NOAA Technical Memorandum NMFS-NWFSC-27

# Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California

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August 1996

**U.S. DEPARTMENT OF COMMERCE**
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of peak flow is later for streams south of Point Arena than those to the north. Minimum winter water temperatures are higher in this area than in streams to the north. The central California coast area includes the southern limit of the redwood forest, and within this area there is a transition to the more xeric vegetation of the south coast and interior.

Only winter steelhead are found in this ESU and those to the south. Migration and spawn timing are similar to adjacent steelhead populations. We have little other life history information for steelhead in this ESU. The relationship between anadromous and nonanadromous *O. mykiss*, including possibly residualized (footnote 5) fish upstream from dams, is unclear.

**10) South-Central California Coast**--This coastal steelhead ESU occupies rivers from the Pajaro River, Santa Cruz County to (but not including) the Santa Maria River.

Mitochondrial DNA data provide evidence for a genetic transition in the vicinity of Monterey Bay. Both mtDNA and allozyme data show large genetic differences between populations in this area, but the data do not provide a clear picture of population structure.

Most rivers of this region drain the Santa Lucia Range, the southernmost unit of the California Coast Ranges. The climate is drier and warmer than in the north, which is reflected in the vegetational change from coniferous forest to chaparral and coastal scrub. Another biological transition at the north of this area is the southern limit of the distribution of coho salmon (*O. kisutch*). The mouths of many rivers and streams in this area are seasonally closed by sand berms that form during periods of low flow in the summer. The southern boundary of this ESU is near Point Conception, a well-recognized transition area for the distribution and abundance of marine flora and fauna.

Only winter steelhead are found in this ESU. Migration and spawn timing are similar to adjacent steelhead populations. We have little other life history information for steelhead in this ESU. The relationship between anadromous and nonanadromous *O. mykiss*, including possibly residualized (footnote 5) fish upstream from dams, is unclear but likely to be important.

**11) Southern California**--This coastal steelhead ESU occupies rivers from the Santa Maria River to the southern extent of the species range. Historically, *O. mykiss* occurred at least as far south as Rio del Presidio in Mexico (Behnke 1992, Burgner et al. 1992). Spawning populations of steelhead did not occur that far south but may have extended to the Santo Domingo River in Mexico (Barnhart 1986); however, some reports state that steelhead may not have existed south of the U.S.-Mexico border (Behnke 1992, Burgner et al. 1992). The present southernmost stream used by steelhead for spawning is generally thought to be Malibu Creek, California (Behnke 1992, Burgner et al. 1992); however, in years of substantial rainfall, spawning steelhead can be found as far south as the Santa Margarita River, San Diego County (Barnhart 1986, Higgins 1991).

Genetic data show large differences between steelhead populations within this ESU as well as between these and populations to the north. Steelhead populations between the Santa

Ynez River and Malibu Creek show a predominance of a mitochondrial DNA type (ST8) that is rare in populations to the north. Allozyme data indicate that two samples from Santa Barbara County are genetically among the most distinctive of any natural populations of coastal steelhead yet examined.

Migration and life history patterns of southern California steelhead depend more strongly on rainfall and streamflow than is the case for steelhead populations farther north (Moore 1980, Titus et al. in press). Average rainfall is substantially lower and more variable in southern California than in regions to the north, resulting in increased duration of sand berms across the mouths of streams and rivers and, in some cases, complete dewatering of the lower reaches of these streams from late spring through fall. Environmental conditions in marginal habitats may be extreme (e.g., elevated water temperatures, droughts, floods, and fires) and presumably impose selective pressures on steelhead populations. Their utilization of southern California streams and rivers with elevated temperatures (in some cases much higher than the preferred range for steelhead) suggests that steelhead within this ESU are able to withstand higher temperatures than populations to the north. The relatively warm and productive waters of the Ventura River have resulted in more rapid growth of juvenile steelhead than occurs in more northerly populations (Moore 1980, Titus et al. in press, McEwan and Jackson 1996). However, we have relatively little life history information for steelhead from this ESU. Additionally, the relationship between anadromous and nonanadromous *O. mykiss*, including possibly residualized (footnote 5) fish upstream from dams, is unclear.

