“Westslope” Cutthroat Trout

Oncorhynchus clarki lewisi

Original prepared by Stephen Bennett

Species Information

Taxonomy

The Westslope Cutthroat Trout is one of 14 subspecies of interior Cutthroat Trout, *Oncorhynchus clarki,* native to western North America (Behnke 1992). Westslope Cutthroat Trout were first described by the Lewis and Clark expedition in the Missouri River, near the present-day city of Great Falls, Montana in 1805 (Behnke 1992). However, as recently as the 1970s, there was confusion regarding the appropriate taxonomic classification of the Westslope Cutthroat Trout (Roscoe 1974). Today, Westslope Cutthroat Trout are considered a distinct taxonomic form, distinguishable from the Yellowstone (*O. clarki bouvieri*) and other subspecies of cutthroat trout on the basis of spotting pattern, karyotype (66 chromosomes), and biochemical characteristics (Behnke 1992). The subspecies *O. clarki alpestris*, known as the “Mountain” Cutthroat Trout, is considered a synonym of Westslope Cutthroat Trout; it occurs as disjunct stocks ranging from eastern Oregon into British Columbia (Trotter 1987; Behnke 1992).

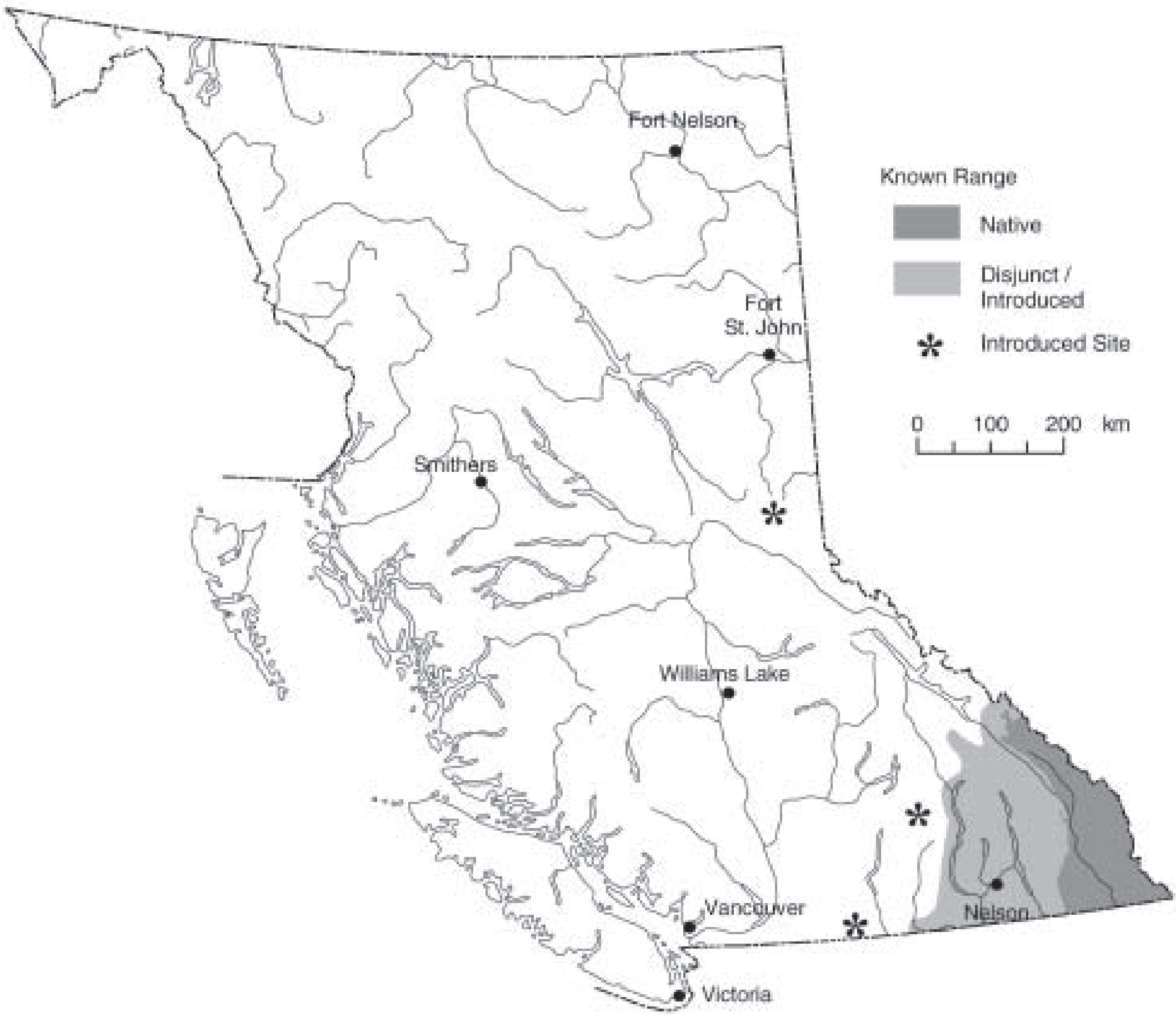
Westslope Cutthroat Trout live in a variety of different stream conditions, from heavily glacial systems to clear, stable, spring-fed streams, and many populations are isolated from one another by natural barriers and watershed divisions. As a result, there are many distinct forms in British Columbia and they exhibit a high degree of within-species diversity.

