine sediments or organic materials that smother the eggs or fry. A significant inverse relationship exists between the percentage of fine sediment in the incubation environment and bull trout survival to emergence. Entombment appeared to be the largest mortality factor in incubation studies in the Flathead drainage. Groundwater influence plays a large role in embryo development and survival by mitigating mortality factors.

Juvenile Rearing in Tributary Streams

Basic rearing habitat requirements for juvenile bull trout include cold summer water temperatures (< 15°C) with sufficient surface and groundwater flows. Warmer temperatures are associated with lower bull trout densities, and can increase the risk of invasion by other species that could displace, compete with, or prey on juvenile bull trout. Juvenile bull trout are generally bottom foragers and rarely stray from cover. They prefer complex forms of cover that include deep pools, large woody debris, rocky stream beds, and undercut banks. High sediment levels and embeddedness can result in decreased rearing densities. Unembedded cobble/rubble substrate is preferred for cover and feeding, and also provides invertebrate production. Highly variable streamflow, reduction in large woody debris, bedload movement, and other forms of channel instability can limit the distribution and abundance of juvenile bull trout.

Subadults and Adults in Tributary Streams

Habitat characteristics that are important for juvenile bull trout of migratory populations (low water temperatures, clean cobble-boulder substrates, and abundant cover) are also important for stream-resident subadults and adults. However, stream resident adults are more strongly associated with deep pool habitats than are migratory juveniles.

Movement and Migration in Tributary Streams

Both migratory and stream-resident bull trout move in response to developmental and seasonal habitat requirements. Migratory individuals can move great distances (up to 156 miles [250 km]) among lakes, rivers, and tributary streams in response to spawning, rearing, and adult habitat needs (Swanberg 1996). Stream-resident bull trout migrate within tributary stream networks for spawning purposes, as well as in response to changes in seasonal habitat requirements and conditions. Open migratory corridors, both within and among tributary streams, larger rivers and lake systems are critical for maintaining bull trout populations.

Subadults and Adults in Large Rivers

Most migratory bull trout remain in tributaries for one year or more before moving into large rivers downstream. After they reach large river habitats, bull trout can remain there for brief periods, or for as long as several years, before either moving into lakes or returning to tributary streams to spawn. During their river residency, bull trout commonly make long-distance annual or seasonal movements among various riverine habitats, apparently in search of foraging opportunities and refuge from warm, low-water conditions in mid-summer and ice in winter. Little is known about these movement patterns among basins, but it is likely that river residency and migratory behavior in each bull trout stock largely reflects local adaptation to the specific array of suitable habitats historically available in the basin. The degree of genetic control of migratory behavior in bull trout is unknown.

Subadults and Adults in Lakes

Lakes and reservoirs are critically important to adfluvial bull trout populations. In six of the 12 bull trout restoration/conservation areas (Flathead, Swan, South Fork Flathead, Upper Kootenai, Lower Kootenai, and Lower Clark Fork), large bodies of standing water form the primary habitat for rearing of subadult migratory bull trout and provide food and cover for fish to achieve rapid growth and maturation. Growth rates of juvenile bull trout increase substantially as they enter large river and lake environments and shift their diet from insects to fish. Despite the importance of lakes and reservoirs, very limited information is available range-wide on habitat use by bull trout in these waters. In general, bull trout appear to be bottom oriented in lakes, but use relatively shallow zones (less than 40 m; 130 ft), provided water temperatures there are less than 15°C (59°F). During summer, bull trout appear to primarily occupy the upper hypolimnion of deep lakes, but forage opportunistically in shallower waters. River/lake transition zones appear to be particularly important habitats. Introduced species, especially lake trout (*S. namaycush*) and Mysis shrimp (*Mysis relicta*) in combination, have been implicated in drastically altering the food web where they occur, which has led to declines or extinction of bull trout in many lakes (McIntyre 1998). Although poorly understood at this time, habitat conditions in lakes and reservoirs are potentially critical to persistence of migratory bull trout populations and require additional investigation.