**12) Central Valley**--This steelhead ESU occupies the Sacramento and San Joaquin Rivers and their tributaries.

Recent allozyme data show that samples of steelhead from Deer and Mill Creeks and Coleman NFH on the Sacramento River are well differentiated from all other samples of steelhead from California.

The Sacramento and San Joaquin Rivers offer the only migration route to the drainages of the Sierra Nevada and southern Cascade mountain ranges for anadromous fish. The distance from the ocean to spawning streams can exceed 300 km, providing unique potential for reproductive isolation among steelhead in California. The Central Valley is much drier than the coastal regions to the west, receiving on average only 10-50 cm of rainfall per year. The valley is characterized by alluvial soils, and native vegetation was dominated by prairie grasses prior to agricultural development.

Currently, all steelhead in the Central Valley are considered winter steelhead by the California Department of Fish and Game (CDFG), although "three distinct runs," including summer steelhead, may have occurred there as recently as 1947 (CDFG 1995, McEwan and Jackson 1996). Steelhead within this ESU have the longest freshwater migration of any population of winter steelhead. There is essentially a single continuous run of steelhead in the upper Sacramento River. River entry ranges from July through May, with peaks in September and February; spawning begins in late December and can extend into April (McEwan and Jackson 1996).

(in press) have documented some of these problems for specific tributaries in the southern portion of this ESU.

Adequate adult escapement information was available to compute a trend for only one stock within this ESU: Carmel River above San Clemente Dam (Table 22, Fig. 27). These data show a significant decline of 22% per year from 1963 to 1993, with a recent 5-year average count of only 16 adult steelhead at the dam. However, general trends for the region can be inferred by comparing the 1960s and 1990s abundance estimates provided above.

Presently, there is little hatchery production within this ESU. There are small private and cooperative programs producing steelhead within this ESU, as well as one captive broodstock program intended to conserve the Carmel River steelhead strain (McEwan and Jackson 1996). Most hatchery stocks used in this region originated from stocks indigenous to the ESU, but many are not native to their local river basins (Bryant 1994). We have little information on the actual contribution of hatchery fish to natural spawning, and little information on present total run sizes or trends for this ESU. However, given the substantial reductions from historical abundance and the recent negative trends in the stocks for which we do have data, it is likely that the majority of natural production in this ESU is not self-sustaining.

Past and present hatchery practices probably pose some risk to steelhead in this ESU as discussed previously in the Background section. Habitat fragmentation and population declines resulting in small, isolated populations also pose genetic risk from inbreeding, loss of rare alleles, and genetic drift.

In evaluating the status of this ESU, we have not accounted for abundance or trends in populations of resident *O. mykiss* (rainbow trout), which may be a significant part of the ESU. We have received insufficient information regarding resident trout in this region to reasonably evaluate their status or their interactions with anadromous steelhead.

**11) Southern California**--Previous assessments within this ESU have identified several stocks as being at risk or of special concern. Nehlsen et al. (1991) identified 11 stocks as extinct and 4 as at high risk (Table 9). Titus et al. (in press) provided a more detailed analysis of these stocks and identified stocks within 14 drainages in this ESU as extinct, at risk, or of concern. They identified only two stocks, those in Arroyo Sequit and Topanga Creek, as showing no significant change in production from historical levels.

Historically, steelhead may have occurred naturally as far south as Baja California. Estimates of historical (pre-1960s) abundance are available for several rivers in this ESU (Table 23): Santa Ynez River, before 1950, 20,000-30,000; Ventura River, pre-1960, 4,000-6,000; Santa Clara River, pre-1960, 7,000-9,000; Malibu Creek, pre-1960, 1,000. In the mid-1960s, CDFG (1965, table S-3) estimated steelhead spawning populations for smaller tributaries in San Luis Obispo County as 20,000, but they provided no estimates for streams farther south.