The present distribution of interior Cutthroat Trout was determined approximately 70 000 years ago by the formation of barrier falls on the Kootenay, Clark Fork, Pend Oreille, and Spokane rivers (Behnke 1992). Westslope Cutthroat Trout were able to colonize above what are now major barrier falls because water levels were higher during the glacial retreat and/or barriers formed following glacial retreat as the land mass rebounded. Westslope Cutthroat Trout were isolated above these barrier falls and survived in refuge areas in Montana, Idaho, and Washington during the last ice age. Rainbow Trout (*Oncorhynchus mykiss*) appear to have been restricted to the lower Columbia River during this period and did not occur above the barrier falls allowing Westslope Cutthroat Trout to colonize inland portions of North America in isolation from Rainbow Trout (Behnke 1992). Westslope Cutthroat Trout were also able to move between some drainage systems likely through headwater transfers. These events are critical in understanding cutthroat conservation as Westslope Cutthroat Trout evolved independent from Rainbow Trout and lack innate isolating mechanisms that allow them to co-exist (Behnke 1992).

Description

Cutthroat Trout get their common name from a distinctive red slash that occurs just below both sides of the lower jaw. Westslope Cutthroat Trout have small irregular-shaped spots along their back, dorsal, and caudal fins. Few spots occur below the lateral line on the anterior of the body. Adults typically exhibit bright yellow, orange, and/or red colours along the ventral area, especially among males during the spawning season. Typically they are silver with yellow, green, blue, or brown hints on the back; however, overall body colour can vary widely and reflects the colour of the substrate and water. Fish in turbid and/or glacial fed streams with moderate to high gradients (e.g., Akolkolex River) tend to be paler and have fewer but larger spots with narrow body profiles, while fish in clear streams with low gradients (e.g., St. Mary River) have heavier smaller spotting and rounder body profiles.

Westslope Cutthroat Trout
(Oncorhynchus clarki lewisi)



Note: This map is based on current knowledge of species' distribution. Distinct populations also occur in scattered locations through the Southern Interior. This species may or may not occur in all areas indicated.

Distinguishing characteristics include the presence of basibranchial teeth (Rainbow Trout lack these) and the upper jaw extends back past the hind margin of the eye (McPhail and Carveth 1992). Westslope Cutthroat Trout adults rarely exceed an overall length of 500 mm in lake- or stream-dwelling populations (Shepard et al. 1984; Westslope Fisheries 2003; J. Baxter, pers. comm.). For example females were found to be larger and weigh more than males in the Elk and Wigwam rivers (adult females = 396 mm [375–421 ± 1.5], 933 g [800–1100 ± 116.9]; adult males = 371 mm [336–422 ± 2.8], 700 g [450–1200 ± 223.6]; Westslope Fisheries 2003). Similar average fish size was observed n the Wigwam River (J. Baxter, pers. comm.).

Distribution

Global

The range of Westslope Cutthroat Trout is the most geographically widespread among the 14 subspecies of interior Cutthroat Trout (Behnke 1992). The Westslope Cutthroat Trout is native to southeastern British Columbia, southwestern Alberta, western Montana, northern Idaho, and small disjunct populations occur in parts of Washington, Oregon, and Wyoming (McPhail and Carveth 1992; Mayhood 1999; USFWS 1999). The historic distribution of Westslope Cutthroat Trout is not exactly known but is thought to have occurred west of the Continental Divide in several tributaries to the Columbia River, including the upper Kootenay River, through northwest Montana, and into northern Idaho (Behnke 1992). East of the Continental Divide, the historic distribution includes the headwaters of the South Saskatchewan River drainage (United States and Canada); and the entire Missouri River drainage upstream from Fort Benton, Montana, and extending into northwest Wyoming (Behnke 1992).

British Columbia

The largest contiguous range of native Westslope Cutthroat Trout is in the upper Kootenay and Flathead River systems with disjunct populations scattered throughout the lower Kootenay, lower Columbia watersheds. The species has been widely introduced in small headwater lakes throughout the upper Columbia and Arrow Lakes region of the lower Columbia watershed and the upper and lower Kootenay river systems. Other scattered introductions have occurred in the Kettle River system, the upper Shuswap river system and the upper Murray River system (Peace drainage) (G. Norris, pers. comm.) Other unconfirmed introductions have likely occurred (McPhail and Carveth 1992). McPhail and Carveth 1993 indicate that Westslope Cutthroat Trout have been introduced into the Similkameen drainage (page 66), but that "natural populations are absent…" (page 77).

