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**Re: Request for Comments on Critical Habitat for the Southwestern Washington/Columbia River DPS of Coastal Cutthroat Trout, 74 FR 12297, March 24, 2009.**

My review of the sea-run life history form of this subspecies, published in 1997, is cited several times in 74 FR 12297. I call your attention to a more recent, more comprehensive review of all life history forms of this subspecies in Chapter 3 of my book, *Cutthroat: Native Trout of the West*, 2nd edition (University of California Press, Berkeley, 2008). The information in that chapter and its included references is up to date as of March 5, 2007, which was the cutoff point for adding new material to the book.

The following comments address your request for information about 1) marine and estuarine areas that could be a significant portion of the range of the Southwestern Washington/Columbia River DPS, and 2) the relationship between the sea-run and freshwater-resident forms. Although the latter was not requested specifically in 74 FR 12297, a forwarded e-mail from Tracy Leavy, U.S. Fish and Wildlife Service, dated March 31, 2009, stated that “the Service is also interested in any new information that helps shed light on the ‘sea-run’ life history type... as well as its relationship with the freshwater migratory or resident form.”

**1. Utilization of Marine and Estuarine Areas by the DPS**

First of all, based simply on how many times they visit or pass through estuarine habitat during their life spans, estuaries may be of greater relative importance to sea-run cutthroat trout than to other species of Pacific salmon. This is because sea-run cutthroat trout do not die after spawning and may spawn two, three, and even four times during their lifetime, whereas other Pacific salmon die after spawning only once (true even for a very large percentage of steelhead, the only other iteroparous Pacific salmon species). Prior to each spawning event, two transits of the estuary, an emigration and a return, must take place. In addition, in many sea-run cutthroat populations—those of the subject DPS included—a majority of the trout may not spawn during their first return from salt water and must make a second pair of transits before spawning for the first time. Therefore, sea-run cutthroat trout may make four, six, eight, or even ten trips through the estuary during their lifetimes where most other salmonids make only two.

There is a fair body of literature from up and down the Pacific Northwest coast describing the use of estuary habitat by sea-run cutthroat trout, including the Rogue River estuary, Oregon (Tomasson 1978), the Alsea River estuary, Oregon (Giger 1972), the Salmon River estuary, Oregon (Krentz 2007), the Cowichan River estuary, British Columbia (Neave 1949), and — specific to the subject DPS— the Chehalis River estuary, Washington (Hiss and Knudsen 1993)

and Columbia River estuary, Washington and Oregon (Johnsen and Sims 1973; Tipping 1981; Loch 1982; Dawley et al. 1985; Emmett et al. 1991; Hudson et al. 2008; USFWS 2008; Zydlewski et al. 2008). I am not aware of any studies of estuaries opening into Willapa Bay.

The available literature on the Columbia River estuary agrees that sea-run cutthroat smolts on their initial journey to salt water enter this estuary during April and May, but the most recent studies (USFWS 2008; Zydlewski et al. 2008) indicate that they do not remain for long, generally no more than a few days to a week before passing out of the river mouth and into the river plume. Sea-run cutthroat kelts (defined here as adults recovering from spawning as well as fish that overwintered in fresh water but did not spawn) enter the estuary earlier, beginning about February, and linger longer, some possibly remaining within the estuary for the full extent of their saltwater stay before next returning to their natal tributaries. The travel routes for smolts and kelts as they enter and move through the estuary are primarily close in along the shores of the river (the fish use both sides), although some fish will cross from one side to the other and others may swim down the shipping channel for brief periods. The latter two behaviors appear to be more common with kelts than with smolts, although smolts too will swap sides of the river and swim in the shipping channel. In the tracking studies reported for smolts, greatest downstream movement through the estuary occurred on outgoing tides, and also immediately after sunrise and sunset; however, downstream movement was punctuated with long lulls in activity, especially during tide changes and incoming tides (Zydlewski et al. 2008).