Table 23. Summary of recent and historical abundance estimates for the Southern California steelhead evolutionarily significant unit. Excludes estimates from CDFG (1965) presented in Table 17.

| River basin | Abundance | Years | Reference |
|---|---|---|---|
| Santa Ynez River | 20,000 - 30,000 | historic | Reavis 1991 |
| | 20,000 | historic | Titus et al. in press |
| | 12,995 - 25,032 | 1940s | Shapovalov and Taft 1954 |
| | 20,000 | 1952 | CDFG 1982 |
| | 100 | 1991 | Reavis 1991 |
| | <100 | 1991 | Nehlsen et al. 1991 |
| | <100 | 1994 | CCC 1994 |
| Gaviota Creek | 10s | 1991 | Reavis 1991 |
| Ventura River | 4,000 - 6,000 | historic | AFS 1991, Hunt et al. 1992, Henke 1994, Titus et al. in press |
| | 4,700 | late 1940s | CDFG 1982 |
| | <100 | 1980 | Moore 1980 |
| | 200 | 1991 | Higgins 1991 |
| | <25 | 1991 | McEwan and Jackson 1996 |
| | few 100s | 1991 | Reavis 1991 |
| | <100 | 1991 | Nehlsen et al. 1991 |
| | 200 | 1993 | Nash 1993 |
| | <200 | 1994 | CCC 1994 |
| Matilija Creek | 2,000 - 2,500 | historic | Clanton and Jarvis 1946 |
| Santa Clara River | 7,000 - 9,000 | historic | Moore 1980 |
| | 9,000 | historic | Moore 1980, Comstock 1992, Henke 1994 |
| | 6 | 1982 | Puckett and Villa 1985 |
| | <100 | 1994 | CCC 1994 |
| | <100 | 1991 | Nehlsen et al. 1991 |
| | few 100s | 1991 | Reavis 1991 |
| Malibu Creek | 1,000 | historic | Nehlsen et al. 1991 |
| | <100 | 1991 | Nehlsen et al. 1991, Reavis 1991 |
| | 60 | 1991 | AFS 1991 |
| | 60 | 1993 | Nash 1993 |

The present total run sizes for 6 streams in this ESU were summarized by Titus et al. (in press); all were less than 200 adults (Table 24, Fig. 26). Titus et al. (in press) concluded that populations have been extirpated from all streams south of Ventura County, with the exception of Malibu Creek in Los Angeles County. However, steelhead are still occasionally reported in streams where stocks were identified by these authors as extirpated.

Titus et al. (in press) cited extensive loss of steelhead habitat due to water development, including impassable dams and dewatering of portions of rivers. They also reported that of 32 tributaries in this region, 21 have blockages due to dams, and 29 have impaired mainstem passage. Habitat problems in this ESU relate primarily to water development resulting in inadequate flows, flow fluctuations, blockages, and entrainment into diversions (McEwan and Jackson 1996, Titus et al. in press). Other problems related to land use practices and urbanization also certainly contribute to stock conditions.

No time series of data are available within this ESU from which to estimate population trends, but Titus et al. (in press) summarized information for steelhead populations based on historical and recent survey information. Of the populations south of San Francisco Bay (including part of the Central California Coast ESU) for which past and recent information was available, they concluded that 20% had no discernible change, 45% had declined, and 35% were extinct. Percentages for the counties comprising this ESU are given in Table 25 and show a very high percentage of declining and extinct populations.

There is no current hatchery production of steelhead within this ESU. The small run sizes and almost universal declines in these populations strongly suggest that natural production is not self-sustaining.