Forest regions and districts

Northern Interior: Peace (introduced population in Murray River)

Southern Interior: Arrow Boundary (scattered/introduced), Columbia (isolated/introduced), Kootenay Lake (scattered/introduced), Okanagan Shuswap (isolated/introduced), Rocky Mountain (native/introduced)

Ecoprovinces and ecosections

SBI: SHR (introduced)

SIM: BBT, CCM, COC, CPK, EKT, ELV, EPM, FLV, MCR, NKM, SCM, SFH, SHH, SPK, SPM, UCV

SOI: OKR (introduced)

Biogeoclimatic units

AT, BG, ESSF, ICH, IDF, MS

Broad ecosystem units

FS, IN, LL, LS, OW, SP, WL

Elevation

450–2300 m

Life History

Diet and foraging behaviour

Like most trout, the Westslope Cutthroat Trout are an opportunistic forager and, without competition from other trout species, they feed on the most abundant food sources available. In general, they feed on aquatic and terrestrial macroinvertebrates such as chironomids, caddisflies, mayflies, stoneflies, water boatmen (Corixidae), ants, and grasshoppers (Alger and Donald 1984; Liknes and Graham 1988; Moore and Gregory 1988b). In lakes, zooplankton also make up an important component of their diet (Liknes and Graham 1988). Other fish and even small mammals can be preyed upon opportunistically.

When feeding in streams Westslope Cutthroat Trout usually depend on drifting aquatic insect larvae. They often feed most at dawn and dusk which corresponds to an increased density of downstream invertebrate drift. Adult fish tend to occupy the best habitat such as deep pools and runs where there is abundant cover and low to moderate gradients. Griffith (1972) found that the age of Westslope Cutthroat Trout was positively correlated to the depth of water they occupied. Juvenile fish are usually forced to feed in less optimal habitat such as shallow riffles and glides.

Reproduction

Westslope Cutthroat Trout typically reach maturity at different ages depending on local conditions and genetic stock. Age at sexual maturity has been reported from 2 to 6 years (Brown 1971; Lukens 1978; Liknes and Graham 1988; Behnke 1992). Males tend to mature a year sooner than females (Behnke 1992). Downs et al. (1997) reported length was a better predictor of maturity than age which suggests that in streams with higher growth rates, fish mature earlier. Adults begin to display spawning colours in March and April and disperse to spawning streams in May and June. Spawning can occur from April through August but tends to peak in late May through to mid-June (Ford et al. 1995; Henderson et al. 2000; Corbett 2001). Populations in headwater streams spawn later, usually peaking in mid July (Northcote and Hartman 1988). They may repeat spawning in successive years depending on local conditions and repeat spawners can be upwards of 70% of the spawning population (Liknes and Graham 1988).

Spawning redds are constructed by the female who is attended by one or more males. Once the eggs are fertilized they are covered by the female and the redd is not protected by the adults. The eggs incubate in the gravel for 6–7 weeks. They spend an additional 1–2 weeks in the interstitial space in the gravel before the fry emerge from the gravel usually peaking in mid-July through early August (Griffith 1972; Northcote and Hartman 1988). The fry then either migrate to other habitat or rear in their natal stream.

Site fidelity

Site fidelity is poorly understood for most British Columbia populations. It is generally accepted that most adults return to the natal stream to spawn and then return to a relatively small home range area in either a large stream or lake for the remainder of the year (Behnke 1992). However, there appears to be a wide variety of site fidelity strategies between disjunct populations and some times within individuals of the same population. A tagged male and female that entered a spawning tributary at the same time returned to the same mainstem location they were captured in and overwintered there (Westslope Fisheries 2003; A. Prince, pers. comm.). However, repeat spawners in the Blackfoot River spawned >3 km from the previous spawning site and showed no fidelity to pre-spawning mainstem location (Schmetterling 2001). Water flows were different between years during the Blackfoot study which may have influenced spawning site selection; however, the author suspected that the abundance of spawning habitat available may have been a more significant factor on spawning site selection.

Home range

Home range size is highly variable and dependent on life style (i.e., adfluvial, fluvial, or resident). In general, resident fish would have smaller home ranges than adfluvial or fluvial forms. Spawning migrations can exceed 150 km (Bjornn and Mallet 1964; Shepard et al. 1984). The mean home range of Elk River fish based on year 2000 radio-telemetry results was 6.19 km (range: 1.6–16.9). More recent observations on the Elk River have discovered adults moving more than 50 km upstream during the fall from summer feeding areas to wintering pools (A. Prince, pers. comm.). In the Wigwam River (a tributary to the Elk River) adults were also observed traveling large distances between spawning and wintering sites and, in one case, traveled 103 km (Baxter and Hagen 2003). Populations in high elevation streams with high gradients and numerous barriers are likely more sedentary.