Fish that exit the river mouth spend their saltwater time in coastal marine waters along the northern Oregon and southwestern Washington coasts in a zone extending from 10 to about 46 km offshore (Loch and Miller 1988; Pearcy et al. 1990; the farthest offshore capture was 66 km from the coast), and almost totally within the influence of the Columbia River plume (Dawley et al. 1985; Brodeur et al. 1987; Loch and Miller 1988; Pearcy and Fisher 1990; Pearcy et al. 1990). The region of highest marine catches for all years reported was characterized by an average surface temperature of 14.4°C and a low surface salinity of 28.6 psu, indicative of the presence of the Columbia River plume (Pearcy 1997).

Sea-run cutthroat trout return to the Columbia River estuary from these coastal marine waters over about a two to three-month period from mid-June through August, with the older, larger fish generally returning earliest. No captures of sea-run cutthroat trout have been reported from coastal marine waters after late summer, presumably because all have returned to the estuary (Pearcy et al. 1990). These returning trout may tarry within the estuary for anywhere from several weeks to three or four months before resuming their upstream journeys. Upstream movement toward natal tributaries begins about mid July (with, again, the larger and older trout generally moving first) and extends through the fall and into the early winter period. According to Loch (1982), adult sea-runs continue feeding during this holding period in the estuary, common food items being Pacific herring, threespine stickleback, and bay shrimp.

This summary of the available evidence makes clear that both the Columbia River estuary and the Columbia River plume are vitally important habitats for the southwestern Washington/Columbia River DPS of coastal cutthroat trout that should be included in any designation of Critical Habitat for this DPS. The extent and influence of the Columbia River plume have been well-studied (Barnes et al. 1972; Fieldler and Lauers 1990; Hickey et al. 1998 in addition to the references cited in Service documents pertaining to this DPS), so defining and designating this marine habitat zone should be straightforward. The extent of the plume during

the spring and summer period when it is occupied by sea-run cutthroat trout is the Critical Habitat zone. Undoubtedly, fish from Willapa Bay and Grays Harbor tributaries also have contributed to the reported marine distribution of this DPS, but I know of no studies that delimit river plume effects, if any, from these systems. With respect to designating the Columbia River estuary as Critical Habitat, special emphasis should be given to the near-shore travel zones along both sides of the river.

## **2. Relationship between Sea-run and Resident Life Histories in Coastal Cutthroat Trout**

74 FR 12297 notes (at page 12299) that “Coastal cutthroat trout appear to exhibit very flexible life history strategies. The extent to which individuals expressing these various strategies are isolated from other life history forms is largely unknown, though there is growing evidence that individuals may express multiple life history behaviors in their life time (Johnson et al. 1999).”

To understand and explain these observations of intra-population diversity in other salmonid species—especially migration behavior wherein one portion of a population is migratory and another remains resident on or near the breeding ground over its lifetime—fishery scientists have invoked a theory of partial migration and its attendant proposed mechanisms first promulgated in the avian literature (Lack 1943; Lundberg 1988). What has become the most commonly accepted mechanism for the maintenance of partial migration (in both fishes and birds) is a conditional strategy in which an individual’s genetic makeup allows for the adoption of migratory or resident behavior based on an interaction between that individual’s physiological condition and the environment (Jonsson and Jonsson 1993; Gross and Repka 1998). If this interaction exceeds some genetically determined threshold, the individual migrates; if not, it remains a resident—or vice versa (Jonsson and Jonsson 1993). Within the genus *Salmo* (brown trout and Atlantic salmon) where this mechanism has been studied most thoroughly to date, growth rate or metabolism early in life has been identified as the developmental threshold that triggers migratory behavior (Forseth et al. 1999; Cucherousset et al. 2005; Metcalfe et al. 1995; Bujold et al. 2004).

However, an alternative mechanism, namely genetic polymorphism wherein resident and migratory forms represent genetically distinct, reproductively isolated sub-populations (Lundberg 1988; Verspoor and Cole 1989), also has considerable experimental backing in brown trout and Atlantic salmon. Genetically distinct resident and migratory populations existing even in sympatry within a watercourse have been widely documented in brown trout and Atlantic salmon (Allendorf et al. 1976; Jonsson 1982; Skaala and Naevdal 1989; Verspoor and Cole 1989; Vuorinen and Berg 1989; Birt et al. 1991; Hindar et al. 1991; Marshall et al. 1992; Näslund 1993).