The influence of hatchery practices on this ESU is not well documented. Common risk factors relating to hatchery practices were discussed previously in the Background section. In some populations, there may be genetic introgression from past steelhead plants and from planting of rainbow trout (Nielsen footnote 9). Habitat fragmentation and population declines have also resulted in small, isolated populations that may face genetic risk from inbreeding, loss of rare alleles, and genetic drift.

In evaluating the status of this ESU, we have not accounted for abundance or trends in populations of resident *O. mykiss* (rainbow trout), which may be a significant part of the ESU. We do not have sufficient information regarding resident trout in this region to reasonably evaluate their status or their interactions with anadromous steelhead.

**12) Central Valley**--Only Nehlsen et al. (1991) have provided a status assessment for stocks within this ESU; they identified one stock (Sacramento River) as at high risk (Table 9). However, this stock represents all the known populations of steelhead within the ESU.

Historical abundance estimates are available for some stocks within this ESU (Table 26), but no overall estimates are available prior to 1961, when Hallock et al. (1961) estimated a total run size of 40,000 steelhead in the Sacramento River, including

Table 24. Summary of estimated total run size for the Southern California steelhead evolutionarily significant unit, by major river basin, as in Table 10. All data are for winter steelhead.

| River basin | Total run size | Total escapement | Natural escapement | Trend (%/yr) | Percent hatchery |
|---|---|---|---|---|---|
| Santa Ynez River | <100 | | | | |
| Ventura River | <200 | | | | |
| Santa Clara River | <100 | | | | |
| Malibu Creek | <100 | | | | |

northern coastal portion of the ESU, steelhead abundance in the Russian River has been reduced roughly sevenfold since the mid-1960s, but abundance in smaller streams appears to be stable at low levels. There is particular concern about sedimentation and channel restructuring due to floods, apparently resulting in part from poor land management practices.

There are two major areas of uncertainty in this evaluation. First, due to the lack of information on steelhead run sizes throughout the ESU, our conclusions were based largely on evidence of habitat degradation and the few estimates of abundance and stock trends in the region. Second, the genetic heritage of the natural populations in tributaries to San Francisco and San Pablo Bays is uncertain, making it difficult to determine which of these populations should be considered part of the ESU.

**10) South-Central California Coast**--The BRT concluded that the South-Central California Coast steelhead ESU is presently in danger of extinction. Total abundance is extremely low, and most stocks for which we have data in the ESU show recent downward trends. There is particular concern about sedimentation and channel restructuring due to floods, which apparently result in part from poor land management practices. There is also concern about the genetic effects of widespread stocking of rainbow trout.

The major area of uncertainty in this evaluation is the lack of information on steelhead run sizes throughout the ESU. Our conclusions were based largely on evidence of habitat degradation and the few estimates of abundance and stock trends in the region.

**11) Southern California**--The BRT concluded that the Southern California steelhead ESU is presently in danger of extinction. Steelhead have already been extirpated from much of their historical range in this region. The BRT members had strong concern about the widespread degradation, destruction, and blockage of freshwater habitats within the region, and the potential results of continuing habitat destruction and water allocation problems. There is also concern about the genetic effects of widespread stocking of rainbow trout.

There are two major areas of uncertainty in this evaluation. First, accurate run size and trend estimates are lacking for natural steelhead stocks in this ESU. Second, the relationship between resident and anadromous forms of the biological species is unclear.

**12) Central Valley**--The BRT concluded that the Central Valley steelhead ESU is presently in danger of extinction. Steelhead have already been extirpated from most of their historical range in this region. Habitat concerns in this ESU focus on the widespread degradation, destruction, and blockage of freshwater habitats within the region, and the potential results of continuing habitat destruction and water allocation problems. The BRT members also had strong concerns about the pervasive opportunity for genetic introgression from hatchery stocks within the ESU and about potential ecological interactions between introduced stocks and native stocks. There is widespread production of hatchery steelhead within this ESU.

There are two major areas of uncertainty in this evaluation. First, there is a total lack of recent run-size estimates for natural steelhead stocks in this ESU. Second, there is a