Movements and dispersal

Fluvial and adfluvial forms have been recorded to move large distances (>25 km) during migrations related to spawning, feeding, or other habitat requirements (Bjornn and Mallet 1964; Shepard et al. 1984; A. Prince, pers. comm.). For example, they often move from shallow summer feeding areas to deep pools for overwintering (Brown and Mackay 1995; Westslope Fisheries 2003). Movement is also associated with water temperature with fish beginning to move to spawning areas when mean average temperatures reach 7–10°C. Adults tend to disperse in the summer after spawning and then begin to congregate in the fall beginning around October when they move in to wintering habitat (Brown and Mackay 1995; Brown 1999; Hilderbrand and Kershner 2000; Westslope Fisheries 2003). Fish remain in wintering habitat for 4–5 months and movement is usually restricted to <1 km within wintering habitat (Brown 1999; Westslope Fisheries 2003).

Westslope Cutthroat Trout may move relatively little in stream reaches that have numerous pools, whereas movement can be more extensive in stream reaches with few pools (McIntyre and Rieman 1995). There are also indications that groundwater springs may play an important role in movements. Fish may be able to overwinter in marginal habitat if groundwater springs are present (P. Davidson, pers. comm.).

Habitat

Structural stage

Generally, structural stages 5–7 produce greater amounts of large organic debris (LOD) which has an important influence on stream channel development (Robison and Beschta 1990); sediment trapping and storage (Bragg et al. 2000); nutrient cycling (Bilby and Likens 1980); and fish habitat stucture (Bragg et al. 2000).

Important habitats and habitat features

Spawning

Spawning habitat for this species varies depending on the available habitat and presence of competitors, but usually occurs in low-gradient stream reaches that have gravel substrate ranging from 2 to 75 mm in diameter, water depths near 0.2–0.40 m, and mean water velocities from 0.25 to 1.05 m/s (Shepard et al. 1984; Ford et al. 1995; Westslope Fisheries 2003). Cover near spawning habitat is important for adult fish to hold in before beginning spawning and to escape predators (Corbett 2001; Westslope Fisheries 2003).

Westslope Cutthroat Trout often spawn in small clear tributaries with low-gradients, gravel substrates, stable flows, low sediment loads, and temperatures around 7–10°C (Behnke 1992; Ford et al. 1995; McIntyre and Rieman 1995). However, 13 of 20 fish tagged in the Elk River in 2001 (65%) spawned in the main Elk River. The 2001 spring freshet was significantly lower than normal which may have influenced the selection of spawning areas. Newly deposited gravel substrate, in either tributaries or mainstems, may be critical for spawning success (Westslope Fisheries 2003). Baxter and Hagen (2003) found that mainstem habitat was used almost exclusively for spawning in the Wigwam River, and that stream margins and/or side channels were of particular importance.

Rearing and foraging

For stream resident fish optimal foraging habitat usually consists of a series of riffles and pools with excellent cover in the form of undercut banks, log jams, boulders, and/or deep pools. Depths of pools have been positively correlated to the age of fish and large adults usually occupy the deepest pools with the best cover (Griffith 1972). Young fish, in particular fry, rear and forage along the margins of streams, in off-channel habitat, and in small tributaries. Lower reaches of streams that are susceptible to warming in the summer are typically avoided or activity is curtailed as Westslope Cutthroat Trout are less tolerant than other salmonids to warm water temperatures (i.e., >20°C) (McIntyre and Rieman

1995). Recent genetics evidence suggests that some adults from the lower St Mary River move to the upper St Mary River, possibly in search of cooler temperatures (P. Corbett, pers. comm.).

Young fish use a variety of habitats depending on the life history of the population they belong to (i.e., adfluvial, fluvial, or lake resident populations). For adfluvial and fluvial populations fry often use habitat where water velocities are very low (<1 cm/s) and water depths often do not exceed 20 cm (Ford et al. 1995). Gravel and cobble substrates are also important as cover for fry (Moore and Gregory 1988a; Ford et al. 1995). Age 1+ and 2+ tend to use areas with higher velocities (maximum of 22 cm/s) and deeper water depths (Ford et al. 1995). Natural lake resident populations are rare in British Columbia although there are numerous stocked mountain lakes. Young lake resident fish rear mainly in the littoral zone.

Overwintering

Overwintering pools may contain large numbers of mature adults throughout the fall and winter (Westslope Fisheries 2003). These pools usually exist in large mainstem streams (order 4 and up) and have features that provide deep water (>2 m deep), slower water velocity, and optimal cover. Large boulders, bedrock, or large organic debris are often associated with these pools.

Staging

Prior to entering a spawning tributary in the spring adults can congregate at the mouth of spawning tributaries for several days or even weeks (Schmetterling 2001). Adults begin to display spawning colours early in the spring (February through May) and move to the mouths of tributary streams prior to spawning. Northcote and Hartman (1988) observed maturing males in April even though no spawning was observed until mid-July in small tributaries to Kootenay Lake. The habitat of staging areas has not been well defined. It likely varies depending on local conditions but generally would consist of pool habitat with good cover.

Conservation and Management

Status

The Westslope Cutthroat Trout is on the provincial *Blue List* in British Columbia. Its status in Canada has not been determined but is currently under review.