In coastal cutthroat trout, the genetic polymorphism mechanism has never gained much traction, largely because 1) early surveys did not detect significant genetic distinction between the life history forms within a drainage (Johnson et al. 1999; Bown et al. 2008), and 2) the conditional life history strategy appears to explain quite adequately the flexibility and life history variation that is reported within the subspecies including the marked differences in size and appearance between migratory and resident forms and the occasional report of an individual shifting between resident and migratory life histories within its lifetime (in coastal cutthroat trout, the oldest reported age for an erstwhile resident trout to undergo smoltification and become a sea-run migrant was age 6 [Giger 1972], whereas the norm for smolt in the southwestern

Washington/Columbia River DPS is age 2 [Chilcote 1980; Tipping and Springer 1980; Tipping 1981]). But I must say here that scientists and managers in this region just seem to take for granted that the theory and strategy apply; I know of no serious studies, either completed, in progress, or planned, to actually put the theory to a serious test, or, perhaps of even greater importance, to elucidate the conditional trigger and its threshold for migration.

In addition, it would also seem that the partial migration theory and conditional life history strategy could only apply in stream reaches where the various life history forms live in sympatry, i.e., to the upstream limit of sea-run cutthroat spawning—or, where the sea-run form is absent but other migrant forms exist, to the upstream limits of their spawning. Upstream of this limit, in the higher gradient, headwater reaches of the stream system where the resident populations of coastal cutthroat trout are ubiquitous and live in allopatry, it is not certain that partial migration theory and the conditional life history strategy have any real meaning. Many of these stream reaches are isolated from downstream migratory and/or anadromous zones by long-standing natural barriers, and others by distance and/or arduous, energy-consuming ascents. Here the alternative genetic mechanism is more likely to apply—or if not that exactly, then strong selection that favors genotypes with such a high threshold for triggering migration that it never or only rarely occurs.

Trout living in above-barrier headwater reaches may possess altogether different genotypes from populations in downstream reaches, owing to strong selection for traits that would oppose migration. Northcote and Hartman (1988) called this “knife-edge selection” because any individual passing downstream over the lip of the barrier would be irrevocably lost to the population, setting up a stringent one-way barrier to gene flow. Northcote and his colleagues have shown that above-barrier populations of coastal cutthroat trout and rainbow trout possess greater swimming stamina than below-barrier populations, and also exhibit a strong upstream movement response to current whereas downstream populations show either a weak upstream response or they go downstream with the flow (Northcote et al. 1970; Tsuyuki and Willisroft 1977; Northcote and Kelso 1981).

Reinforcing the findings outlined above, recent work from the Umpqua River drainage, Oregon, where a complete census of resident coastal cutthroat trout was made in a headwater tributary upstream of a waterfall, found that only about 1 percent of the trout were ever lost from the population by going over the falls (Hendricks and Gresswell 2001; Bateman et al. 2008).

Finally, even though no significant genetic differences were found between upstream resident and migratory populations in earlier surveys, there is growing evidence that genetic distinction does in fact exist (Griswold 1996; Latterell 2001; Guy 2004; Wofford et al. 2005; Guy et al. 2008).

For these reasons, even though some small level of one-way gene flow may take place from drop-downs, it is unlikely that headwater resident coastal cutthroat trout contribute to the maintenance of the sea-run populations in their watercourses. This does not happen in either brown trout or Atlantic salmon (Jonsson 1982; Vuorinen and Berg 1989; Näslund 1993; Pettersson et al. 2001), and the negative result from the single direct experiment conducted with coastal cutthroat trout (Michael 1983) suggests it does not happen with this subspecies either. Given this evidence, might one suggest that within each coastal cutthroat DPS, the sea-run

component, or better perhaps, the panmictic group of forms within the zone of sea-run spawning, comprises its own distinct population segment?

Respectfully submitted,



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