Summary of ABI status in BC and adjacent jurisdictions (NatureServe Explorer 2002)

BC	ID	MT	OR	WA	Canada	Global
S3SE	S2	S3	S3	S?	N?	G4T3

Trends

Population trends

In the United States and Alberta, populations have declined significantly from historic levels (Mayhood 1999; USFWS 1999). In the Missouri River Basin, 90% of the 144 populations known to have at least 90% genetic purity are at "high to very high" risk of becoming extinct (Shepard et al. 1997). In British Columbia, populations declined significantly in the 1960s through to the mid-1980s due to liberal fishing regulations, and increased angling pressure, access, and habitat loss (B. Westover, pers. comm.). Since implementation of more restrictive fishing regulations in the mid-1980s, populations have increased substantially (B. Westover, pers. comm.). The general trend for B.C. populations as a whole appears to be stable or increasing. However, many populations have some level of hybridization with Rainbow Trout. The number of genetically pure populations has declined in Alberta by as much as 95% from their former range (Mayhood 1999) and by as much as 97.5% in parts of their range in the United States (McIntyre and Rieman 1995). The genetic status of populations in British Columbia has not been completely determined; however, it appears that pure populations are declining (Rubidge et al. 2002; P. Corbett, pers. comm.). Genetic studies in 1987 found one tributary stream to the Kootenay River had Westslope Cutthroat

Trout/Rainbow Trout hybrids (Leary et al. 1987). A repeat sampling of the same streams in 1999 found seven streams with hybrids present (P. Corbett, pers. comm.; Rubidge et al. 2002). Current studies in British Columbia have looked at 20 streams in southeastern British Columbia and found that only five have pure populations and 15 had a moderate to high risk of becoming introgressed populations due to presence of either hybrids or naturalized Rainbow Trout populations (P. Corbett, pers. comm.).

Rainbow trout have been stocked in several lakes and streams that flow into the Kootenay River since the early 1900s. The Libby dam was completed on the Kootenay River in 1972 forming the Koocanusa Reservoir. For several years the United States attempted to establish Westslope Cutthroat in the Reservoir with little success (B. Westover, pers. comm.). Between 1986 and 1998 Gerrard Rainbow Trout were stocked in the Koocanusa Reservoir. This stocking history has no doubt been the cause of the hybridization between Westslope and Rainbow evident today. It is not known if the rate of hybridization is increasing and if populations of Westslope Cutthroat Trout in British Columbia will continue to decline as they have in Alberta and the United States; however, the genetics work conducted to date and reports from local anglers suggest that hybridization is likely increasing.

Habitat trends

Large amounts of Westslope Cutthroat Trout habitat were lost between 1960 and 1981 which coincided with a dramatic increase in the population of many East Kootenay communities. For example, Cranbrook grew from approximately 5000 to over 15 000 during this time (B. Westover, pers. comm.). With an increase in human population, a variety of development activities dramatically increased, which contributed to an incremental loss of high quality Westslope Cutthroat Trout habitat throughout much of its range. In general, lake and large stream habitat is more secure, although there continue to be some cumulative impacts from forestry, hydroelectric, mining, agriculture, urban development, and industrial pollution (Haas 1998). Tributary streams at higher elevations where forestry operations are now focusing may be at higher risk. Some habitat losses are being offset by restoration efforts (e.g., Mark Creek, Sand Creek).

Threats

Population threats

By far the biggest threat to the continued existence of Westslope Cutthroat Trout is genetic introgression with Rainbow Trout (Allendorf and Leary 1988; Taylor and Stamford 2000). Stocking of Rainbow Trout in Westslope Cutthroat Trout habitat and the subsequent naturalization of Rainbow Trout is the leading cause of introgression between the two species (McIntyre and Rieman 1995; Haas 1998). Other threats include increased access; overfishing; predation by non-native species; and competition and displacement from non-native fish. Some populations may be more susceptible to disturbance if they naturally occur over a limited range and/or in small numbers (Allendorf and Leary 1988).

The vast increase in the number of roads in previously unroaded watersheds is a major concern because it is allowing anglers unprecedented access to streams. Westslope Cutthroat Trout are particularly sensitive to angling pressure because they are readily caught even by novice anglers. Poaching can also increase if access to previously roadless areas is developed and the number of enforcement personnel is not also increased.

Haas (1998) classified Westslope Cutthroat Trout a species that requires "special forestry consideration" because they exhibit the following life history and ecological characteristics that make them susceptible to forestry and other development activities:

- often found in the headwaters and small streams,
- most populations are stream resident,
- dependent on riparian and instream cover,
- dependent on natural flow and stream hydrological features,
- require clean, well-oxygenated, unembedded gravel substrate for spawning,
- repeat spawners,
- sport species that is easily angled, and
- intolerant of high temperatures.

Habitat threats

Forest harvesting, mining, agriculture, hydroelectric development, urban development, and livestock grazing have all impacted Westslope Cutthroat habitat in the past and may continue to do so. These threats influence fish habitat in the following general categories: elimination of habitat or restriction of fish access; sedimentation and erosion; and alteration or loss of required habitat characteristics.

Elimination or restriction

The creation of dams and reservoirs in the Columbia basin has eliminated large amounts of low elevation stream reaches via complete inundation (Ford et al. 1995; McIntyre and Rieman 1995). Hydroelectric developments have also created barriers that in some cases alter historic movement patterns (Ford et al. 1995). At smaller scales forestry and urban development can also impede fish movement if proper road building practices are not followed (DFO and MOE 1992). Perched culverts, debris, channelization, and increased water velocities are a common source of barriers to adfluvial, fluvial, and resident populations preventing populations from accessing key habitats (Rieman and Apperson 1989; DFO and MOE 1992; McIntyre and Rieman 1995). The isolation and restriction of populations can compromise the gene flow within and between populations and negatively affect the long-term persistence of the species (Allendorf and Leary 1988; McIntyre and Rieman 1995). Some streams in Alberta are estimated to have fewer than 30 adults in the population which may not be a sufficient minimum viable population size (D. Mayhood, pers. comm.)

Sedimentation and erosion

Forest harvesting, grazing, mining, and urban development can all contribute to increased sedimentation and nutrient loading through the increased runoff, debris torrents, and slides (Rieman and Apperson 1989; Dunnigan et al. 1998; Huntington 1998; Oman 1998; Spencer and Schelske 1998). Increased sedimentation and erosion (above natural background levels) are undesirable as they can degrade spawning and rearing habitat and cause direct injury to fish by:

- embedding (infilling gravel substrate);
- infilling pool and riffle habitat;
- clogging and abrading fish gills;
- increasing turbidity, impairing feeding ability; and
- smothering aquatic insects, reducing food availability and lowering stream productivity (Weaver and Fraley 1991; DFO and MOE 1992; Anderson 1998; USFWS 1999).

Alteration of habitat characteristics

During forest harvesting, grazing, mining, and urban development, riparian vegetation is sometimes removed or degraded. Loss of riparian vegetation can have adverse impacts on fish habitat because it can be critical in the maintenance of many important habitat features required by Westslope Cutthroat Trout. Riparian vegetation is important as it:

1. provides short- and long-term recruitment of LOD for the creation of optimal salmonid habitat such as pools and cover (DFO and MOE 1992);
2. provides shade which cools streams significantly more than streams without riparian vegetation (Scruton et al. 1998; Maloney et al. 1999);
3. increases bank stability and maintains channel morphology (Robison and Beschta 1990; DFO and MOE 1992; Bragg et al. 1998, 2000);
4. acts as a substrate for many terrestrial insects, which in turn are an important food source, and provides organic matter (in the form of leaf litter) that supports the aquatic food chain (Minshall 1967; DFO and MOE 1992; Wipfil 1997); and
5. intercepts runoff and acts as a filter for sediment and pollutants (DFO and MOE 1992).

Global warming is also predicted to further reduce Westslope Cutthroat Trout habitat by changing water temperatures thereby reducing the amount of low elevation habitat suitable for adults (Kelehar and Rahel 1992; Mullan et al. 1992; McIntyre and Rieman 1995). Increased water temperatures will also reduce the amount of cool water habitat for rearing in the upper reaches of the watershed.

Legal Protection and Habitat Conservation

Westslope Cutthroat Trout in British Columbia are protected under the provincial *Wildlife Act*, the provincial *Fish Protection Act*, and the federal *Fisheries Act*. The *Wildlife Act* enables provincial authorities to license anglers and angling guides, and to supply scientific fish collection permits, and the *Fish Protection Act* provides the legislative authority for water managers to consider impacts on fish and fish habitats before approving new water licences or amendments to existing licences, or issuing approvals for works in and about streams. However, the *Fish Protection Act* cannot be used to supercede activities authorized under the provincial *Forest Act*, or where the Forest Practices Code or its successor, the *Forest and Range Practices Act*, applies (see Section 7(7), *Fish Protection Act*).

The federal *Fisheries Act* delegates authority to the Province to establish and enforce fishing regulations under the British Columbia Sport Fishing Regulations. These Regulations incorporate a variety of measures to protect fish stocks, including stream and lake closures, catch and release fisheries, size and catch limits, and gear restrictions (e.g., large portions of the Elk and St Mary rivers are designated "catch and release" zones for most of the fishing season).

In addition, Section 35(1) of the federal *Fisheries Act* prohibits activities that may result "in the harmful alteration, disruption, or destruction of fish habitat." Similarly, Section 36(3) of the Act prohibits the deposition of a "deleterious substance of any type" into waters frequented by fish.

Also of note is the fish habitat policy of the federal Department of Fisheries and Oceans, which includes a goal of "… no net loss of the productive capacity of fish habitat", which is designed to maintain the maximum natural fisheries capacity of streams (Chilibeck et al. 1992).

The provincial system of parks and protected areas, and the federal system of parks, provide some level of protection for certain populations, or portions of populations, of Westslope Cutthroat Trout. Streams within these protected areas include: the upper portions of the Kootenay River watershed within Kootenay National Park; tributaries to the upper and lower Kootenay River within Height of the Rockies, Elk Lakes, St Mary's Alpine, West Arm, Valhalla, and Kokanee provincial parks; and tributaries to the upper Columbia River within the Purcell Wilderness Area. However, many of these areas either have limited amounts of quality habitat and/or have been subjected to many years of fish stocking with other stocks of Westslope Cutthroat Trout, Rainbow Trout, and/or Brook Trout (*Salvelinus fontinalis*), which may have compromised the genetics of the native Westslope Cutthroat Trout populations, and/or acted as direct competitors of the native populations.

Provisions enabled under the Forest Practices Code (FPC) or its successor, the *Forest and Range Practices Act* (FRPA), that may help maintain habitat for this species include: ungulate winter range areas; old growth management areas; riparian management areas; community watersheds; coarse woody debris retention, visual quality objectives; and the wildlife habitat feature designation. All of these, except community watersheds, have the ability to protect relatively small portions of streamside vegetation (i.e., a few hundred hectares) along a stream; community watersheds have the potential to protect an entire population of a stream resident form.

However, one potential problem with these provisions is that the current Riparian Management Area (RMA) guidelines do not require retention of a reserve zone on S4 streams (small, fish-bearing; <1.5 m wide), only a 30 m management zone (MOF and MOELP 1995). This could put many of the remaining pure populations of Westslope Cutthroat Trout at risk because most pure populations are now found in smaller headwater tributary streams above natural or man-made barriers (McIntyre and Rieman 1995; Mayhood 1999; P. Corbett, pers. comm.). It has not been fully determined how important S4 streams are to resident Westslope Cutthroat Trout populations but they likely provide valuable rearing habitat for fry and possibly 1+ and 2+ age classes, and potentially provide valuable spawning habitat. Under the proper conditions (i.e., groundwater springs or upwelling areas), S4 streams may even provide some overwintering habitat.

Identified Wildlife Provisions

Sustainable resource management and planning recommendations

To date there are few medium to large streams (order 4 or higher) with confirmed pure populations of Westslope Cutthroat Trout in the Kootenay River watershed (P. Corbett, pers. comm.). These streams are important and can act as a source of native, non-hybridized Westslope Cutthroat Trout that could be used to re-establish populations where they have been extirpated. To protect native populations of Westslope Cutthroat Trout consider the following recommendations:

- ❖ Because larger streams with intact populations of Westslope Cutthroat Trout are rare throughout their range and are extremely valuable, these streams (order 4 or greater) should be recognized as sensitive streams and designated as "regionally significant."
- ❖ Because the most serious threat to the native, non-hybridized populations is the introduction of non-native species to the watershed (i.e., other strains of Westslope Cutthroat Trout or other species especially Rainbow Trout), current natural and/or human-made barriers should be maintained in the short-term until the threats from non-native invasions are further assessed.
- ❖ Local managers should determine the appropriate size of the riparian zone on all order 3 and smaller streams with pure Westslope Cutthroat Trout populations based on the potential for impacts on the stream due to development. Low elevation streams susceptible to warming in the summer and any stream with naturally unstable banks or temperature sensitive streams should have minimum riparian management reserve zone of 20 m.
- ❖ Limit access to undisturbed Westslope Cutthroat Trout populations. Westslope Cutthroat Trout are susceptible to overfishing; therefore, future road building in sub-basins with Westslope Cutthroat Trout populations should be located in upslope positions to avoid providing easy access for fishing. Maintenance of restrictive fishing regulations will help to limit some impacts from the extensive existing access. Consider the following access management recommendations:
  - When planning new road development keep roads ≥1 km from mainstem streams (order 4 and greater).
  - In previously developed drainages, assess the percentage of the streamside paralleled by roads and the number of access points provided by crossings, spur roads, etc.
  - If <25% of the mainstem stream is >1 km beyond a known access point, consider removing some access points.
- ❖ Maximize connectivity of native, non-hybridized populations. Movement of individuals (gene flow) between subpopulations in the same watershed may be an important way for populations to rebound after natural catastrophic events and limiting this movement could decrease the likelihood of local populations persisting over time (Hilderbrand and Kershner 2000; Schmetterling 2001). Therefore, obstructions should not be created by in-stream structures such as culverts and bridges, and construction of dams and weirs should be strongly discouraged in Westslope Cutthroat Trout habitat.
- ❖ Limit competition from non-native species that can often displace Westslope Cutthroat Trout from preferred habitat.
- ❖ In sub-basins where Westslope Cutthroat Trout spawning or rearing are known to occur or where they likely occur and forest activities are planned in the next 5 years, any of the following criteria are recommended as supplementary triggers for the watershed assessment procedure (WAP):
  - more than 10% of the watershed has been logged in the 20 years prior to the start of the proposed development plan, or will be logged in the 25 years prior to the end of the proposed development plan.
  - sub-basins where a significant number of mass wasting events have occurred (i.e., more than one landslide/km^2 and more than two events reaching the mainstem);
  - sub-basins where there is either high road density (i.e., >150 m of road/km^2) or high stream density (i.e., >1 km of channel/km^2) or a significant number of stream crossings (i.e., >0.6/km^2); and
  - evidence of significant stream channel stability problems.

If the WAP determines that the watershed is sensitive to disturbance (i.e., a rating of medium or high in the hazard category), Westslope Cutthroat Trout populations are at risk, in which case, the temporal and spatial layout of cutblocks, hydrologic green-up, and recovery standards, and road layout and design must be considered.

- Recent genetic studies have shown that there is a large degree of genetic divergence between populations throughout their range (Taylor et al. 2003). In particular, populations above and streams in close proximity can have genetically unique populations. These studies suggest that multiple populations within a region need to be conserved to maintain the full spectrum of cutthroat genetic resources.

Wildlife habitat area

Goal

Maintain overwintering, staging, spawning, and rearing habitat of native, non-hybridized populations not addressed through strategic or landscape level planning. WHAs should be established across the landscape to best protect a variety of subpopulations and life stages with particular emphasis on those populations with the least risk of genetic introgression.

Feature

The priority for WHA establishment is known spawning, rearing, overwintering, and staging pools for populations of native, non-hybridized Westslope Cutthroat Trout that occur in small streams (S4). Priority for WHAs should be for populations that are naturally isolated above barriers that have evolved unique morphological and presumably genetic characteristics (e.g., Akolkolex River, Bull River, Kirkup Creek, Fording River). Select areas where there appear to be higher than average concentrations of fish (>20% of the adult population of a run) and/or where the habitat appears to be susceptible to impacts from human activities.

Size

Generally between 5 and 20 ha; however, the size of the WHA will vary depending on the stream system, feature to be protected, or inclusion of upstream reaches (S5, S6) necessary to achieve goals. Spawning and rearing areas could be larger if adult fish spawn or rear over several kilometres (1–5 km) of stream reach (i.e., Elk River, St Mary River).

Design

The WHA should include the entire feature of interest (e.g., spawning area) plus a 20 m core area and 20–30 m management zone determined from stream size.

Overwintering and staging pools have been identified in the Elk and St. Mary rivers (Westslope Fisheries 2003). Spawning habitat is typically found in smaller, low-gradient stream reaches that have abundant gravel substrate, shallow riffles, and good cover. Rearing habitat typically is found in very small tributaries and fisheries sensitive zones such as beaver ponds and back channels.

General wildlife measures

Goals

1. Prevent disturbance of Westslope Cutthroat Trout particularly during spawning and overwintering periods when adults tend to be congregated.
2. Maintain sufficient riparian vegetation to maintain stream temperatures within the natural range of variability and provide nutrient input, cover, stream bank stability, and shade.
3. Limit access to populations that may be sensitive to overharvest.
4. Maintain critical instream habitats including spawning and rearing habitat.
5. Maintain water quality sufficient to sustain fish, fish habitats, and aquatic ecosystems.
6. Maintain sufficient water to sustain fish, fish habitat and aquatic ecosystems through all life stages.
7. Maintain natural stream morphology and complexity.
8. Maintain structural integrity of riparian plant community, stream banks, and channel.
9. Maintain processes that lead to the creation of a wide variety of aquatic habitats similar to the local reference conditions.

Measures

Access

- Limit access through road closures, deactivation, or seasonal closures during critical times (e.g., overwintering and staging – 30 September to 15 April; spawning – 15 April to 15 July; rearing – 15 July to 31 March). Consult MWLAP for site-specific times.
- Do not place roads or crossing structures within WHA.

Harvesting and silviculture

- Do not harvest or salvage in the core area.
- When conducting silvicultural practices, minimize access developments as per above access measure and ensure natural processes for stream maintenance are not adversely affected. Consult MWLAP for site-specific recommendations.

Pesticides

- Do not use pesticides.

Range

- Control livestock use of riparian areas. Where assessments have determined that range practices have degraded or altered riparian and aquatic habitat, change management practices, and/or remediate to achieve properly functioning condition. Ensure livestock use does not impede natural recovery or other remediation efforts.
- Fencing could be recommended by the statutory decision maker.
- Plan livestock grazing to maintain desired plant community, stubble height, and browse utilization.

Recreation

- Do not develop recreational sites or trails.

Additional Management Considerations

Maintain riparian reserves on all S4 streams with or suspected to have pure Westslope Cutthroat Trout populations or S5 and S6 streams that are tributary to streams with Westslope Cutthroat Trout, where local managers deem it necessary to protect natural stream processes and limit erosion and sedimentation caused by forestry practices.

Information Needs

1. Determine status of population, specifically how many pure populations exist.
2. Determine the risk of extinction of non-pure populations and rank them based on potential to rehabilitate.
3. Investigate life history of adfluvial, fluvial, and lake resident Westslope Cutthroat Trout populations.

Cross References

Bull Trout, Rocky Mountain Tailed Frog

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